ANNUAL REPORT

OF THE

MINISTER OF MINES

FOR THE

YEAR ENDING 31ST DECEMBER

1914

BEING AN ACCOUNT OF

MINING OPERATIONS FOR GOLD, COAL, ETC.

IN THE

PROVINCE OF BRITISH COLUMBIA

THE GOVERNMENT OF
THE PROVINCE OF BRITISH COLUMBIA.

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1915.

ANNUAL REPORT

OF THE

MINISTER OF MINES,

1914.

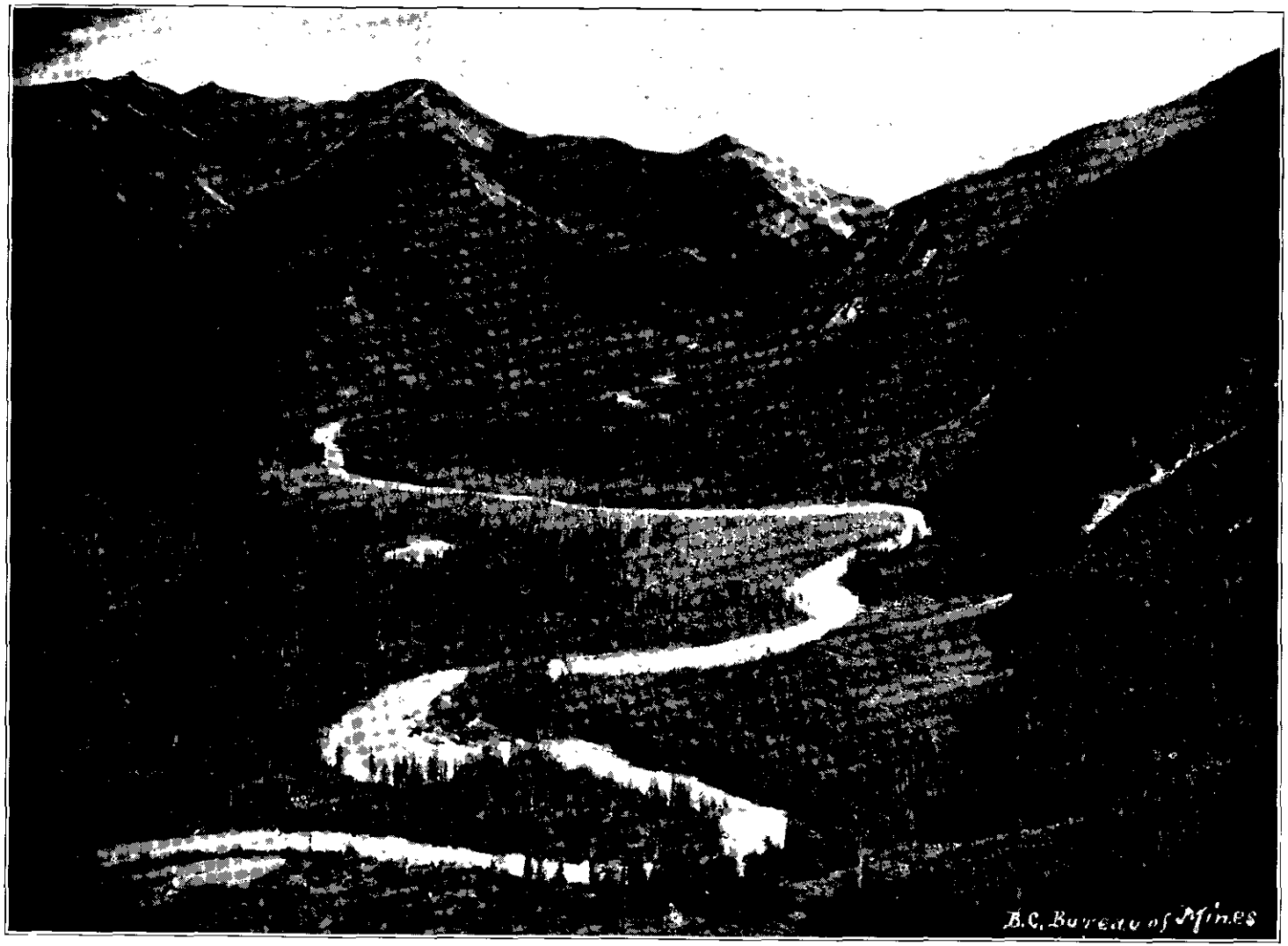
To His Honour FRANK STILLMAN BARNARD,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Provincial Mineralogist upon the Mining Industry of the Province for the year 1914 is herewith respectfully submitted.

RICHARD McBRIDE,
Minister of Mines.

Minister of Mines' Office,
April 18th, 1915.



Valley of Incomuppleux River—looking North from Eva Mine—Lardeau Mining Division, British Columbia.

REPORT OF THE BUREAU OF MINES

—BY—

WILLIAM FLEET ROBERTSON, PROVINCIAL MINERALOGIST.

To the Honourable Sir Richard McBride, K.C.M.G.,
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, 1914.

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

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

I have the honour to be,
Sir,
Your obedient servant,

WILLIAM FLEET ROBERTSON,
Provincial Mineralogist.

Bureau of Mines, Victoria, B.C.,
April 18th, 1915.

MINERAL PRODUCTION OF BRITISH COLUMBIA.

METHOD OF COMPUTING PRODUCTION.

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

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

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

TABLE I.—TOTAL PRODUCTION FOR ALL YEARS UP TO AND INCLUDING 1914.

Gold, placer	$ 73,269,603
Gold, lode	81,595,516
Silver	37,709,282
Lead	31,468,462
Copper	86,939,370
Coal and coke	149,814,462
Building-stone, bricks, etc.	23,827,101
Other metals, zinc, etc	2,198,949
Total	$486,822,745

TABLE II.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1913 (INCLUSIVE).

1852 to 1892 (inclusive)	$ 81,090,069
1893	3,588,413
1894	4,225,717
1895	5,643,042
1896	7,507,956
1897	10,455,268
1898	10,906,861
1899	12,393,131
1900	16,344,751
1901	20,086,780
1902	17,486,550
1903	17,495,954
1904	18,977,359
1905	22,461,325
1906	24,980,546
1907	25,882,560
1908	23,851,277
1909	24,443,025
1910	26,377,066
1911	23,499,072
1912	32,440,800
1913	30,296,398
1914	26,388,825
Total	$486,822,745

Table III. gives a statement in detail of the quantities and value of the different mineral products for the years 1912, 1913, and 1914. It has been impossible as yet to collect complete statistics regarding building-stone, lime, bricks, tiles, and other miscellaneous products, but such figures as it has been possible to secure are given in some detail in Table V.

TABLE III.

QUANTITIES AND VALUE OF MINERAL PRODUCTS FOR 1912, 1913, AND 1914.

	Customary Measure.	1912.		1913.		1914.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold, placer	Ounces.	.....	$ 555,500	.....	$ 510,000	.....	$ 565,000
" lode	"	257,496	5,322,442	272,254	5,627,490	247,170	5,109,004
Silver	"	3,132,108	1,810,045	3,465,856	1,968,606	3,602,180	1,876,736
Lead	Pounds	44,871,454	1,805,627	55,364,677	2,175,832	50,625,048	1,771,877
Copper	"	51,456,537	8,408,513	46,460,305	7,094,489	45,009,699	6,121,319
Zinc	"	5,358,280	316,139	6,758,768	324,421	7,866,467	346,125
Coal	Tons, 2,240 lb.	2,628,804	9,200,814	2,137,483	7,481,190	1,810,967	6,338,385
Coke	" "	264,333	1,585,998	286,045	1,716,270	234,577	1,407,462
Miscellaneous products	.....	.....	3,435,722	.....	3,398,100	.....	2,852,917
			$32,440,800		$30,296,398		$26,388,825

TABLE IV.

OUTPUT OF MINERAL PRODUCTS BY DISTRICTS AND DIVISIONS.

NAMES.	DIVISIONS.			DISTRICTS.		
	1912.	1913.	1914.	1912.	1913.	1914.
CARIBOO DISTRICT	.....	.....	.....	$ 268,000	$ 226,024	$ 308,807
Cariboo Mining Division	$ 180,000	$ 131,000	$ 166,500	.....	.....	.....
Quesnel "	80,000	55,000	37,000	.....	.....	.....
Omineca "	8,000	40,024	105,307	.....	.....	.....
CASSIAR DISTRICT	.....	.....	.....	467,579	412,748	2,079,177
EAST KOOTENAY DISTRICT	.....	.....	.....	5,723,004	5,947,935	4,703,672
WEST KOOTENAY DISTRICT	.....	.....	.....	6,165,255	7,092,107	6,311,205
Ainsworth Division	371,760	627,150	471,534	.....	.....	.....
Slocan and Slocan City "	1,951,315	2,258,309	1,780,936	.....	.....	.....
Nelson "	581,700	863,966	579,563	.....	.....	.....
Trail Creek "	3,214,751	3,305,771	3,456,610	.....	.....	.....
Other parts	45,729	36,911	22,562	.....	.....	.....
BOUNDARY DISTRICT	.....	.....	.....	8,716,406	7,925,336	4,867,029
Osoyoos, Grand Forks & Greenwood Divisions	7,903,006	6,833,902	4,270,744	.....	.....	.....
Similkameen, Nicola, Vernon	748,900	1,019,340	533,991	.....	.....	.....
Yale, Ashcroft, Kamloops	64,500	72,094	62,294	.....	.....	.....
LILLOOET DISTRICT	.....	.....	.....	5,000	71,445	38,978
COAST DISTRICTS (Nanaimo, Alberni, Clayoquot, Quatsino, Victoria, Vancouver)	.....	.....	.....	11,095,556	8,620,803	8,079,957
				$32,440,800	$30,296,398	$26,388,825

TABLE V.

MISCELLANEOUS PRODUCTS AND TOTALS OF PRODUCTION, 1914.

DISTRICT AND DIVISION.	DETAILS OF MISCELLANEOUS PRODUCTS.										SUMMARY OF TOTALS OF PRODUCTION.				
	Cement.	Lime and Limestone.	Building-stone.	Riprap.	Crushed Rock.	Sand and Gravel.	Pottery and Tile.	Red Brick.	Fire, Face, Silica Brick.	Clay, Gypsum, etc.	Total Miscellaneous Products.	Total Output of Collieries.	Total of Metalliferous Mines.	Totals for Divisions.	Totals for Districts.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
CARIBOO															308,807
Cariboo					500	1,000					1,500		165,000	166,500	
Quesnel					1,000	1,000					2,000		35,000	37,000	
Omineca				10,000	1,500	1,000					12,500		92,807	105,307	
CASSIAR															2,079,177
Atlin													342,670	342,670	
Liard-Stikine Skeena, Portland C Queen Charlotte		5,000	22,000	5,000	6,600	9,000		25,000			72,600		1,663,907	1,736,507	
EAST KOOTENAY															4,703,672
Fort Steele			5,000		9,000	15,000			6,600		35,600	3,506,489	1,127,583	4,669,672	
Windermere-Golden			4,000	5,000	10,000	15,000					34,000			34,000	
WEST KOOTENAY															6,311,205
Ainsworth					2,000	1,000					3,000		468,534	471,534	
Slocan & Slocan City					2,000	1,000					3,000		1,777,936	1,780,936	
Nelson		3,000	7,500	2,000	5,000	3,000					20,500		559,063	579,563	
Trail Creek		3,000			2,000	1,000		1,200	200		7,400		3,449,210	3,456,610	
Other Divisions					6,000	4,000					10,000		12,562	22,562	
YALE															4,867,029
Grand Forks Greenwood Osoyoos Similkameen Nicola Vernon Yale Ashcroft Kamloops		55,000	10,000	5,000	15,000	12,000		2,000			99,000		4,171,744	4,270,744	
		2,000	10,000	5,000	15,000	12,000					44,000	486,259	3,732	533,991	
		2,000	5,000	5,000	13,000	12,000		20,000			57,000		5,294	62,294	
LILLOOET				5,000	18,000	8,000					31,000		7,978	38,978	38,978
COAST DISTRICT	861,756	72,311	85,389	637,435	66,641	312,280	152,914	115,099	107,904	8,088	2,419,817	3,753,099	1,907,041	8,079,957	8,079,957
	861,756	142,311	148,889	679,435	173,241	408,280	152,914	163,299	114,704	8,088	2,852,917	7,745,847	15,790,061	26,388,825	26,388,825

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 PER YEAR TO DATE.

1858	$ 705,000	1873	$ 1,305,749	1888	$ 616,731	1903	$ 1,060,420
1859	1,615,070	1874	1,844,618	1889	588,923	1904	1,115,300
1860	2,228,543	1875	2,474,004	1890	490,435	1905	969,300
1861	2,666,118	1876	1,786,648	1891	429,811	1906	948,400
1862	2,656,903	1877	1,608,182	1892	399,526	1907	828,000
1863	3,913,563	1878	1,275,204	1893	356,131	1908	647,000
1864	3,735,850	1879	1,290,058	1894	405,516	1909	477,000
1865	3,491,205	1880	1,013,827	1895	481,683	1910	540,000
1866	2,662,106	1881	1,046,737	1896	544,026	1911	426,000
1867	2,480,868	1882	954,085	1897	513,520	1912	555,500
1868	3,372,972	1883	794,252	1898	643,346	1913	510,000
1869	1,774,978	1884	736,165	1899	1,344,900	1914	565,000
1870	1,336,956	1885	713,738	1900	1,278,724		
1871	1,799,440	1886	903,651	1901	970,100		
1872	1,610,972	1887	693,709	1902	1,073,140		
						Total	$73,269,603

TABLE VII.—PRODUCTION OF LODE MINES.

YEAR.	GOLD.		SILVER.		LEAD.		COPPER.		ZINC.		TOTAL VALUE.
	Oz.	Value.	Oz.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
		$		$		$		$		$	$
1887	.....	.....	17,690	17,331	204,800	9,216	.....	.....	.....	.....	26,547
1888	.....	.....	79,780	75,000	674,500	29,813	.....	.....	.....	.....	104,813
1889	.....	.....	53,192	47,873	165,100	6,498	.....	.....	.....	.....	54,371
1890	.....	.....	70,427	73,948	*Nil.*	*Nil.*	.....	.....	.....	.....	73,948
1891	.....	.....	4,500	4,000	*Nil.*	*Nil.*	.....	.....	.....	.....	4,000
1892	.....	.....	77,160	66,935	808,420	33,064	.....	.....	.....	.....	99,999
1893	1,170	23,404	227,000	195,000	2,135,023	78,996	.....	.....	.....	.....	297,400
1894	6,252	125,014	746,379	470,219	5,662,523	169,375	324,680	16,234	.....	.....	781,342
1895	39,264	785,271	1,496,522	977,229	16,475,464	532,255	952,840	47,642	.....	.....	2,342,397
1896	62,259	1,244,180	3,135,343	2,100,689	24,199,977	721,384	3,818,556	190,926	.....	.....	4,257,179
1897	106,141	2,122,820	5,472,971	3,272,836	38,841,135	1,390,517	5,325,180	266,258	.....	.....	7,052,431
1898	110,061	2,201,217	4,292,401	2,375,841	31,693,559	1,077,581	7,271,678	874,781	.....	.....	6,529,420
1899	138,315	2,857,573	2,939,413	1,663,708	21,862,436	878,870	7,722,591	1,351,453	.....	.....	6,751,604
1900	167,153	3,453,381	3,958,175	2,309,200	63,358,621	2,691,887	9,997,080	1,615,289	.....	.....	10,069,757
1901	210,384	4,348,603	5,151,333	2,884,745	51,582,906	2,002,733	27,603,746	4,446,963	.....	.....	13,683,044
1902	236,491	4,888,269	3,917,917	1,941,328	22,536,381	824,832	29,636,057	3,446,673	.....	.....	11,101,102
1903	232,831	4,812,616	2,996,204	1,521,472	18,089,283	689,744	34,359,921	4,547,535	.....	.....	11,571,367
1904	222,042	4,589,608	3,222,481	1,719,516	36,646,244	1,421,874	35,710,128	4,578,087	.....	.....	12,309,085
1905	238,660	4,933,102	3,439,417	1,971,818	56,580,703	2,399,022	37,692,251	5,876,222	.....	.....	15,180,164
1906	224,027	4,630,639	2,990,262	1,897,320	52,408,217	2,667,578	42,990,488	8,288,565	.....	.....	17,484,102
1907	196,179	4,055,020	2,745,448	1,703,825	47,738,703	2,291 458	40,832,720	8,166,544	.....	.....	16,216,847
1908	255,582	5,282,880	2,631,389	1,321,483	43,195,733	1,632,799	47,274,614	6,240,249	.....	.....	14,477,411
1909	238,224	4,924,090	2,532,742	1,289,270	44,396,346	1,709,259	45,597,245	5,918,522	8,500,000	400,000	14,191,141
1910	267,791	5,533,380	2,450,241	1,245,016	34,658,746	1,336,350	38,243,934	4,871,512	4,184,192	192,473	13,228,731
1911	228,617	4,725,513	1,892,364	958,293	26,872,397	1,069,521	36,927,656	4,571,644	2,634,544	129,092	11,454,063
1912	257,496	5,322,442	3,132,108	1,810,045	44,871,454	1,805,627	51,456,587	8,408,513	5,358,280	316,139	17,662,766
1913	272,254	5,627,490	3,465,856	1,968,606	55,364,677	2,175,832	46,460,305	7,094,489	6,758,768	324,421	17,190,838
1914	247,170	5,109,004	3,602,180	1,876,736	50,625,048	1,771,877	45,009,699	6,121,819	7,866,467	346,125	15,225,061
Total	3,958,273	81,595,516	66,740,895	37,709,282	791,648,396	31,468,462	595,207,906	86,939,370	35,302,251	1,708,250	239,420,880

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

COAL.

Year.	Tons (2,240 lb.).	Value.
1836-1881	1,873,907	$ 6,003,245
1882	282,139	846,417
1883	213,299	639,897
1884	394,070	1,182,210
1885	265,596	796,788
1886	326,636	979,908
1887	413,360	1,240,080
1888	489,301	1,467,903
1889	579,830	1,739,490
1890	678,140	2,034,420
1891	1,029,097	3,087,291
1892	826,335	2,479,005
1893	978,294	2,934,882
1894	1,012,953	3,038,859
1895	939,654	2,818,962
1896	896,222	2,688,666
1897	882,854	2,648,562
1898	1,135,865	3,407,595
1899	1,306,324	3,918,972
1900	1,439,595	4,318,785
1901	1,460,331	4,380,993
1902	1,397,394	4,192,182
1903	1,168,194	3,504,582
1904	1,253,628	3,760,884
1905	1,384,312	4,152,936
1906	1,517,303	4,551,909
1907	1,800,067	6,300,235
1908	1,677,849	5,872,472
1909	2,006,476	7,022,666
1910	2,800,046	9,800,161
1911	2,193,062	7,675,717
1912	2,628,804	9,200,814
1913	2,137,483	7,481,190
1914	1,810,967	6,338,385
Total	41,199,387	$132,507,063

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
Total	3,101,869	$17,307,399

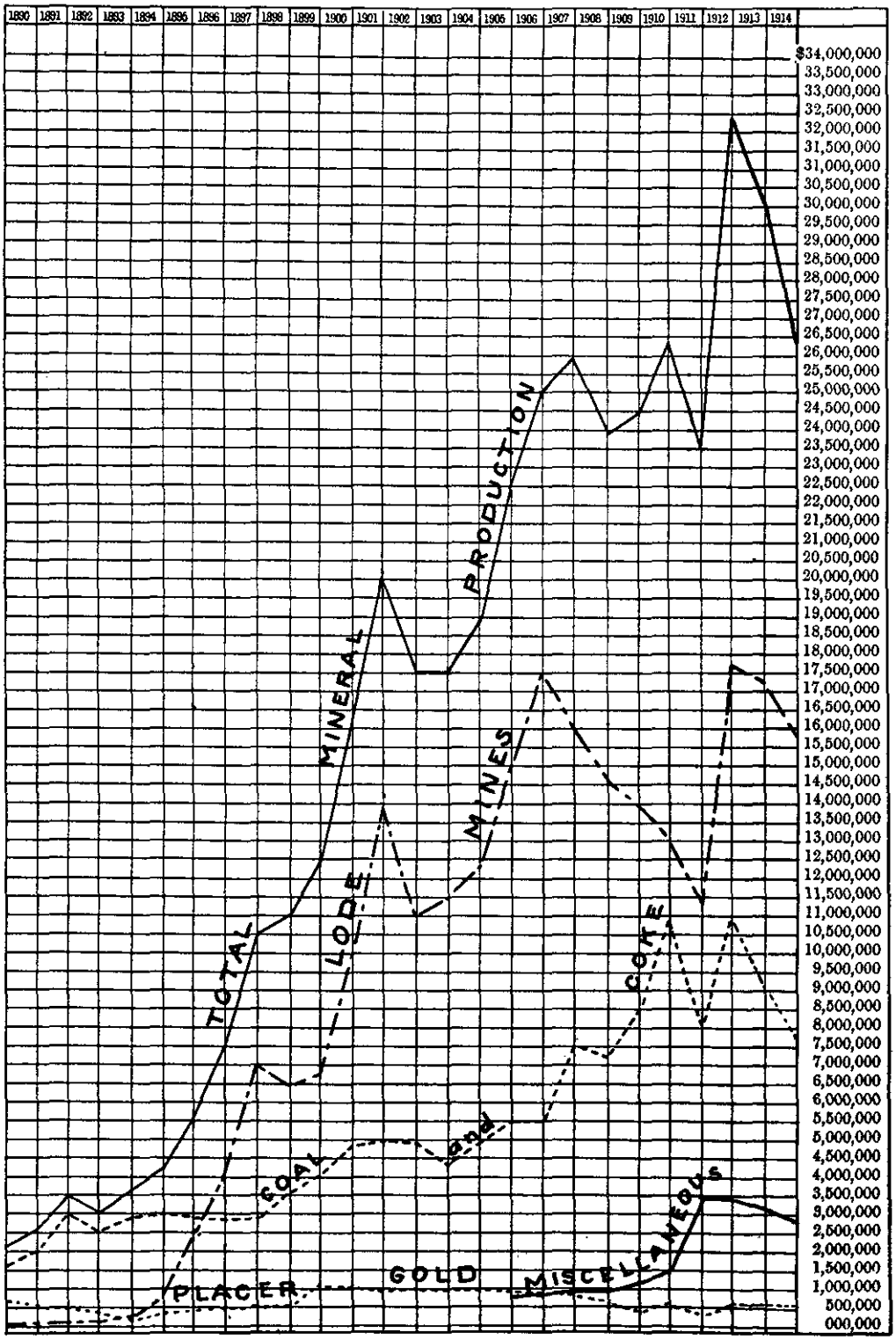
TABLE IX.—PRODUCTION IN DETAIL OF THE

DISTRICT.	YEAR.	TONS.	GOLD—PLACER.		GOLD—LODE.		SILVER.	
			Ounces.	Value.	Ounces.	Value.	Ounces.	Value.
				$		$		$
Cariboo								
Cariboo Division	1911		6,800	136,000				
	1912		9,000	180,000				
	1913		6,550	131,000				
	1914		8,250	165,000				
Quesnel "	1911		1,700	34,000				
	1912		2,500	50,000				
	1913		1,500	30,000				
	1914		1,750	35,000				
Omineca "	1911		500	10,000				
	1912		400	8,000				
	1913	353	300	6,000	62	1,281	46,298	26,297
	1914	850	300	6,000	203	4,196	135,255	70,473
Cassiar								
Atlin Division	1911	38	11,250	225,000	3	62	2,653	1,343
	1912		14,500	290,000				
	1913	310	15,750	315,000	1,355	28,008		
	1914	270	16,100	322,000	1,000	20,670		
Liard, Stikine, Skeena, Queen Charlotte, Portland Canal Divisions.	1911	7,061	300	6,000	500	10,335	27,323	13,836
	1912	3,249	450	9,000	197	4,072	5,868	3,391
	1913	51	650	13,000	29	599	4,714	2,678
	1914	261,987	1,150	23,000	2,884	59,612	131,509	68,516
East Kootenay								
Fort Steele Division	1911	30,543	150	3,000			330,235	167,231
	1912	29,910	100	2,000			376,918	217,821
	1913	32,626	100	2,000			362,311	205,793
	1914	35,384	50	1,000			452,080	256,374
Windermere-Golden	1911							
	1912	20,400					7,405	4,279
	1913	10,000					4,756	2,701
	1914							
West Kootenay								
Ainsworth Division	1911	671			4	83	77,375	39,183
	1912	32,741			80	1,653	301,755	174,384
	1913	92,472			25	517	447,015	253,905
	1914	66,441			100	2,067	329,686	171,714
Slocan and Slocan City	1911	45,466			47	971	793,926	402,044
	1912	103,629			198	4,092	1,657,105	957,641
	1913	116,206			252	5,209	1,841,226	1,045,816
	1914	104,510			13	269	1,775,975	925,283
Nelson Division	1911	39,756	50	1,000	17,649	364,619	76,774	38,878
	1912	52,323	50	1,000	17,513	361,994	164,182	94,881
	1913	79,843	50	1,000	26,324	544,117	129,011	73,278
	1914	57,879			15,298	316,210	150,268	78,290
Trail Creek Division	1911	254,062			116,682	2,411,837	88,076	44,602
	1912	243,870			132,073	2,729,949	87,580	50,584
	1913	253,870			137,004	2,831,873	109,585	62,244
	1914	297,260			138,568	2,864,201	136,185	70,952
Revelstoke, Trout Lake and Lardeau	1911	746	100	2,000	57	1,178	67,884	34,376
	1912	451	225	4,500	89	1,840	43,536	25,159
	1913	546	100	2,000	54	1,116	23,397	13,289
	1914	149	100	2,000	8	165	11,295	5,885
Boundary								
(Grand Forks, Greenwood and Osoyoos Divisions.)	1911	1,244,819	50	1,000	87,745	1,813,690	326,849	165,517
	1912	1,989,084	50	1,000	104,849	2,167,229	389,341	225,000
	1913	1,344,795	50	1,000	101,195	2,091,701	394,048	223,819
	1914	1,093,229	50	1,000	84,908	1,775,048	347,981	181,228
Similkameen, Nicola, and Vernon Divisions	1911		50	1,000				
	1912		100	2,000				
	1913	54	150	3,000	1	20	335	190
	1914	150	150	3,000	35	724	15	8
Yale, Ashcroft and Kamloops Divisions	1911	4,257	50	1,000	52	1,075	343	174
	1912		100	2,000				
	1913	557	100	2,000	25	517	126	72
	1914	279	150	3,000	14	289	57	30
Lillooet								
Lillooet and Clinton Divisions	1911	84	250	5,000	71	1,467		
	1912		250	5,000				
	1913	840	150	3,000	1,368	28,277	295	168
	1914	120	150	3,000	231	4,775	390	203
Coast								
(Nanaimo, Alberni, Clayoquot, Quatsino, New Westminster, Vancouver, and Victoria Divisions.)	1911	143,252	50	1,000	5,815	120,196	100,926	51,109
	1912	212,875	50	1,000	2,497	51,613	98,468	56,905
	1913	231,286	50	1,000	4,560	94,255	102,739	58,356
	1914	258,463	50	1,000	3,908	80,778	91,574	47,710
TOTALS	1911	1,770,755	21,300	426,000	228,617	4,725,513	1,892,364	958,293
	1912	2,688,532	27,775	555,500	257,496	5,322,442	3,132,108	1,810,045
	1913	2,663,809	25,500	510,000	272,254	5,627,490	3,465,856	1,968,606
	1914	2,175,971	28,250	565,000	247,170	5,109,004	3,602,180	1,876,736

METALLIFEROUS MINES, ETC., FOR 1911, 1912, 1913, AND 1914.

LEAD.		COPPER.		ZINC.		TOTALS FOR DIVISIONS.				TOTALS FOR DISTRICTS.
Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	1911.	1912.	1913.	1914.	1914.
	$		$		$	$	$	$	$	$
										292,807
						136,000				
							180,000			
								131,000		
									165,000	
						34,000				
							50,000			
								80,000		
									35,000	
						10,000				
							8,000			
156,862	6,165	1,838	281					40,024		
323,482	11,322	6,000	816						52,807	
										2,008,577
		19,151	2,371			228,776				
							290,000			
								343,008		
									342,670	
238,578	9,495					39,666				
41,512	1,670	88,403	14,446				32,579			
6,579	259	1,336	204					16,740		
		11,123,376	1,512,779						1,663,907	
										1,127,583
17,168,069	682,891					853,122				
18,238,238	733,907						953,728			
18,525,083	728,036							935,829		
24,363,105	870,209								1,127,583	
2,249,237	90,509			142,643	8,416		103,204			
2,495,355	98,067							100,768		
										6,267,305
289,009	11,502					50,768				
4,863,894	195,723						371,760			
9,027,861	354,795			150,680	7,233			616,450		
8,069,525	282,433			280,006	12,320				468,534	
6,705,571	266,882			2,634,544	129,092	798,989				
16,944,811	681,859			5,215,637	307,723		1,951,315			
22,648,766	890,096			6,608,088	317,188			2,258,309		
15,233,910	533,187			7,254,464	319,197				1,777,936	
1,928,836	76,768					481,265				
2,293,000	92,270	26,257	4,291				554,436			
1,936,418	76,101	815,126	124,470					818,966		
2,004,436	70,155	586,764	79,800	332,003	14,608				559,063	
8,301	330	3,429,702	424,597			2,881,366				
11,396	459	2,539,900	416,045				3,196,037			
		2,538,661	387,654					3,281,771		
		3,779,830	514,057						3,449,210	
514,314	20,470					58,024				
229,366	9,230						40,729			
521,771	20,506							36,911		
128,912	4,512								12,562	
										4,180,770
29,719	1,183	22,827,359	2,764,127			4,745,517				
		33,372,199	5,453,351				7,846,580			
45,982	1,807	28,621,973	4,370,575					6,688,902		
1,578	59	16,423,959	2,234,339						4,171,744	
						1,000				
							2,000			
		8,073	1,233					4,443		
									3,732	
		152,723	18,907			21,156				
							2,000			
		29,505	4,505					7,094		
		14,525	1,975						5,294	
										7,978
						6,467				
							5,000			
								31,445		
									7,978	
										1,507,041
		10,998,721	1,361,642			1,533,947				
		15,429,778	2,521,380				2,630,898			
		14,443,793	2,205,567					2,359,178		
		13,070,245	1,777,553						1,507,041	
26,873,397	1,069,521	36,927,656	4,571,644	2,634,544	129,092	11,890,063				
44,871,454	1,805,627	51,456,537	8,408,513	5,358,280	316,139		18,218,266			
55,364,677	2,176,832	46,460,305	7,094,489	6,758,768	324,421			17,700,838		
50,625,048	1,771,877	45,009,698	6,121,319	7,866,467	346,125				15,790,061	15,790,061

TABLE X.—Showing Mineral Production of British Columbia.



TABLE

SHOWING MINERAL PRODUCTION

OF

BRITISH COLUMBIA

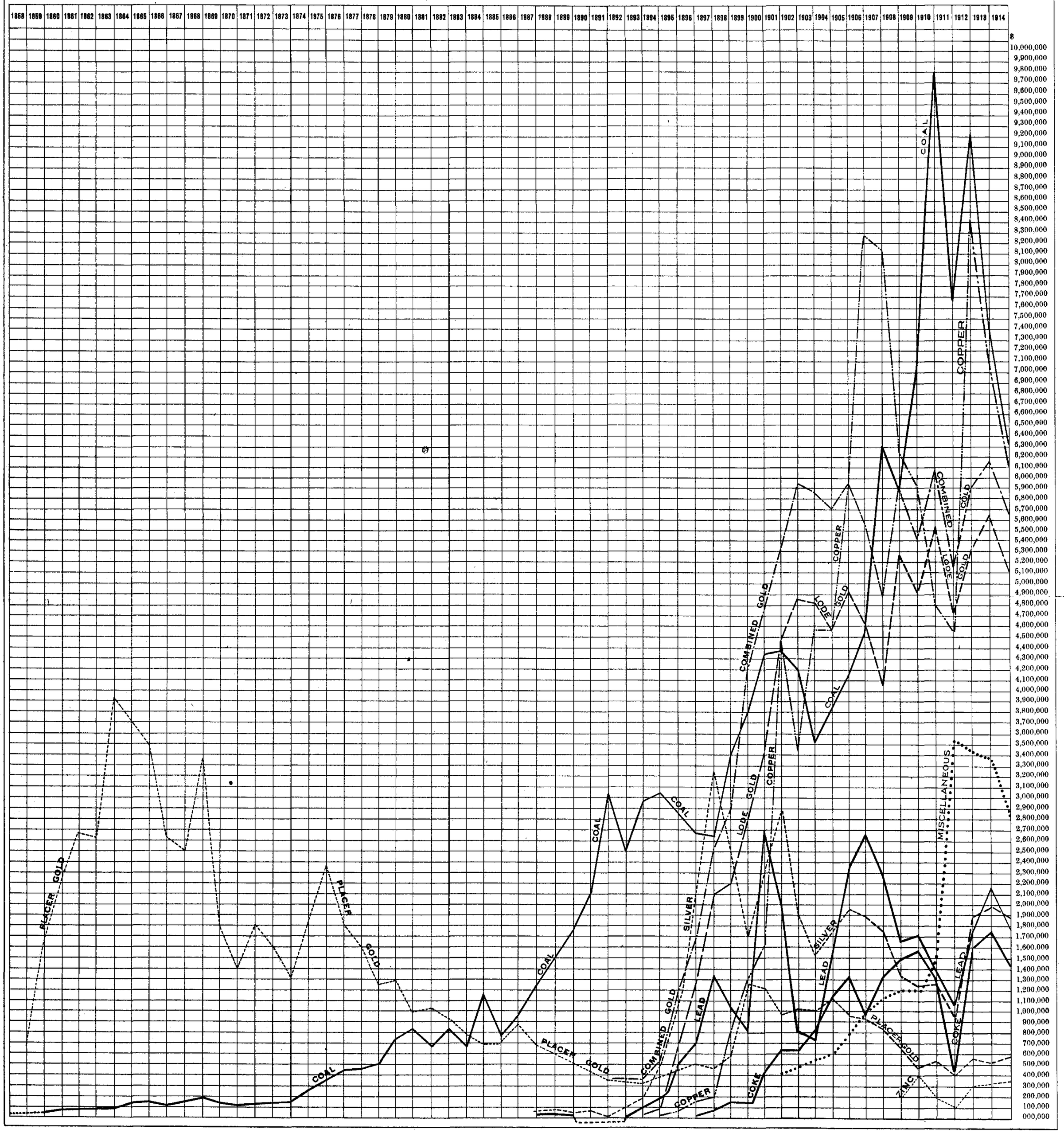
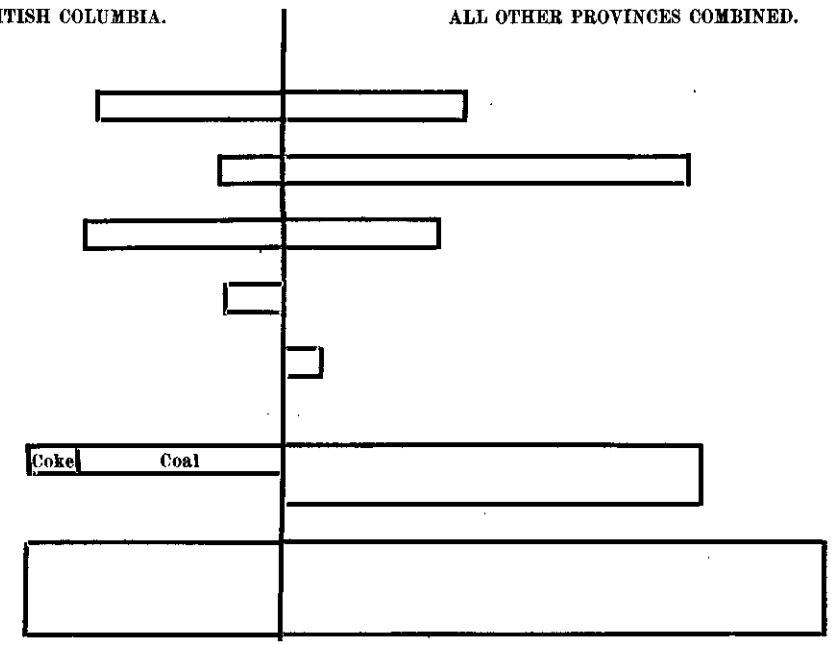


TABLE XI.

Showing Comparative Production in 1914 of Certain Minerals by British Columbia and All Other Provinces of Dominion Combined.

YUKON TERRITORY. Gold..... $5,125,396 Silver†..... $35,132 Coal $53,760

	Aggregate of Provinces.*	BRITISH COLUMBIA.	ALL OTHER PROVINCES COMBINED.
Gold	$11,296,309	$5,674,004	$5,622,305
Silver†	14,518,638	1,876,736	12,641,902
Copper	10,817,113	6,121,319	4,695,794
Lead†	1,771,877	1,771,877	*Nil.*
Iron	1,138,912	*Nil.*	1,138,912
Coal	34,130,385	6,338,385	26,384,538
Coke		1,407,462	
Total	$73,673,234	$23,189,783	$50,483,451



*Taken from "Preliminary Report on the Mineral Production of Canada in 1914," corrected by final figures of British Columbia Statistics.
†At the British Columbia valuation.

PROGRESS OF MINING.

The year 1914, during its first half, gave promise of being an exceedingly favourable one for mining in the Province, and it was even expected that its mineral production would exceed that of any previous year.

These expectations, however, were shattered by the unprecedented conditions which confronted the mineral industry during the last half of the year. These conditions were brought about by the great European war, which so upset the metal markets of the world that quotations of prices for the more important metals were unobtainable for months. Such a condition was never before experienced, leaving no basis on which present sales of ores or metals could be transacted, or even the future values of these predicted.

Gold alone had a stable value, but the other metals that go to make up the mineral output of the Province are all such as America produces a large surplus of, which surplus had been disposed of in the European markets, and with these markets temporarily destroyed, the production of these metals was either stopped or materially curtailed.

Recently, however, since the eventual outcome of the struggle can be definitely predicted and Britain has obtained the undisputed command of the seas, the metal markets have been able to again resume business and to quote prices, these, however, being somewhat lower than previously prevailing.

It will be seen, therefore, that the conditions adversely affecting the mining industry are but temporary and with their end within sight.

The production for 1914, although it is materially less than those for the years 1912 and 1913, is, nevertheless, about the same as for the year 1910, while it is considerably greater than that of any other year and is much greater than the average production for the last ten years.

The decrease shown this year, while it is partially caused by a lesser quantity of the metals produced, is not entirely attributable to that cause, but is partially due to the lower average price of the metals prevailing in 1914 as compared with those of 1913.

For example, the average market value of silver in 1914 was about 4.9 cents an ounce lower than in 1913; copper was 2.27 cents a pound lower; lead, 0.5 cent a pound lower; zinc, 0.45 cent a pound lower.

If the metal prices of 1913 had been maintained during 1914 and applied to the output for that year, this output would have been valued at some $1,170,117 greater than it appears. The lower average prices for the metals prevailing in 1914 are partially attributable to the war, but to some extent were occasioned by the financial stringency which preceded the war and possibly foreshadowed it.

The gross value of the mineral production for 1914 was $26,388,825, a decrease from that of the year 1913 of $3,907,573, or about 12.2 per cent.

The gradual increase in production during the past twenty-three years, and its fluctuations, are graphically shown in Table X., on page 14 of this Report.

The tonnage of ore mined in the lode mines of the Province during the past year was less than that of 1913. The ore mined amounted to 2,175,971 tons, showing a decrease from that of the previous year of 487,838 tons.

The tonnage mined in 1914 was produced by the various districts in about the following proportions: Boundary, 50.3 per cent.; Rossland, 13.6 per cent.; Cassiar, 12.1 per cent.;

General View of Mineral Court—Canadian Pavilion, Panama-Pacific Exposition.

the Coast District, 11.7 per cent.; Slocan District, 4.7 per cent.; Ainsworth, 3.1 per cent.; Nelson, 2.7 per cent.; East Kootenay, 1.7 per cent.; and all other parts of the Province combined, 0.1 per cent.

The following table shows the number of mines which shipped ore during the year 1914, 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:—

TABLE SHOWING DISTRIBUTION OF SHIPPING MINES IN 1914.

	Tons of Ore shipped.	No. of Mines shipping.	No. of Mines shipping over 100 Tons in 1914.	Men employed in these Mines.		
				Below.	Above.	Total.
CARIBOO AND CASSIAR:						
Omineca, Atlin, Skeena, Queen Charlotte, and Portland Canal	263,107	10	4	253	125	378
EAST KOOTENAY:						
Fort Steele	36,384	2	2	76	32	108
Windermere-Golden	.....	.....	.....	.....	.....	.....
WEST KOOTENAY:						
Ainsworth	66,441	14	6	176	87	263
Slocan and Slocan City	104,510	23	10	406	156	562
Nelson	57,879	19	12	239	124	363
Trail Creek	297,260	5	3	600	153	753
Other Divisions	149	3	.....	11	6	17
BOUNDARY:						
Grand Forks, Greenwood, and Osoyoos	1,093,229	12	10	568	284	852
Ashcroft-Kamloops	279	1	1	20	12	32
Similkameen-Vernon	150	1	1	3	4	7
LILLOOET	120	1	1	4	2	6
COAST	256,463	7	6	248	365	613
Total	2,175,971	98	56	2,604	1,350	3,954

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 NON-SHIPPING MINES AND MEN EMPLOYED.

District.	Number of Mines.			Men employed.		
	Working.	Idle.	Total.	Below.	Above.	Total.
COAST AND CASSIAR	3	9	12	24	11	35
EAST KOOTENAY	.....	2	2	.....	.....	.....
AINSWORTH	5	5	10	16	6	22
SLOCAN	8	16	24	37	12	49
NELSON	2	8	10	8	2	10
TRAIL CREEK	2	7	9	7	5	12
LARDEAU	2	3	5	3	1	4
BOUNDARY	7	21	28	41	45	86
LILLOOET	1	1	2	1	1	2
Total	30	72	102	137	83	220

SUMMARY OF THE 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 1914, aggregating $486,822,745. From this table it will be seen that coal-mining has produced more than any other separate class of mining, a total of $149,814,462; followed next in importance by copper at $86,939,370, and next in order is lode gold at $81,595,516, with placer gold in fourth place at $73,269,603.

The metal gold, obtained from both placer and lode mining, amounts to a value of $154,865,119, the greatest amount derived from any one mineral, the next important being coal, the total gross value of which, combined with that of coke, is $149,814,462, followed by copper at $86,939,370, silver at $37,709,282, and lead at $31,468,462.

TABLE II. shows the value of the total production of the mines of the Province for each year from 1893 to 1914 (inclusive), during which period the output increased nearly tenfold, and reached a production, for the year 1913, valued at $30,296,398, which is nearly three times what it was in 1898. The gross production for the year 1914, is $26,388,825, which is materially less than that of either the year 1912 or 1913, a condition not due to the mines, but to be accounted for by the disruption of the metal markets occasioned by the war, which necessitated the closing-down of some of the larger mines during the last half of the year. During the first six months, the year gave promise of making a record production.

The value of the total mineral production of the Province up to the end of 1914 was $486,822,745.

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 purposes 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 some $55,000, but at the same time a decrease in the output of lode gold of $518,486, making a decrease of $463,486 in the total production of the metal.

The amount of silver produced this year was 3,602,180 oz., having a gross value of $1,876,736, an increase in the number of ounces produced of 136,324, due to an increased production in the Omineca, Skeena, and Fort Steele Divisions. The gross value of the silver product this year, however, shows a decrease over that of last year of $91,870, on account of the market price of silver being lower during this year.

The table shows an output of lead in 1914 amounting to 50,625,048 lb., valued at $1,771,877, which is a decrease from the production of the preceding year of 4,739,629 lb. of lead.

The production of copper this year was 45,009,699 lb., valued at $6,121,319, a decrease in amount of 1,450,606 lb., or about 3.12 per cent. The value of the product was less than that of the preceding year by $973,170—a decrease of 13.7 per cent.

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

The Coast District also derives a large proportion of its production from "Miscellaneous products," such as building materials, etc., due to the larger cities therein; this year this amounted to $2,419,817, as shown in Table V.

In this table, this year again, the value of zinc has been distributed to the districts producing it, which has occasioned some changes in this table as compared with the 1909 Report, thus making it differ from the column in that and previous reports.

TABLE V. is a new table introduced three years ago, and is an endeavour to show in some detail the production of those products, such as building materials, previously summarized under "Miscellaneous products," and which amounts this year to $2,852,917. 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.

TABLE VI. gives the statistical record of the placer mines of the Province from 1858 to 1914, and shows a total production of $73,269,603. The output for 1914 was $565,000, an increase, as compared with the previous year, of about 10.8 per cent.

TABLE VII. relates entirely to the lode mines of the Province, and shows the quantities and values of the various metals produced each year since the beginning, in 1887, of such mining in the Province. The gross value of the product of these mines to date is $239,420,880; this figure includes the zinc production of 1909 and all subsequent years.

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

TABLE VIII. contains the statistics of production of the coal-mines of the Province. The total amount of coal produced to the end of 1914 was 41,199,387 tons (of 2,240 lb.), worth $132,507,063. Of this, there was produced in 1914 some 1,810,967 tons valued at $6,338,385, a decrease of 326,516 tons in quantity and of $1,142,805 in value compared with the preceding year. In these figures of coal production the coal used in making coke is not included, as such coal is accounted for in the figures of output of coke. The amount of coal used in making coke in 1914 was 355,461 tons, from which was made 234,577 tons of coke, having a value of $1,407,462, a decrease from the preceding year of 51,468 tons, or about 17.95 per cent., with a decrease in value of $308,808. While 234,577 tons of coke was actually made, only 234,480 tons was actually sold; 94 tons being added to the stocks at the mines, and 3 tons was used under the company's boilers. The total value of the output of the collieries of the Province in 1914 was $7,745,847.

The average selling prices taken this year in the calculation of value of product are the same as those used last year; that for coal being $3.50 and for coke $6 a ton of 2,240 lb. The prices used in calculations prior to 1907 were $3 and $5 respectively.

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

TABLE IX. gives the details of production of the metalliferous mines of the Province for the years 1911, 1912, 1913, and 1914, 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 1914 was 2,175,971 tons, having a gross value of $15,225,061 and with the placer gold a total value of $15,790,061.

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

Boundary District	50.25	per cent.	of tonnage.
Trail Creek Mining Division	13.65	"	"
Cassiar District	12.10	"	"
Coast District	11.75	"	"
Slocan District	4.73	"	"
Ainsworth Mining Division	3.05	"	"
Nelson Mining Division	2.72	"	"
East Kootenay District	1.65	"	"
Other Divisions	0.1	"	"
	100.00		

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

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

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

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

TABLE XI. compares graphically the output of certain mineral products in British Columbia with that of the combined output of similar products in all the other Provinces of the Dominion, and shows that in 1913 British Columbia produced, in the minerals shown, an amount equal to over 45.9 per cent. of all the other Canadian Provinces combined.

GOLD.

Placer Gold.

The production of placer gold during the past year was worth about $565,000 as nearly as can be ascertained; great difficulty is found in obtaining reliable figures, since the work is, in many cases, carried out by individuals or unorganized groups of men who keep no books, frequently paying wages, or for supplies, in gold-dust, which, being readily transported, is scattered, and the tax imposed thereon by law is thus evaded.

This year's output shows an increase, as compared with 1913, of $55,000, chiefly due to a better gravel-washing season than usual in the Atlin District.

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

The production of placer gold is nearly all from the Atlin and Cariboo Districts; over 93 per cent. of the total coming from these two sections.

Gold from Lode-mining.

The value of the gold produced from lode-mining in the Province during the year 1914 was $5,109,004, a decrease, as compared with the previous year, of $518,486, or about 9.2 per cent. This reduction in the production of lode gold is due to large decreases in the output of the Boundary and Nelson Districts and smaller decreases in the Atlin, Lillooet, and Coast Districts. Against this there is a considerable increase in the Skeena Division of the Cassiar District, due to the commencement of smelting operations by the Granby Company at Anyox, and a slight increase in the yearly output of the Trail Creek Division.

The falling-off of the gold production in the Boundary District is entirely attributable to the closing of the smelters in August, on account of the European war. This same cause is largely responsible for the reduction in output of the Nelson Mining Division.

The only large stamp-mill in operation in the Province is at the *Nickel Plate* mine at Hedley, in the Osoyoos Mining Division, which, this past year, milled some 78,494 tons of ore having a value of about $800,000. There are smaller stamp-mills operating at the *Poorman*, *Queen*, *Mother Lode*, and other mines in the Nelson Division; and in addition, there are stamp-mills at the *Jewel* mine, Greenwood; *Coronation* mine, Lillooet; and *Engineer* mine, Atlin, which operated during the year.

The following are the values of the gold product of the three most important camps; Rossland, $2,864,201; Boundary, $1,775,048; and Nelson, $316,210. About 74 per cent. of the gold production of the Province is obtained from the smelting of copper-bearing ores, the remainder mainly from stamp-milling.

SILVER.

The total amount of silver produced in the Province during the year 1914 was 3,602,180 oz., valued at $1,876,736, an increase in amount, as compared with the previous year, of 136,324 oz.; but, owing to the decrease in the market value of this metal, the value of the silver-output in 1914 was $91,870 less than in 1913. This is the greatest production of this metal since 1902.

The Slocan District—including the Ainsworth, Slocan, Slocan City, and Trout Lake Mining Divisions—produced about 59 per cent. of the total Provincial output of silver this year, and the Fort Steele Mining Division about 13.7 per cent., all from argentiferous galena. The remainder is chiefly derived from the smelting of copper-ores carrying silver.

The Hazelton District shows a big increase over the output of the previous year, the figures being respectively 135,265 and 46,298 oz.; most of this is credited to the *Silver Standard* mine.

The following table shows the silver production from the different Mining Divisions:—

Slocan and Slocan City M.D.	produced	1,775,975	oz. silver =	49.35	per cent. of total.
Fort Steele	"	492,080	"	13.65	"
Boundary	"	347,981	"	9.64	"
Ainsworth	"	329,586	"	9.15	"
Nelson	"	150,268	"	4.18	"
Trail Creek	"	136,185	"	3.78	"
Omineca	"	135,265	"	3.75	"
Skeena	"	131,509	"	3.64	"
Coast	"	91,574	"	2.54	"
Trout Lake	"	11,295	"	0.31	"
All others	"	462	"	0.01	"
		3,602,180		100.00	

LEAD.

The lead production of the Province for the year 1914 was 50,625,048 lb. of lead having a market value of $1,771,877, showing, as compared with the previous year, a decrease in amount of 4,739,629 lb. of lead, or 8.55 per cent., and a decrease in value of $403,954, or 18.5 per cent.

This amount of lead represents the amount of metallic lead actually received and paid for by the smelters.

Instead of taking account of "loss in slags," we have followed, as has been our habit, the practice of the smelters of deducting 10 per cent. from the market price of the metal, in calculating the value.

The average market price of this metal for the year 1914 was a little lower than for the previous year.

The lead production is this year, as usual, derived chiefly from the Slocan and Fort Steele Mining Divisions, as is shown in the following table:—

Fort Steele M.D.	produced	24,863,105 lb.	lead =	49.13	per cent. of total.
Slocan	"	15,233,910	"	30.10	"
Ainsworth	"	8,069,525	"	15.92	"
Nelson	"	2,004,436	"	3.95	"
Omineca	"	323,482	"	0.64	"
All others	"	130,590	"	0.26	"
		50,625,048		100.00	

COPPER.

The amount of copper produced in the Province in 1914, smelted during the year, was 45,009,699 lb. fine copper, valued at the average New York market price for copper at $6,121,319. These figures represent the amount of copper actually recovered, as nearly as it is possible to ascertain; the amount of copper really in the ores mined would be approximately 25 per cent. greater.

As compared with the year 1913, these figures show a decreased production in amount of 1,450,606 lb., or about 3.13 per cent. This decrease is accounted for by the war conditions.

It is an agreeable surprise to find that under these conditions, the quantity of copper produced in 1914, as compared with 1913, shows only the comparatively small decrease of 1,450,606 lb. The explanation lies in the fact that the operation of the Granby Consolidated Company's *Hidden Creek* mine and its smelting-works at Anyox, in Skeena Mining Division, resulted in the production of copper to an extent that largely offset the decrease that resulted from the suspension of production from Boundary District mines.

The following table shows the production of the various districts for the years 1911, 1912, 1913, and 1914:—

	1911.	1912.	1913.	1914.	
Boundary District	22,327,359 lb.	33,372,199 lb.	28,621,973 lb.	16,428,959 lb.	= 36.52 %
Rossland "	3,429,702 "	2,539,900 "	2,538,661 "	3,779,830 "	8.40 "
Coast & Cassiar "	11,017,872 "	15,518,181 "	14,446,967 "	24,199,621 "	53,74 "
Yale-Kamloops "	152,723 "	..... "	37,578 "	14,525 "	0.03 "
Nelson "	..... "	26,257 "	815,126 "	586,764 "	1.31 "
	36,927,656 "	51,456,537 "	46,460,305 "	45,009,699 "	100.00 "

The average assays of the copper ores of the various camps, based upon the copper recovered were as follows:—

Boundary, 0.753 per cent.; Coast, 2.545 per cent.; and Rossland, 0.636 per cent.

ZINC.

The total quantity of zinc produced in 1914 was 7,866,467 lb., valued at $346,125 the average New York price, less 15 per cent., being taken as the basis of valuation.

This shows an increase, as compared with the year 1913, of 1,107,699 lb., or 16.36 per cent.

The lowering of the United States tariff on zinc concentrates and ore entering that country served to stimulate zinc production, and during the latter months of 1914 the high price prevailing and the great demand for zinc for war purposes accelerated the shipments of concentrates.

The experiments and plant for the electric smelting of zinc-lead ores which had been in operation at Nelson for about a year under G. C. Mackenzie, of the Mines Branch of the Department of Mines, Ottawa, were finally abandoned during last summer. W. R. Ingalls, who acted as consulting zinc metallurgist to that Department, writes —

"The experimental work at Nelson, B.C., was discontinued, it being regarded as conclusively settled that an electric zinc-smelting furnace so small as one ton of daily capacity is a commercial impossibility, while the satisfactory development of a larger furnace was regarded as too doubtful to be undertaken at Nelson."

COAL.

The gross production of coal in 1914 was 2,166,428 long tons, of which 355,461 tons was made into coke, leaving the net production at 1,810,967 tons. These figures show a decrease, as compared with 1913, of 404,332 tons gross and of 326,516 tons net. The quantity of coke made was 234,577 tons, which is a decrease of about 51,468 tons as compared with 1913. For purposes of comparison the following table is shown :—

	1914.	1913.	1912.	1911.	1910.	1909.
Coal, gross.....tons, 2,240 lb..	2,166,428	2,570,760	3,025,709	2,297,718	3,139,235	2,400,600
Less made into coke "	355,461	433,277	396,905	104,656	339,189	394,124
Coal, net..... "	1,810,967	2,137,483	2,628,804	2,193,062	2,800,046	2,006,476
Coke made..... "	234,577	286,045	264,333	66,005	218,029	258,703

These figures indicate a serious decrease, which is, however, only temporary, being mainly attributable to the European war.

In the interior of the Province the war brought about at least a partial closing-down of the metalliferous mines and smelters, and thus diminishing the amount of railway transportation, all of which constituted the chief market for the coal of this district.

In the Vancouver Island District the output in 1914 was greater than it was in 1913, when the labour troubles interfered with the production, but it is still much below the normal output of these collieries.

Production was not interfered with to any appreciable extent, if at all, by labour troubles in 1914. In fact, it was claimed that much more coal could have been produced had there been demand for it. There is no doubt that all there was a market for was produced. Unfortunately, though, less coal than usual was required from Vancouver Island mines for bunkering purposes, the state of war having considerably lessened the demand. The activity

of German cruisers that sought to destroy the shipping of the allied powers at war with Germany, for a period of four or five months interfered with the steamship trade to which Vancouver Island collieries ordinarily look for a considerable portion of their market. The destruction in December of those of the enemy's war-ships that had disturbed the mercantile service removed this menace to shipping. Again, the competition of fuel-oil continued to be felt, though not in a larger degree than in 1913.

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

	1912.	1913.	1914.
Vancouver Island mines.....tons, 2,240 lb.	1,558,240	973,493	1,072,314
Nicola and Similkameen mines ..... "	206,257	265,542	138,931
Crowsnest mines ..... "	1,261,212	1,331,725	955,183
Total quantity of coal mined ..... "	3,025,709	2,570,760	2,166,428
Less made into coke ..... "	396,905	433,277	355,461
Net quantity of coal produced ..... "	2,628,804	2,137,483	1,810,967

Collieries of Coast District.

The Coast collieries mined 1,211,245 tons of coal in 1914, of which 18,635 tons was added to stock, making 1,192,610 tons distributed from these collieries in 1914. This amount was distributed thus:

Sold as coal in Canada.....	724,066 tons.	
" United States.....	213,324 "	
" other countries.....	.....	
Total sold as coal.....		937,390 tons.
Used under companies' boilers, etc.....		107,991 "
Used in making coke.....		.....
Lost in washing.....		147,229 "
		1,192,610 "
Plus coal added to stock.....		18,635 "
Gross output.....		1,211,245 "

The total coal sales of the Coast collieries for the year show, as compared with the sales of the previous year, a decrease of 44,700 tons, equivalent to 4.5 per cent.

The consumption of coal in that part of British Columbia served by the Vancouver Island collieries shows this year a decrease of 36,011 tons, or about 5.64 per cent. from the preceding year; the amount exported to the United States was 114,392 tons greater, and no coal was exported to other countries.

Only one company in the Coast District—the Canadian Collieries, Limited, has ever made coke, and this year the ovens have not been in operation, although the company sold 2,314 tons of coke from stock, exhausting the stock.

The coke sold was entirely for consumption in British Columbia, no export sales having been made.

On Vancouver Island, four companies produced coal this year—the Canadian Collieries, Limited, the Western Fuel Company, the Pacific Coast Coal Mines, and the Vancouver-Nanaimo Coal Company; the majority of these companies each operate two, or more, collieries. The combined output of the Island collieries was 1,072,314 tons.

In the Nicola and Princeton valleys of the Coast District, the Middlesboro Colliery Company produced 60,705 tons of coal; the Princeton Colliery, 19,535 tons; the Inland Coal and Coke Syndicate (formerly Coal Hill Syndicate), 53,281 tons; the Coalmont Colliery, 4,850 tons; and the Pacific Coast Colliery Company, 560 tons.

The total output of this portion of the district was 138,931 tons.

EAST KOOTENAY COALFIELD.

There were three companies operating in this district—the Crow's Nest Pass Coal Company, operating two separate collieries, the combined output of which was 778,403 tons; the Corbin Coke and Coal Company, which made an output of 74,312 tons; and the Hosmer Mines, Limited, which produced 102,468 tons of coal, making a gross output for the district for 1914 of 955,183 tons of coal.

Of the coal mined, 3,205 tons was added to stock, making the amount of coal distributed from the collieries 951,978 tons.

Of this gross tonnage, 355,461 tons was used in the manufacture of coke, of which there was produced 234,577 tons (2,240 lb.).

The coke sold this year amounted to 232,166 tons, and 3 tons was used under the companies' boilers, making a total of 232,169 tons, to which must be added 2,408 tons added to stock, making the coke production for this year 234,577 tons, as compared with 286,045 tons in 1913.

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

Sold as coal in Canada	140,094 tons.	
" United States	389,383 "	
Total sold as coal		529,477 tons.
Used by the companies in making coke		355,461 "
Used by the companies under boilers, etc		67,040 "
		951,978 "
Plus coal added to stock		3,205 "
Gross output		955,183 "

The greater part of the gross Provincial production is still being mined by three companies—the Crow's Nest Pass Coal Company of East Kootenay, the Canadian Collieries and the Western Fuel Company of Vancouver Island, which mined, collectively, 74.4 per cent. of the gross output, their respective production representing 36 per cent., 24.1 per cent., and 14.3 per cent. of such total.

Of the other collieries: In the Coast District, on Vancouver Island, the Pacific Coast Coal Mines, Limited, produced 130,645 tons, and the Vancouver-Nanaimo Coal Company 107,158 tons; and in the Nicola Valley section of the district, the Middlesboro Colliery Company mined 60,705 tons, the Inland Coal and Coke Company 53,281 tons, the Princeton Coal and Land Company 19,535 tons, while the Coalmont Colliery produced some 4,850 tons of coal.

In the East Kootenay District, in addition to the Crow's Nest Pass Coal Company, which produced 778,403 tons, the Hosmer Mines, Limited, produced 102,468 tons and the Corbin Coal and Coke Company 74,312 tons.

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

The collieries of the Coast District, including the Nicola Valley field, are to be credited this year with about 56 per cent. of the total coal output.

The gross output of the collieries of the Province for the past year was, as already stated, 2,166,428 tons, of which some 21,840 tons of coal was added to stock, making the gross amount of coal distributed 2,144,588 tons.

Of this gross amount, there was sold for consumption in Canada, 864,160 tons; sold for consumption in the United States, 602,707 tons; making the total coal sales for the year 1,466,867 tons of 2,240 lb.

In addition to the coal sold, there was used in the manufacture of coke 355,461 tons, all in the East Kootenay field; and used under companies' boilers, etc., 175,031 tons; while 147,229 tons was lost in washing and screening.

There was no coke made this year in the Coast District, although some 2,314 tons was sold from stock, the total coke production having been made by the Crow's Nest Pass Coal Company, and Hosmer Mines, Limited, in the East Kootenay field, where, from 355,461 tons of coal, 234,577 tons of coke was manufactured, of which 3 tons was used under the companies' boilers.

The coke sales of the Province for the past year amounted to 234,480 tons, and in addition 94 tons was added to stock.

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

Coal.	Coast District.	Crowsnest Pass District.	Total for Province.
Sold for consumption in Canada .....tons, 2,240 lb.	724,066	140,094	864,160
" export to United States ..... "	213,324	389,383	602,707
" export to other countries ..... "	.....	.....	.....
Total coal sales	937,390	529,477	1,466,867
Coke.			
Sold for consumption in Canada .....tons, 2,240 lb.	2,314	177,853	180,167
" export to United States ..... "	.....	54,313	54,313
" export to other countries ..... "	.....	.....	.....
Total coke sales	2,314	232,166	234,480

OTHER MINERALS.

Iron Ore.

The situation in regard to iron ore remains unchanged, no material advancement having been made in the utilization of the numerous deposits throughout the Province. At present there is no market in the Province for iron ore, and, as a consequence, very little development-work has been done. There are, undoubtedly, a number of iron-ore deposits in different districts which are of considerable size, and which are, as a rule, very free from injurious elements. In considering the possibility of the successful establishment of an iron and steel industry, other factors besides availability of ore are important—namely, a sufficient market for the products, a supply of fuel near by at a price comparable with what it is in the East, and a steady supply of suitable labour.

So far as is at present known, there is on the Coast no developed body of hæmatite or other ore of iron, such as would be desirable to mix with the magnetites for blast-furnace smelting.

A deposit of hæmatite is being developed on the Zymoetz river, a description of which is given elsewhere in this Report.

As to the electro-thermic smelting of such iron ores into commercial pig-iron, the process has not as yet been sufficiently perfected, although it is looked upon as one of the possibilities of the future.

Considerable interest has been manifested during the past year in regard to iron-deposits generally, and there have been many rumours of intended installations of iron-smelting plants, but nothing at all definite has yet become public.

Platinum. No production of platinum in 1914 has been reported, and it is not likely that the Tulameen output from placer-mining was more than a few ounces.

Oil. Drilling for oil was continued in the Fraser valley, and also in the neighbourhood of Otard bay, Graham island, but although the results are said to be encouraging, no appreciable flowage of oil is yet reported.

Mica. A small amount of development-work was carried out on the mica claims in the vicinity of Tete Jaune Cache, but no output is yet recorded. Now that the Grand Trunk Pacific Railway has been built within a few miles of these claims, it is pretty well assured that they will be seriously investigated this coming summer.

Molybdenum. It is of interest to note the fact that the mineral molybdenite has been discovered, in what appears to be commercial quantities, at the head of Lost creek, some fifteen miles from the town of Salmo, in the Nelson Mining Division; two carloads of the mineral has been mined and taken to Salmo for shipment. The deposit would appear to be of considerable size, but, judging from the samples sent to this Department by the owners, the material will require to be concentrated to bring it up to the market requirements of about 85 per cent. molybdenite.

BUILDING MATERIALS.

The production of building materials during 1914 was less than in the year 1913, due no doubt to the financial depression and the war, which have, to some extent, retarded construction-work, especially in the Coast cities.

The decrease in output was general with each of the different kinds of building material, except in the case of riprap. Nearly $500,000 worth of this material was used in the construction of the breakwater and piers at Victoria, and therefore this column in the table shows a large increase over that of the previous year.

The output of pottery and tile was also nearly equal to that of the previous year. The heaviest decreases were in red brick and cement.

For the past year, although the statistical returns are not as complete as desired, a production of about $2,852,917 is accounted for, the details of which are given in Table V., on page 9. Approximately 85 per cent. of this output comes from the Coast District, and the larger part of this finds its market in the Coast cities.

Building-stone. Excellent building-stone of various sorts is found in abundance in almost every part of the Province, but 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 also export to the United States.

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

Marble. The marble-quarry in the Ainsworth Mining Division is still being developed, but it is not known that any appreciable output was made. Two new marble-quarries were opened up on the southern end of Texada island, but it is too soon as yet to expect anything more than sample shipments. Sample slabs from one of those quarries sent to the Provincial Museum show a marble very pleasing to the eye and of excellent quality, hard, and taking a good polish. The other quarry is known to have sent at least one scow-load of large blocks to Vancouver—presumably to be slabbed—but no information is as yet available as to the results obtained.

Red Brick. The production of red brick during the past year was about 17,000 M., amounting in value to $163,300. The price of common brick ranges from $8 to $11 a thousand, according to quality and demand. A considerable quantity of brick is still imported into Vancouver, but, as the local plants are now well equipped with modern appliances, they should be able to overcome outside competition.

Firebrick. The only company producing firebrick in the Province is the Clayburn Company, Limited, with a plant at Clayburn, where the beds of clay are of the age of the coal-measures. This company made approximately 1,600 M. firebrick, worth about $43,000, and 1,100 M. front or face brick, worth over $30,000. Besides this the company made a large number of common brick, paving-brick, tiles, drain-pipes, etc.

Pottery Drain-pipe, and Tile. The plant of the British Columbia Pottery Company at Victoria West, which manufactures drain and sewer pipe, chimney-tiles, etc., was rebuilt after having been burned down in 1913, and had nearly a full year's output. The Port Haney Brick Company, besides manufacturing common brick, also make drain-pipe, partition-block, etc.

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

The Consolidated Mining and Smelting Company quarried about 52,000 tons of limestone from the Fife quarries for use as flux in the furnaces at the Trail smelter.

Portland Cement.

Two companies manufactured cement in the Province during the past year. The Vancouver Portland Cement Company, with works at Tod inlet, is said to have produced over $550,000 worth of cement. The Associated Cement Company, with works at Bamberton, made a production valued at about $300,000. The cement plant started near Princeton has ceased to operate.

Crushed Rock and Gravel.

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

Concrete construction has become so extensive on the Coast that a number of plants are well fitted up with crushing and screening machinery to make the various products required.

Near Vancouver and Victoria a number of companies supply 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. The value of the sand and gravel produced for use in these two cities amounted during the past year to over $300,000.

BUREAU OF MINES.

WORK OF THE YEAR.

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

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

The permanent staff of the Bureau now consists of the Provincial Mineralogist and Assayer, Wm. Fleet Robertson; the Assistant Provincial Assayer and Provincial Analyst, D. E. Whittaker; and, since September, 1913, of J. D. Galloway, M.Sc., who was then appointed Assistant Provincial Mineralogist; while H. Nation nominally continues as general office assistant, but went to the war in August.

During the season of 1914 the Bureau was allowed the temporary assistance in the field of two private practising mining engineers, who were engaged to make examinations of and report on the mineral properties in certain portions of the Province. These were W. M. Brewer, M.E., who made inspections in the Northern Coast Districts, and Newton W. Emmens M.E., who reported on the Lardeau and Trout Lake Mining Divisions.

In addition, the Bureau engaged the services of J. W. Astley, M.E., of Toronto, and A. G. Larson, of Vancouver, to make special reports on Quadra Island and North Fork of Kettle river respectively.

In March, 1913, the office of the Provincial Mineralogist was moved from the Department of Mines offices in the main Parliament Buildings to quarters in the old Legislative Hall on Superior street, where offices were fitted up; in this building are also located the Mineral Museum, Assay Office, and Laboratory.

Provincial Mineralogist.

After the report for the preceding year had been issued, the Provincial Mineralogist, with assistants, in May and December, held examinations at Victoria of candidates for Certificates of Competency as Assayers, each of which lasted a week. During the season of 1914 the greater part of the time of the Provincial Mineralogist was occupied in attending to work in connection with the publication of reports and to the routine work of the Bureau, necessitated by the absence for nearly the entire year, on military duties, of his assistant, Harold Nation.

The only field-work he was able to perform this past season consisted of short trips to Portland Canal and the Skeena Mining Divisions; the engaging and directing the operations of the parties in the field occupying all the season.

Assistant Provincial Mineralogist.

The Assistant Mineralogist was, during the early part of the year, engaged in routine office-work and preparation of reports. In February he made a trip to Nicola, Aspen Grove, and Princeton, and from data gathered submitted a report on the prospective ore tonnages along alternate routes of the Kettle Valley Railway. This report was included in the Annual Report of the Minister of Mines for the year 1913.

A revision and relabelling of the specimens in the Mineral Museum occupied part of his time during the first half of the year.

The field-work for the summer months consisted of making an examination of the important mineral camps along the route of the Grand Trunk Pacific Railway in the Omineca and Cariboo Mining Divisions; this work lasted for about four months. Leaving Victoria on July 9th, the Assistant Mineralogist proceeded to Prince Rupert and then by railway on to Skeena Crossing, at which point the field-work was commenced. The more important camps visited in the Omineca Division were: Rocher Déboulé mountain, Red Rose basin, Brian Born basin, Glen mountain, and Nine-mile mountain in the Hazelton District; coal areas at the headwaters of the Zymoetz river, Hudson Bay mountain, Telkwa river, Hunter basin, Hankin basin, Sawmill camp, and the Babine range.

In the Cariboo Division a stop was made at Fort George to examine the reported showings of quartz veins carrying free gold, and then he went on to Tete Jaune to examine the mica claims there; unfortunately, owing to the lateness of the season, these claims were covered with snow, and hence examination of them was impossible.

A return was made to Fort George, and from thence he proceeded to Barkerville, where a short examination of placer properties was made. From Barkerville auto-stage was taken out to Ashcroft on the Canadian Pacific Railway, and thence to Vancouver and to Victoria, arriving there on October 16th.

The writer's report on the Omineca Mining Division has been published as Bulletin No. 4, 1915, but will also be found under the heading "Omineca Mining Division" in this Report. Similarly, the notes on the Cariboo Division will be found under that heading.

In December the writer made a hasty visit of a few hours to the property of the Port Haney Oilfields Company. A brief report on it will be found under the heading "Vancouver Mining Division."

ASSAY OFFICE.

The following is a summary of the work of the Assay Office of the Bureau of Mines for the year 1914 as reported by the Assistant Provincial Assayer, D. E. Whittaker:—

During the year 1914 there were made by the staff in the Government Assay Office 1,945 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 analysis	$644 00
" assaying	333 75
" melting and assaying gold-dust and bullion	8 54
" assayer's examinations	210 00
Total cash receipts	$1,196 29

Determinations and examinations made for other Government departments for which no fees were collected:—

Attorney-General's Department	$880 00
Agriculture Department	325 00
Board of Health	90 00
Works Department	50 00
Treasury Department	123 50
	$1,468 50
Value of work done outside of Department work	$2,664 79

The value of gold melted during the year 1914 was $28,744 in 38 lots, as against $17,600 in 48 lots in 1913.

Some years ago, in this Province, nickel was erroneously reported from numerous places. It was found that the assayers let a part of the iron in solution pass through the filter-paper, then precipitated it and supposed it to be nickel, when if it had been properly precipitated and filtered off in the first place it would have left nothing to be precipitated later.

In the separation of gold, silver, and platinum, it has been the practice with many local assayers to dissolve the total metals, get out the gold and silver, and if there was any loss call it platinum, or to weigh up part of the gold as platinum. Such methods have cost the unfortunate investor many thousands of dollars.

Free Determinations.

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

EXAMINATION 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 1914 of the Board of Examiners for Certificates of Competency and Licence to Practice Assaying in British Columbia, as established under the "Bureau of Mines Act Amendment Act, 1899."

An examination was held at Victoria, in the Government Laboratory, on May 11th and the following days. One candidate came up for examination and failed to qualify. Three candidates applied for exemption under section 2, subsection (2), of the Act, and the Board recommended that two of them be granted a Certificate.

Another examination was held at the Government Labratory, Victoria, on December 14th. Two candidates came up for examination; one passed and one failed. Three candidates applied for exemption under section 2, subsection (2), of the Act, and the Board recommended that a Certificate be granted them.

In accordance with the recommendations of the Board, certificates have been duly issued by the Honourable the Minister of Mines to these seven 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).

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

Under section 2, subsection (2).

Archer, Allan .....
Blaylock, Selwyn G. ..... Trail.
Bolton, George E. ..... Silverton.
Brennan, Charles Victor .... Bingham, Utah.
Browne, R. J. ..... Rossland.
Browne, P. J ..... Nelson.
Bryant, Cecil M. ..... Vancouver.
Burwash, N. A. .....
Cartwright, Cosmo T ..... Ottawa.
Cavers, Thomas W .....
Clothier, George A ..... Stewart.
Cole, Arthur A. ..... Cobalt, Ont.
Cole, G. E. ..... Rossland.
Cole, L. Heber. ..... Ottawa, Ont.
Conway, E. J .....
Coulthard, R. W. ..... Blairmore, Alta.
Cowans, Frederick .....
Dawson, V. E. ..... Trail.
Dempster, R. C. ..... Rossland.
Dixon, Howard A. ..... Toronto, Ont.
Eardley-Wilmot, V. L .... Rossland.
Eldridge, Gardner S. ..... Vancouver.
Evans, A. J. L. ..... Rossland.
Galbraith, M. T. .....
Gilman, Ellis P. ..... Vancouver.
Green, J. T. Raoul ..... Blairmore, Alta.
Guess, George A. ..... Toronto, Ont.
Gwillim, J. C. ..... Kingston, Ontario.
Harding, Wilson M. ..... Victoria.
Heal, John H. .....

Under section 2, subsection (2).—Concluded.

Hearn, Roy D.....Trail.
Hilliary, G. M.....Idaho, U.S.A.
Holdich, Augustus H .....England.
Johnston, William Steele....Lachine, Que.
Kaye, Alexander .....Vancouver.
Kendall, George.....Vancouver.
Kilburn, Geo. H.....
Lathe, Frank E.....Grand Forks.
Lay, Douglas .....Silverton.
Lewis, Francis B..... .... South Africa.
Merrit, Charles P.....
Murphy, C. J. .....
Musgrave, William N.....Mexico City.
McArthur, Reginald E .....
McDiarmid, S. S .....
McGinnis, Wm. C.....Queen Charlotte Islands.
McKay, Robt. B.....Vancouver.
McLellan, John .....Queen Charlotte Islands.
McMurtry, Gordon O.....
McNab, J. A.....Thompson, Nevada.
McPhee, W. B.... .....
McVicar, John.....Edmonton, Alta.
Maclennan, F. W.....
Moran, P. J.....Vancouver.
Newton, W. E.....Sandon.
Oughtred, S. W.....Ainsworth.
Outhett, Christopher .....Kamloops.
Pemberton, W. P. D.....Victoria.
Reid, J. A.....Greenwood.
Ritchie, A. B.... .....Nelson.
Roaf, J. R.....Nanaimo.
Rose, J. H.....
Sampson, E. H. S.....Riondel.
Scott, Oswald Norman.....
Shannon, S.....
Sharpe, G. P.....Midland, Ont.
Shorey, P. M.....Trail.
Sloan, David.....Three Forks.
Stevens, F. G.....Mexico.
Sullivan, Michael H.....Trail.
Sutherland, T. Fraser.....
Swinney, Leslie A. E.....
Thomson, H. Nellis.....Anaconda, Montana.
Thomson, Robt. W. .....
Watson, A. A.....Olalla.
Watson, Henry .....
Winslow, R. H.....Vancouver.
Wilson, Ridgeway R. ... .Fernie.
Workman, Ch. W.....
Wright, Richard .....Rossland.
Wynne, Lewellyn C.....
Yuill, H. H.....

Under section 2, subsection (3).

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

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

Pinder, W. J.....
Thompson, James B.....Vancouver.

EXAMINATIONS FOR COAL-MINE OFFICIALS.

The "Coal-mines Regulation Act," as now consolidated and amended, provides that all officers of a coal-mining company having any direct charge of work underground shall hold Government Certificates of Competency, which are to be obtained only after passing an examination before a duly qualified Board, appointed for the purpose of holding such examinations, and known as the Managers' Board.

The certificates granted on the recommendation of such Board and the requirements shall be as follows:—

"(*a.*) If a candidate for a manager, that he is a British subject and has had at least five year's experience in and about the practical workings 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-three 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's or other recognized ambulance society, showing that he has taken a course in ambulance-work fitting him, the said candidate, to give first aid to men injured in coal-mining operations.

"For the purposes of this section the experience demanded by such section shall be of such character as the Board shall consider of practical value in qualifying the candidate for the position to which such class of certificate applies.

"Experience had in a mine outside of the Province may be accepted should the Board consider such of equal value."

Any certificate is considered as including that of any lower class.

EXAMINATION FOR MINERS.

In addition to the examinations and certificates already specified as coming under the Managers' Board, the Act further provides that every coal-miner shall be the holder of a certificate of competency 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 for a miner's certificate are held each month at each colliery by a Board of Examiners, known as the Miners' Board, and consisting of an examiner appointed by the owners, an examiner elected by the miners of that colliery, and an examiner appointed by the Government.

BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS.

FIRST, SECOND, AND THIRD-CLASS CERTIFICATES.

Report of Tully Boyce, Secretary of Board.

I beg to submit the Annual Report covering the transactions of the above Board for the year ending December 31st, 1914.

The Board consists of Thos. R. Stockett, of Nanaimo, Chairman; Andrew Thomson, of Nanaimo, Vice-Chairman; Tully Boyce, of Nanaimo, Secretary; Thomas Graham, of Victoria, Chief Inspector of Mines; Andrew Bryden, of Merritt; and Bernard Cawfield, of Coal Creek. The meetings are held in the office of the Board at Nanaimo.

During the year two vacancies occurred on the Board, the first through the death of George Williams, of Nanaimo, who died on July 16th. Mr. Williams had been an active member of the Board for twenty-five years, his appointment being dated June 3rd, 1889. This vacancy was filled by the appointment of Andrew Thomson, of Nanaimo. The second vacancy occurred in August through Henry E. Miard, of Coal Creek, leaving the Province to join his regiment in France. This vacancy is still open pending the return of Mr. Miard.

An examination for First-, Second-, and Third-class Certificates was held at Nanaimo, Cumberland, Merritt, and Fernie on May 19th, 20th, and 21st, at which there were 95 candidates, as follows: For first-class there were 19, of whom 7 passed and 12 failed; for second-class there were 22, of whom 14 passed and 8 failed; for third-class there were 54, of whom 32 passed and 22 failed.

Another examination for third-class only was held at Nanaimo, Cumberland, Merritt, and Fernie on October 14th, at which 15 candidates appeared, of whom 13 passed and 2 failed.

All of the candidates who passed the examination, with the exception of 5 third-class candidates, have fully complied with the provisions of the Act, and certificates have been issued accordingly.

The fullest information as to standard of efficiency required and copies of previous question papers in printed form may be had by applying to the Secretary at Nanaimo.

LIST OF CANDIDATES TO WHOM CERTIFICATES WERE ISSUED AT THE EXAMINATIONS HELD IN MAY AND OCTOBER 1914, AT NANAIMO, CUMBERLAND, MERRITT, AND FERNIE.

FIRST-CLASS CANDIDATES.

NAME.	DATE.	No.
David Brown	May 21st, 1914	
Thomas Owen Davies	"	
Rowland Blakeney Gascoyne	"	
George O'Brien	"	
Hugh Penman	"	
John Russell	"	
James Touhey	"	

SECOND-CLASS CANDIDATES.

NAME.	DATE.	No.
William Harrison Moore	May 21st, 1914	B 173
Frederick William Dennis	"	B 174
Robert Nesbitt Hamilton	"	B 175
Thomas James Wood	"	B 176
Robinson Wilson	"	B 177
John Arthur Challoner	"	B 178
Ernest Harry Devlin	"	B 179
William Walter Clarkstone	"	B 180
James Quinn	"	B 181
David Morgan Francis	"	B 182
Robert Brown	"	B 183
Arthur Newbury	"	B 184
Isaac Hutton	"	B 185
James Fairfoull	"	B 186

THIRD-CLASS CANDIDATES.

NAME.	DATE.	No.
John Martin McGuckie	May 21st, 1914	C 562
John Michek	"	C 563
John Yardly Murdock	"	C 564
Thomas Robson	"	C 566
James Taylor	"	C 567
Frank Bobba	"	C 568
George Archibald	"	C 569
Robert Vardy	"	C 570
George Maxwell	"	C 571
Neil McIntyre	"	C 574
John Greenhorn	"	C 575
William Anderson Brown	"	C 576
Thomas Taylor	"	C 577
Owen Dabb	"	C 578
Matthew McKibben	"	C 580
John Jack	"	C 582
Benjamin Ball	"	C 583
Alfred George Jones	"	C 584
John Malone	"	C 585
William Walker	"	C 586
Andrew Yuill Dow	"	C 587
Thomas James	"	C 588
Robert Wright	"	C 589
James Edward Parrott	"	C 590
Thomas Reid	"	C 592
John Wright	"	C 593
William Kemp	October 14th, 1914	C 594
Herbert Hener	"	C 595
Alfred Arthur Brown	"	C 596
John Bennett	"	C 597
Matthew Turnbull	"	C 598
Robert Anderson	"	C 599
James Mercer	"	C 600
Gomer Trehearne	"	C 601
John Rowan	"	C 602
John Newman	"	C 603
John Strachan	"	C 604
John McCourt	"	C 605
William Dunn	"	C 606

DELINQUENTS.

First-class Candidate.—James William Jemson, May 27th, 1913.

Second-class Candidate.—John Thomas Challinor, May 27th, 1913; Cert. No. B 169.

Third-class Candidate.—Peter Carr, October 31st, 1912; Cert. No. C 497.

Registered List of Holders of Certificates of Competency as Coal-mine Officials.

FIRST-CLASS CERTIFICATES.—SERVICE CERTIFICATES ISSUED UNDER SECTION 39, "COAL MINES REGULATION ACT, 1877."

Edward G. Prior. James Dunsmuir, Victoria.
Thomas A. Buckley. James Cairns, Comox.
Archibald Dick, ex-Government Inspector of Mines.

FIRST-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL MINES REGULATION ACT, 1897."

NAME.	DATE.
Shepherd, Francis H	March 5th, 1881
Honobin, William	May 1st, 1882
Little, Francis D	" 1st, "
Chandler, William	December 21st, 1883
Priest, Elijah	" 21st, "
McGregor, James	January 18th, 1888
Randle, Joseph	" 18th, "
Matthews, John	" 8th, 1889
Norton, Richard Henry	August 26th, "
Bryden, Andrew	December 30th, "
Russell, Thomas	April 20th, 1891
Sharp, Alexander	October 27th, "
Kesley, John	March 4th, 1892
Wall, William H	May 30th, 1896
Morgan, Thomas	" 30th, "
Wilson, David	" 30th, "
Smith, Frank B	" 30th, "
Bradshaw, George B	June 12th, 1899
Simpson, William G	" 12th, "
Hargreaves, James	February 5th, 1901
Drinnan, Robert G	" 5th, "
Stockett, Thomas, Jr	August 3rd, "
Pearson, Robert	" 3rd, "
Cunliffe, John	" 3rd, "
Evans, Daniel	" 3rd, "
McEvoy, James	October 17th, 1902
Wilson, A. R	" 17th, "
Simister, Charles	" 17th, "
Budge, Thomas	" 17th, "
Mills, Thomas	" 17th, "
Faulds, Alexander	" 17th, "
Richards, James A	" 17th, "
McLean, Donald	January 21st, 1905
Wilkinson, Geo	" 21st, "
Wright, H. B	" 21st, "
Coulthard, R. W	" 21st, "
Roaf, J. Richardson	" 21st, "
John, John	" 21st, "
Manley, H. L	" 21st, "
Battey, Richard	May 27th, 1913
Baxter, Andrew	June 10th, 1911

FIRST-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

NAME.	DATE.
Biggs, J. G.	July 22nd, 1908
Bonar, Robert	October 28th, 1911
Bridge, Edward	July 22nd, 1908
Broom, Robert	May 27th, 1913
Brown, David	" 21st 1914
Caufield, B.	" 1st, 1909
Church, James A. H	June 10th, 1911
Crowder, James	" 10th, "
Cunningham, John Howard	May 9th, 1912
Darbyshire, James	November 9th, 1907
Davidson, W. A	May 1st, 1909
Davies, David	June 10th, 1911
Davies, Thos. Owen	May 21st 1914
Devlin, Henry	" 1st, 1909
Dixon, James	October 31st, 1912
Elliott, Daniel	November 9th, 1907
Emmerson, Joseph	" 9th, "
Evans, Evan	" 9th, "
Fairfoull, Robert	June 10th, 1911
Foy, Joseph	" 10th, "
France, Thos	November 22nd, 1906
Fraser, Norman	March 4th, 1905
Freeman, H. N	May 1st, 1909
Galloway, C. F. J.	July 22nd, 1908
Gascoyne, Rowland B.	May 21st 1914
Glover, Francis	October 31st, 1912
Graham, Charles	November 14th, 1905
Graham, Thomas	" 9th, 1907
Gray, James	" 27th, 1909
Henderson, Robert	" 27th, "
Hewlett, Howe	May 27th, 1913
Holden, James	" 1st, 1909
Howden, Archibald	" 27th, 1913
Howells, Nathaniel	October 28th, 1911
Humphries, Clifford	June 10th, "
Jackson, Thos. R.	November 9th, 1907
James, William	July 22nd, 1908
Jemson, Jas. W.	May 27th, 1913
Keith, Thomas	November 9th, 1907
Kellock, George	June 10th, 1911
Kinsman, A. D.	September 10th, 1910
Knox, T. K	July 27th, 1909
Lancaster, W	" 22nd, 1908
Leighton, Henry	May 9th, 1912
Macauley, D. A	June 10th, 1911
McCulloch, J.	September 10th, 1910
McGuickie, Thomas	July 22nd, 1908
McKendrick, Andrew	May 27th, 1913
McMillan, J. H.	September 10th, 1910
McVicar, Samuel	May 1st, 1909
Mazey, William John	October 31st, 1912
Miard Henry Ernest	May 9th, "
Millar, John K	November 22nd, 1906
Miller, Andrew Anderson	October 31st, 1912
Montgomery, John W.	May 1st, 1909
Mordy, Thomas	September 10th, 1910
Musgrave, J. T.	October 28th, 1911
Newton, John	July 22nd, 1908
O'Brien, George	May 21st 1914
Ovington, John	" 27th, 1913
Peacock, Frank David	October 28th, 1911
Penman, Hugh	May 21st 1914
Phelan, Arthur	" 27th, 1913
Powell, J. W.	June 10th, 1911
Russell, John	May 21st 1914

FIRST-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."—*Concluded.*

NAME.	DATE.
Saville, Luther	July 22nd, 1908
Shanks, John	May 1st, 1909
Shaw, Alex	November 14th, 1905
Shaw, William	May 9th, 1912
Shenton, T. J	September 10th, 1910
Shone, Samuel	May 1st, 1909
Sloan, Hugh	November 27th, "
Smith, A. E	October 28th, 1911
Smith, Joseph	July 22nd, 1908
Spicer, J. E	October 28th, 1911
Spruston, T. A	November 27th, 1909
Stevens, L. C	" 27th, "
Stewart, R. T.	September 10th, 1910
Strachan, Robert	March 4th, 1905
Strang, James	June 10th, 1911
Thomas, J. D.	September 10th, 1910
Thorne, B. L.	" 10th, "
Touhey, James	May 21st, 1914
Wallbank, J.	September 10th, 1910
Willey, Edward	October 31st, 1912
Williams, Thos. H	November 22nd, 1906
Wylie, John	July 22nd, 1908

SECOND-CLASS CERTIFICATES OF SERVICE.

NAME.	DATE.	Cer. No.
Corkhill, Thomas	March 4th, 1905	B 7
Lee, John S	" 4th, "	B 9
Millar, J. K	" 4th, "	B 10
McCliment, John	" 4th, "	B 11
Martin, David	" 4th, "	B 12
Hunt, John	" 4th, "	B 13
Walker, David	" 4th, "	B 14
Powell, William Baden	" 4th, "	B 16
Bryden, Alexander	" 4th, "	B 18

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

NAME.	DATE.	Cer. No.
Adamson, Robert	September 10th, 1910	B 120
Allan, Alex. McDairmid	May 27th, 1913	B 167
Anderson, Robert	September 10th, 1910	B 119
Barclay, Andrew	July 29th, 1905	B 25
Bastian, John	November 2nd, 1907	B 42
Bevis, Nathaniel	September 10th, 1910	B 123
Biggs, J.	May 1st, 1909	B 94
Biggs, John G	November 2nd, 1907	B 40
Brace, Thomas	" 27th, 1909	B 96
Bridge, Edward	October 23rd, 1906	B 33
Brown, David	September 10th, 1910	B 108
Brown, James L.	October 28th, 1911	B 136
Brown, John C	" 23rd, 1906	B 39
Brown, John Todd	May 9th, 1912	B 150

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."—*Continued.*

NAME.	DATE.	Cer. No.
Brown, R. J.	October 28th, 1911	B 134
Brown, Robert	May 21st, 1914	B 183
Bushell, J. P	" 1st, 1909	B 81
Carroll, Henry	July 22nd, 1908	B 62
Caufield, Bernard	October 23rd, 1906	B 30
Cawthorne, L.	May 1st, 1909	B 93
Challinor, Jno. Thomas	" 27th, 1913	B 169
Challoner, Jno. Arthur	" 21st, 1914	B 178
Churchill, James	July 22nd, 1908	B 65
Clarkstone, Wm. W.	May 21st, 1914	B 180
Commons, Wm	September 10th, 1910	B 115
Cook, Joseph	July 22nd, 1908	B 64
Courtney, A. W.	October 28th, 1911	B 138
Cox, Richard	May 9th, 1912	B 143
Crawford, David	" 1st, 1909	B 88
Cunliffe, T.	" 1st, "	B 78
Dando, John	" 27th, 1913	B 164
Daniels, David	November 2nd, 1907	B 53
Darbyshire, James	October 23rd, 1906	B 32
Davidson, Hugh	May 27th, 1913	B 165
Davies, Stephen	September 10th, 1910	B 113
Dennis, Fred. W.	May 21st, 1914	B 174
Devlin, Ernest H	" 21st, "	B 179
Devlin, Henry	November 2nd, 1907	B 44
Dewar, Alexander	October 31st, 1912	B 162
Dunsmuir, John	November 14th, 1905	B 26
Dykes, J. W	May 1st, 1909	B 77
Eccleston, Wm	" 1st, "	B 87
Evans, Evan	March 11th, 1905	B 2
Fairfoull, James	May 21st, 1914	B 186
Fairfoull, R	" 1st, 1909	B 83
Finlayson, James	July 29th, 1905	B 21
Ford, Allan	May 27th, 1913	B 171
Foster, W. R.	November 27th, 1909	B 102
France, Thos	" 14th, 1905	B 27
Francis, David M.	May 21st, 1914	B 182
Francis, Enoch	" 1st, 1909	B 86
Francis, James	July 22nd, 1908	B 63
Freeman, Henry N.	November 2nd, 1907	B 45
Garbett, Richard	October 31st, 1912	B 161
Garman, Morris Wilbur	" 31st, "	B 155
Gillespie, Hugh	July 29th, 1905	B 24
Gillespie, John	October 23rd, 1906	B 36
Gillespie, John M.	June 10th, 1911	B 126
Graham, Chas	March 4th, 1905	B 1
Gray, David	May 1st, 1909	B 76
Hamilton, Robert N.	" 21st, 1914	B 175
Henderson, Robert	July 22nd, 1908	B 60
Horrocks, Abner G.	June 10th, 1911	B 130
Howells, N.	November 27th, 1909	B 97
Hudson, George	September 10th, 1910	B 121
Hughes, John C.	" 10th, "	B 109
Hutton, Isaac	May 21st, 1914	B 185
Hutton, John	" 9th, 1912	B 154
Jackson, Thos. R	March 4th, 1905	B 5
James, David	November 2nd, 1907	B 58
Jarrett, Fred	May 1st, 1909	B 84
Jaynes, Frank	September 10th, 1910	B 111
John, Howell	" 10th, "	B 122
Johnson, Moses	May 1st, 1909	B 75
Jones, William	July 29th, 1905	B 20
Jones, William T	" 22nd, 1908	B 66
Jordon, Thos	November 27th, 1909	B 104
Joyce, Walter	May 27th, 1913	B 168
Kirkwood, John Robertson	October 31st, 1912	B 160

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."—*Continued.*

NAME.	DATE.	Cer. No.
Knowles, James E.	October 28th, 1911	B 137
Lancaster, William	November 2nd, 1907	B 50
Lane, Joseph	May 9th, 1912	B 142
Lee, Robert John	September 10th, 1910	B 110
Littler, Matthew	October 31st, 1912	B 157
Luck, George	June 10th, 1911	B 128
Manifold, Albert	May 9th, 1912	B 145
Massey, H	November 27th, 1909	B 99
Mather, Thomas	June 10th, 1911	B 127
Mattishaw, S. K.	October 28th, "	B 135
Matusky, A	May 1st, 1909	B 91
Mayer, Ralph Waldo	" 9th, 1912	B 144
Mazay, W. J.	November 27th, 1909	B 101
Merryfield, William	July 22nd, 1908	B 61
Miard, Hy. E.	September 10th, 1910	B 107
Middleton, Robert	July 22nd, 1908	B 72
Monks, James	November 2nd, 1907	B 55
Moore, Wm. H.	May 21st, 1914	B 173
Morgan, John	November 2nd, 1907	B 43
Morris, John	July 22nd, 1908	B 67
Morton, Robert W	" 22nd, "	B 59
Musgrave, J.	May 1st, 1909	B 90
Myers, Peter	" 9th, 1912	B 149
McDonald, J. A.	October 28th, 1911	B 133
McDonald, John	May 27th, 1913	B 172
McFegan, W	November 27th, 1909	B 106
McGarvey, Martin	October 31st, 1912	B 156
McGuckie, Thomas M	" 23rd, 1906	B 35
McKelvie, J.	May 1st, 1909	B 92
McKendrick, And.	September 10th, 1910	B 112
McMillan, D.	June 10th, 1911	B 125
McNay, Carmichael	May 9th, 1912	B 151
McPherson, James E.	July 22nd, 1908	B 73
Neen, Joseph	June 10th, 1911	B 129
Nellist, David	March 4th, 1905	B 6
Newbury, Arthur	May 21st, 1914	B 184
Newton, John	October 23rd, 1906	B 31
Newton, Wm	September 10th, 1910	B 116
O'Brien, Charles	May 9th, 1912	B 148
O'Brien, George	" 1st, 1909	B 82
Ovington, John	November 2nd, 1907	B 52
Parkinson, T	May 1st, 1909	B 80
Parnham, Charles	November 2nd, 1907	B 49
Quinn, James	May 21st, 1914	B 181
Quinn, John	" 9th, 1912	B 146
Rankin, Geo.	November 27th, 1909	B 103
Raynes, M. T.	October 28th, 1911	B 139
Reid, Thomas	July 29th, 1905	B 23
Reid, Wm.	October 28th, 1911	B 132
Renny, James.	" 28th, "	B 140
Richards, Thomas	November 2nd, 1907	B 57
Richards, Samuel	May 9th, 1912	B 152
Rigby, John.	July 29th, 1905	B 29
Roberts, Ebenezer	September 10th, 1910	B 117
Robinson, William.	July 22nd, 1908	B 69
Rogers, George	May 1st, 1909	B 79
Roper, William	" 9th, 1912	B 141
Russell, John	November 2nd, 1907	B 47
Saville, Luther	" 2nd, "	B 51
Shanks, David	October 31st, 1912	B 159
Shaw, Alex	July 29th, 1905	B 19
Shaw, Thomas John	May 27th, 1913	B 166
Somerville, Alex.	March 4th, 1905	B 4
Spruston, Thos. A.	November 2nd, 1907	B 46
Stafford, Matthew	June 10th, 1911	B 131

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."—*Concluded.*

NAME.	DATE.	Cer. No.
Stewart, J. M	May 1st, 1909	B 95
Stobbart, Jacob	" 9th, 1912	B 153
Stockwell, William	November 2nd, 1907	B 56
Strang, Thomas	October 31st, 1912	B 158
Thomas, J. B	November 27th, 1909	B 105
Thomas, Joseph D	October 23rd, 1906	B 38
Thompson, Joseph	September 10th, 1910	B 114
Touhey, James	May 9th, 1912	B 147
Tonge, Thomas	July 22nd, 1908	B 71
Vanhulle, Peter	November 2nd, 1907	B 54
Virgo, J	May 1st, 1909	B 89
Warburton, Ernest Leonard	" 27th, 1913	B 170
Watson, Adam G	November 14th, 1905	B 28
Webber, John Frank	March 4th, "	B 3
Wesnedge, W	November 27th, 1909	B 98
White, John	" 2nd, 1907	B 48
Whitehouse, William	October 31st, 1912	B 163
Wilson, Robinson	May 21st, 1914	B 177
Wilson, Thomas	July 22nd, 1908	B 74
Wilson, W	" 22nd, "	B 70
Wood, Thos. James	May 21st, 1914	B 176
Worthington, Joseph	" 1st, 1909	B 85

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

NAME.	DATE.	Cer. No.
Adamson, Robert	May 1st, 1909	C 323
Aleen, Alexander	October 28th, 1911	C 430
Almond, Alex	" 1st, 1907	C 252
Almond, W.	July 22nd, 1908	C 286
Anderson, John	October 28th, 1911	C 437
Anderson, Robt	" 14th, 1914	C 599
Archibald, Geo.	May 21st, "	C 569
Archibald, Thomas	October 28th, 1911	C 454
Ashman, Jabez	May 27th, 1913	C 131
Bann, Thomas	October 31st, 1912	C 494
Baggaley, J.	July 22nd, 1908	C 300
Bain, James	May 27th, 1913	C 546
Ball, Benjamin	" 21st, 1914	C 583
Barker, Robert	June 10th, 1911	C 415
Barlow, B. R	May 1st, 1909	C 337
Barnes, B. J	" 1st, "	C 346
Bateman, Joseph William	October 28th, 1913	C 551
Bauld, Wm.	June 10th, 1911	C 422
Baxter, Robert	October 28th, "	C 450
Baybutt, Thomas	May 27th, 1913	C 548
Beeton, D. H	" 1st, 1909	C 338
Bell, Fred	" 27th, 1913	C 514
Bell, John	" 9th 1912	C 477
Bennett, John	October 14th, 1914	C 597
Bennie, John	June 10th, 1911	C 411
Beveridge, Wm	" 10th, "	C 396
Biggs, John	March 4th, 1905	C 210
Biggs, Thomas	October 28th, 1911	C 449
Birchell, Richard	" 1st, 1907	C 266
Blair, James	" 31st, 1912	C 502
Blewett, Ernest	July 22nd, 1908	C 298
Bobba, Frank	May 21st, 1914	C 568
Bradley, William	July 22nd, 1908	C 291

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."—*Continued.*

NAME.	DATE.	Cer. No.
Bridge, Edward	July 29th, 1905	C 223
Briscoe, F.	" 22nd, 1908	C 309
Broderick, Matthew	January 21st, 1913	C 525
Brown, Arthur A.	October 14th, 1914	C 596
Brown, David	November 1st, 1909	C 348
Brown, James	September 10th, 1910	C 364
Brown, James	June 10th, 1911	C 412
Brown, John	September 10th, 1910	C 392
Brown, Robert	October 28th, 1911	C 451
Brown, Robert D.	June 10th, "	C 423
Brown, Robert S.	" 10th, "	C 408
Brown, Wm. A.	May 21st, 1914	C 576
Brownrigg, J. H.	July 22nd, 1908	C 276
Bullen, Thomas	September 10th, 1910	C 379
Bushell, Jas. P	October 1st, 1907	C 264
Cairnes, Andrew	June 10th, 1911	C 420
Cairnes, Robert	May 27th, 1913	C 539
Calverly, Joseph	September 10th, 1910	C 375
Camamile, Hollis	October 28th, 1911	C 443
Carr, Peter	" 31st, 1912	C 497
Catchpole, Charles	July 29th, 1905	C 227
Caufield, J.	May 1st, 1909	C 321
Challoner, Arthur	October 28th, 1911	C 433
Cheetham, Ben	July 22nd, 1908	C 311
Chester, John	October 28th, 1911	C 440
Clark, Lewis	June 10th, "	C 405
Clark, Walter Pattison	May 9th, 1912	C 480
Clarkstone, Wm. W	October 28th, 1911	C 431
Cleaves, Walter	May 9th, 1912	C 475
Clifford, William	July 22nd, 1908	C 313
Commons, William	" 22nd, "	C 304
Cooke, Joseph	March 4th, 1905	C 209
Coombe, Alexander	May 27th, 1913	C 533
Cope, Frank	October 28th, "	C 549
Coulthard, James	June 10th, 1911	C 407
Crawford, David	March 4th, 1905	C 208
Cunningham, G. F	November 11th, "	C 229
Cunliffe, Thos	October 1st, 1907	C 265
Dabb, Owen	May 21st, 1914	C 578
Dando, John	" 9th, 1912	C 465
Davidson, Hugh	" 9th, "	C 464
Davies, Evan Thomas	" 9th, "	C 463
Davis, William	" 1st, 1909	C 339
Derbyshire, A.	June 10th, 1911	C 401
Dewar, Alex.	September 10th, 1910	C 369
Devlin, Edward	October 23rd, 1906	C 241
Devlin, Ernest Henry	May 27th, 1913	C 538
Dickson, Clifford	" 27th, "	C 532
Dingsdale, Geo.	October 28th, 1911	C 459
Doherty, J. J.	May 1st, 1909	C 340
Doney, John	March 4th, 1905	C 211
Donnachie, John	June 10th, 1911	C 425
Doodson, Robert	October 28th, "	C 455
Dorrance, Orlin William	January 21st, 1913	C 517
Douglas, D. B	October 23rd, 1906	C 235
Dow, And. Y	May 21st, 1914	C 587
Dunn, Wm.	October 14th, "	C 606
Dykes, Isaac	June 10th, 1911	C 409
Dykes, Joseph W.	October 1st, 1907	C 248
Edwards, John	May 27th, 1913	C 542
Elliott, John	" 27th, "	C 541
Elmes, George	October 31st, 1912	C 511
Evans, D.	July 22nd, 1908	C 284
Ewart, Alex.	September 10th, 1910	C 374
Fairfoull, James	October 28th, 1911	C 453

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."—*Continued.*

NAME.	DATE.	Cer. No.
Fitzpatrick, T. J.	October 28th, 1911	C 452
Flockart, David	January 21st, 1913	C 531
Ford, Allen	October 28th, 1911	C 445
Fowler, Robert	" 31st, 1912	C 495
Francis, David Morgan	" 28th, 1913	C 558
Francis, James	" 1st, 1907	C 250
Freeman, H. G	November 14th, 1905	C 230
Frew, A.	" 27th, 1909	C 360
Frodsham, Vincent	July 22nd, 1908	C 282
Furbow, John	January 21st, 1913	C 528
Garbett, Richard	September 10th, 1910	C 377
Gascoyne, Rowland B	January 21st, 1913	C 513
Gemmell, James	October 31st, 1912	C 505
Glen, James	" 28th, 1911	C 435
Gordon, Davis John	May 9th, 1912	C 474
Gourley, Robert	" 9th, "	C 470
Graham, John	July 22nd, 1908	C 292
Gray, George	May 9th, 1912	C 467
Greenhorn, John	" 21st, 1914	C 575
Griffoth, Edward	October 31st, "	C 508
Gunniss, Matthew	May 9th, 1912	C 460
Hallinan, W.	" 1st, 1909	C 343
Halsall, J.	July 22nd, 1908	C 307
Hamilton, John	October 28th, 1911	C 444
Hamilton, Robert Nesbitt	" 28th, 1913	C 550
Hartley, Thomas	" 31st, 1912	C 510
Harwood, Fred	September 10th, 1910	C 384
Harvey, Thomas	May 9th, 1912	C 466
Harvie, George	September 10th, 1910	C 378
Hayes, Edward	May 1st, 1909	C 320
Heaps, Robert	September 10th, 1910	C 373
Hener, Herbert	October 14th, 1914	C 595
Henney, Jonathan	June 10th, 1911	C 424
Henry, James	May 9th, 1912	C 471
Hilley, Fred	July 22nd, 1908	C 290
Hilton, R. G.	September 10th, 1910	C 376
Hodson, R. H	March 4th, 1905	C 216
Horbury, Joseph W.	June 10th, 1911	C 406
Horrocks, A. G.	May 1st, 1909	C 324
Horwood, S.	July 22nd, 1908	C 312
Howells, Nathaniel	May 1st, 1909	C 316
Huby, Norman	June 10th, 1911	C 394
Hutchison, Ben	November 14th, 1905	C 232
Hutchison, F.	" 27th, 1909	C 358
Ireson, John	October 31st, 1912	C 507
Irvine, David	June 10th, 1911	C 413
Jack, John	May 21st, 1914	C 582
James, Thos.	" 21st, "	C 588
Jardine, George Edward	January 21st, 1913	C 521
Jarrett, Fred. J.	October 1st, 1907	C 256
Jaynes, Frank	July 22nd, 1908	C 277
Jemson, J. W	March 4th, 1905	C 205
Jenkins, John	September 10th, 1910	C 390
John, Howel	July 22nd, 1908	C 305
Johnson, Moses	October 1st, 1907	C 258
Johnston, Robert	May 9th, 1912	C 479
Jones, Alf. Geo	" 21st, 1914	C 584
Jones, Samuel	" 27th, 1913	C 518
Jones, William C.	January 21st, "	C 556
Jones, William Ernest	October 28th, "	C 221
Jones, W. T.	March 4th, 1905	C 544
Joshua, John	May 9th, 1912	C 478
Joyce, W.	November 27th, 1909	C 361
Judge, Peter	September 10th, 1910	C 391
Keenan, Wm. James	June 10th, 1911	C 426

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."—*Continued.*

NAME.	DATE.	Cer. No.
Kemp, Wm	October 14th, 1914	C 594
Kingham, Alfred	" 28th, 1913	C 559
Kirkeberg, H. S.	November 27th, 1909	C 350
Lancaster, William	October 23rd, 1906	C 243
Lane, Joseph	" 1st, 1907	C 254
Leeman, T.	May 1st, 1909	C 345
Lewis, Benj. J.	September 10th, 1910	C 386
Liddle, John	July 29th, 1905	C 228
Littler, John	June 10th, 1911	C 410
Littler, Matthew	" 10th, "	C 417
Littler, Robert	" 10th, "	C 418
Livingstone, Alex	October 28th, "	C 436
Loxton, George	June 10th, "	C 428
Loxton, John	" 10th, "	C 416
Lynch, Stewart	October 28th, "	C 432
Mackie, John	June 10th, "	C 421
Makin, J. Wm.	September 10th, 1910	C 385
Malone, John	May 21st, 1914	C 585
Malone, Patrick	October 1st, 1907	C 247
Maltman, James	" 31st, 1912	C 501
Mansfield, A.	May 1st, 1909	C 336
Manson, T. H.	July 22nd, 1908	C 280
Marsh, Daniel Parks	May 27th, 1913	C 543
Marsh, John	October 1st, 1907	C 270
Martin, James	June 10th, 1911	C 398
Mason, J.	July 22nd, 1908	C 297
Massey, Henry	May 1st, 1909	C 317
Mather, Thomas	July 22nd, 1908	C 293
Mattishaw, Samuel K.	October 23rd, 1906	C 237
Matusky, Andrew	" 1st, 1907	C 259
Mawson, J. T.	November 27th, 1909	C 359
Maxwell, Geo.	May 21st, 1914	C 571
Meek, Matthew	" 9th, 1912	C 484
Mercer, Jas.	October 14th, 1914	C 600
Merrifield, George	" 23rd, 1906	C 239
Merrifield, William	" 23rd, "	C 236
Michek, John	May 21st, 1914	C 563
Miles, John	June 10th, 1911	C 414
Millar, Peter	September 10th, 1910	C 388
Mitchell, C.	May 1st, 1909	C 322
Mitchell, Henry	September 10th, 1910	C 366
Monks, James	November 14th, 1905	C 234
Moore, George	October 23rd, 1906	C 242
Moore, J.	May 1st, 1909	C 335
Moreland, Thomas	July 22nd, 1908	C 299
Morgan, John	" 29th, 1905	C 224
Morris, David	May 9th, 1912	C 472
Murdock, Jno. Y.	" 21st, 1914	C 564
Myers, Peter	October 28th, 1911	C 446
McAlpine, John	March 4th, 1905	C 217
McBroom, Al.	July 2nd, 1908	C 287
McCourt, John.	October 14th, 1914	C 605
McCulloch, James	May 1st, 1909	C 315
McDonald, John	October 28th, 1911	C 448
McFagen, Alexander	May 9th, 1912	C 490
McFegan, W.	" 1st, 1909	C 319
McGarry, M.	" 1st, "	C 326
McGuckie, Jno. M.	" 21st, 1914	C 562
McGuckie, Thomas	July 29th, 1905	C 226
McGuire, Thomas	October 28th, 1913	C 553
McIntyre, Neil.	May 21st, 1914	C 574
McKelvie, J.	July 22nd, 1908	C 285
McKenzie, Peter	June 10th, 1911	C 427
McKibben, Matthew	May 21st, 1914	C 580
McKinley, John	October 28th, "	C 442

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."—*Continued.*

NAME.	DATE.	CER. NO.
McLaughlin, James	May 9th, 1912	C 485
McLachlan, Alex.	June 10th, "	C 419
McLean, M.D.	September 10th, 1910	C 389
McLellan, William	March 4th, 1905	C 219
McLeod, James	July 22nd, 1908	C 296
McMillan, D.	September 10th, 1910	C 363
McMillan, Edward	October 31st, 1912	C 493
McNay, Carmichael	July 22nd, 1908	C 306
McNeill, Adam T.	" 22nd, "	C 281
McNeill, Robert	September 10th, 1910	C 387
Neen, Joseph	November 27th, 1909	C 352
Nelson, Horatio	October 1st, 1907	C 263
Neilson, William	May 9th, 1912	C 481
Newman, John	October 14th, 1914	C 603
Nicholson, James	May 9th, 1912	C 469
Nimmo, James	" 9th, "	C 461
Norris, Joshua	October 28th, 1913	C 557
Oakes, Robert	" 31st, 1912	C 498
O'Brien, Charles	November 27th, 1909	C 349
Odgers, Alfred	January 21st, 1913	C 529
Odgers, Eli	" 21st, "	C 523
Orr, Alexander	October 28th, 1911	C 434
Osborne, Hugh	" 28th, 1913	C 555
Oswald, Geo. L.	September 10th, 1910	C 370
Owen, T.	May 1st, 1909	C 347
Park, Alexander	January 21st, 1913	C 519
Parker, L.	May 1st, 1909	C 341
Parkinson, T	July 22nd, 1908	C 289
Parrott, Jas. E.	May 21st, 1914	C 590
Pearson, Jonathan	" 9th, 1912	C 473
Penman, Hugh	October 28th, 1913	C 552
Perry, James	March 4th, 1905	C 215
Philips, T	November 27th, 1909	C 356
Pickup, A.	July 22nd, 1908	C 310
Picton, W.	May 1st, 1909	C 333
Plank, Samuel	November 14th, 1905	C 233
Poole, Samuel	May 27th, 1913	C 536
Potter, Robert	October 31st, 1912	C 503
Price, Walter	September 10th, 1910	C 371
Puckey, Wm. R.	" 10th, "	C 368
Quinn, James	October 28th, 1911	C 441
Quinn, John	" 28th, "	C 429
Rallison, R.	July 22nd, 1908	C 279
Rankin, George	" 22nd, "	C 275
Rankin, Wm. Shaw	May 9th, 1912	C 489
Ratcliffe, Thomas	October 1st, 1907	C 253
Raynor, Fred	" 1st, "	C 257
Reid, Robert	September 10th, 1910	C 383
Reid, Thos.	May 21st, 1914	C 592
Reid, Wm.	June 10th, 1911	C 403
Reilly, Thomas	July 22nd, 1908	C 303
Renny, Jas.	November 27th, 1909	C 354
Richards, James	" 1st, 1907	C 249
Richards, Samuel	October 23rd, 1906	C 244
Richardson, J. H.	" 28th, 1911	C 458
Rigby, John.	July 29th, 1905	C 225
Roberts, E	May 1st, 1909	C 327
Robinson, M.	" 1st, "	C 332
Robson, Thomas	" 21st, 1914	C 566
Roper, William	July 22nd, 1908	C 274
Rowan, Alexander	October 31st, 1912	C 500
Rowan, John	" 14th, 1914	C 602
Rowbottom, Thomas	" 31st, "	C 492
Royle, Edward	" 31st, 1912	C 506
Russell, Robert	November 27th, 1909	C 351

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."—*Continued.*

NAME.	DATE.	Cer. No.
Rutledge, Edwin	July 22nd, 1908	C 302
Scott, Henry	" 22nd, "	C 294
Saunders, Eustace L.	January 21st, 1913	C 520
Seggie, Robert	" 21st, "	C 524
Shanks, David	September 10th, 1910	C 372
Sharp, James	May 1st, 1909	C 325
Sharples, J. T.	September 10th, 1910	C 380
Shearer, L.	May 1st, 1909	C 330
Shenfield, W	November 27th, "	C 357
Shipley, John W.	October 28th, 1911	C 456
Shooter, Joseph	" 1st, 1907	C 261
Shortman, J	May 1st, 1909	C 331
Simister, J. H	November 27th, "	C 353
Simister, W	May 1st, "	C 334
Simms, Hubert Allan	January 21st, 1913	C 526
Sinclair, William	" 21st, "	C 527
Skelton, Thos.	May 1st, 1909	C 344
Smith, A. E.	September 10th, 1910	C 367
Smith, Joseph	March 4th, 1905	C 207
Smith, Richard Beveridge	October 28th, 1913	C 561
Smith, Thos. J	" 1st, 1907	C 271
Smith, Thomas	May 9th, 1912	C 486
Sopwith, Reginald Scott	January 21st, 1913	C 512
Sparks, Edward (C 314 issued in lieu of C 255 destroyed by Fernie fire)	October 1st, 1907	C 255
Spencer, G	May 1st, 1909	C 329
Sprusten, R. L	November 27th, "	C 355
Spruston, Thomas A	March 4th, 1905	C 206
Stafford, M.	September 10th, 1910	C 382
Starr, Wallace	May 9th, 1912	C 488
Steele, James	" 9th, "	C 462
Steele, Walter	October 28th, 1911	C 439
Stewart, George	May 27th, 1913	C 534
Stewart, James M.	October 23rd, 1906	C 240
Stockwell, William	" 23rd, "	C 238
Strachan, John	" 14th, 1914	C 604
Strang, Thomas	June 10th, 1911	C 400
Strang, Wm.	" 10th, "	C 395
Suik, George	May 1st, 1909	C 318
Sutherland, John	" 27th, 1913	C 545
Taylor, Charles M	March 4th, 1905	C 213
Taylor, Hugh	January 21st, 1913	C 530
Taylor, James	May 21st, 1914	C 567
Taylor, J. T.	October 28th, 1911	C 447
Taylor, Leroy	September 10th, 1910	C 381
Taylor, Thomas	May 21st, 1914	C 577
Thacker, Geo.	" 27th, 1913	C 537
Thomas, Thomas	September 10th, 1910	C 365
Thomas, John B	November 14th, 1905	C 231
Thomas, Joseph	March 4th, "	C 220
Thomas, Warriett	October 1st, 1907	C 273
Thompson, Thomas	" 1st, "	C 267
Thompson, John	" 31st, 1912	C 509
Thompson, Joseph	" 1st, 1907	C 269
Thomson, Duncan	March 4th, 1905	C 218
Trehearne, Gomer	October 14th, 1914	C 601
Touhey, William	May 27th, 1913	C 547
Tully, Thomas	" 9th, 1912	C 468
Tune, Elijah	" 9th, "	C 476
Turnbull, Matthew	October 14th, 1914	C 598
Vardy, Robt.	May 21st, "	C 570
Vaughan, John Henry	October 28th, 1913	C 560
Walker, Jas. Alexander	" 31st, 1912	C 496
Walker, Wm.	May 21st, 1914	C 586
Wallace, Fred	October 1st, 1907	C 260
Warburton, Ernest Leonard	June 10th, 1911	C 399

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."—*Concluded.*

NAME.	DATE.	Cer. No.
Wardrop, James	October 31st, 1912	C 504
Watkins, William	May 9th, "	C 483
Watson, Adam G	March 4th, 1905	C 212
Watson, Arthur W.	May 27th, 1913	C 535
Watson, George	July 22nd, 1908	C 288
Watson, Joseph	January 21st, 1913	C 515
Watson, William	October 22nd, 1906	C 246
Webb, Herbert	" 28th, 1911	C 457
Weeks, John	March 4th, 1905	C 214
White James	October 31st, 1912	C 499
White, John	" 22nd, 1906	C 245
Whitehouse, Wm	June 10th, 1911	C 402
Wilcock, J.	July 22nd, 1908	C 308
Wilkinson, Edward	October 28th, 1911	C 438
Williams, John Sam.	June 10th, "	C 404
Williams, Watkin	" 22nd, 1908	C 301
Wilson, Robinson	" 10th, 1911	C 397
Wilson, Thomas	October 1st, 1907	C 272
Wilson, William	" 1st, "	C 262
Winstanley, H.	July 22nd, 1908	C 283
Wintle, Thomas A	" 29th, 1905	C 222
Witherington, George	October 28th, 1913	C 554
Wood, Thos. James	" 31st, 1912	C 491
Worthington, J.	July 22nd, 1908	C 295
Wright, John	May 21st, 1914	C 593
Wright, Robert	" 21st, "	C 589
Wright, William	January 21st, 1913	C 522

COAL-MINES OFFICIALS.

Third-class Certificates issued under "Coal Mines Regulation Act Further Amendment Act, 1904," sec. 38, subsec. (2), in exchange for Certificates issued under the "Coal Mines Regulation Act Amendment Act, 1901."

Name.	Date.	Certificate No.	Name.	Date.	Certificate No.
Adam, Robert	Oct. 12, 1904	C 42	Marsden, John	May 3, 1904	C 21
Addison, Thos	Dec. 10, 1904	C 52	Marshall, Howard	Dec. 6, 1905	C 127
Aitken, James	Oct. 24, 1904	C 44	Matthews, Chas	April 27, 1904	C 9
Allsop, Harry	Oct. 11, 1904	C 34	Miard, Harry E	March 3, 1905	C 76
Aughinvole, Alex	March 29, 1905	C 89	Middleton, Robt	Feb. 11, 1905	C 71
Barclay, Andrew	April 27, 1904	C 19	Miles, Thos	Aug. 10, 1904	C 31
Barclay, James	April 27, 1904	C 20	Miller, Thos. K	Feb. 21, 1905	C 74
Barclay, John	April 17, 1905	C 111	McKenzie, John R	Oct. 12, 1904	C 40
Berry, James	Feb. 11, 1905	C 70	McKinnon, Arch'd	April 3, 1905	C 102
Bickle, Thos	Oct. 11, 1904	C 37	McMillan, Peter	March 29, 1905	C 94
Biggs, Henry	April 10, 1905	C 110	McMurtrie, John	March 29, 1905	C 96
Black, John S	April 3, 1905	C 108	Moore, Wm. H	June 17, 1905	C 119
Bowie, James	May 13, 1905	C 116	Morris, John	Dec. 27, 1904	C 57
Briscoe, Edward	Oct. 10, 1906	C 129	Myles, Walter	April 3, 1905	C 100
Campbell, Dan	March 29, 1905	C 93	Nash, Isaac	June 1, 1904	C 120
Carr, Jos. E	Oct. 11, 1904	C 36	Neave, Wm	Oct. 12, 1904	C 43
Carroll, Harry	March 29, 1905	C 98	Nellist, David	April 27, 1904	C 13
Clarkson, Alexander	April 27, 1904	C 18	Nelson, James	April 27, 1904	C 16
Collishaw, John	Feb. 7, 1905	C 68	Newton, John	Oct. 12, 1904	C 39
Comb, John	March 23, 1904	C 2	Nimmo, Jas. P	April 3, 1905	C 103
Cosier, Wm	March 29, 1905	C 86	O'Brien, Geo	Feb. 6, 1905	C 66
Courtney, A. W	Nov. 2, 1904	C 45	Perrie, Jas	March 15, 1905	C 81
Crawford, Frank	April 6, 1904	C 7	Perry, James	June 13, 1904	C 27
Daniels, David	April 27, 1904	C 12	Pounder, Geo	Oct. 16, 1905	C 125
Davidson, David	April 3, 1905	C 106	Price, Jas	Nov. 8, 1904	C 50
Davidson, John	March 29, 1905	C 87	Rafter, Wm	March 29, 1905	C 95
Devlin, Henry	Oct. 12, 1904	C 41	Reid, Thos	Nov. 3, 1904	C 47
Dobbie, John	Nov. 27, 1905	C 126	Reid, James	March 23, 1904	C 1
Dudley, James	March 22, 1905	C 114	Reid, Wm	Dec. 15, 1904	C 54
Duncan, Thomas	Aug. 29, 1906	C 128	Richards, Thos	April 27, 1904	C 14
Dunlap, Henry	Nov. 21, 1904	C 51	Ross, John	April 3, 1905	C 101
Dunn, Geo	Dec. 19, 1904	C 56	Roughead, George	Jan. 30, 1907	C 130
Dunsmuir, John	March 29, 1905	C 90	Ryan, John	Dec. 28, 1904	C 59
Eccleston, Wm	March 15, 1905	C 80	Sanders, John W	April 3, 1905	C 107
Evans, Evan	March 13, 1905	C 78	Shenton, Thos. J	July 25, 1904	C 30
Evans, W. H	March 14, 1905	C 79	Shepherd, Henry	June 13, 1904	C 26
Fagan, David	April 6, 1905	C 109	Smith, Ralph	March 7, 1905	C 77
Farquharson, John	April 27, 1904	C 17	Smith, Geo	March 29, 1905	C 84
Findlayson, James	June 6, 1904	C 25	Somerville, Alex	March 24, 1904	C 3
Fulton, Hugh T	April 3, 1905	C 105	Stauss, Chas. F	Feb. 9, 1905	C 69
Gibson, Edward	May 30, 1905	C 118	Steele, Jas	March 29, 1905	C 92
Gilchrist, Wm	March 29, 1905	C 85	Stewart, Duncan H	March 28, 1904	C 4
Gillespie, Hugh	April 6, 1904	C 8	Stewart, John	April 3, 1904	C 104
Gillespie, John	April 6, 1904	C 5	Stewart, Daniel W	May 16, 1904	C 23
Gould, Alfred	April 17, 1906	C 112	Stoddart, Jacob	Feb. 21, 1905	C 73
Green, Francis	Oct. 11, 1904	C 38	Strachan, Robt	April 27, 1904	C 15
Handlen, Jas	June 16, 1904	C 122	Strang, James	April 27, 1904	C 10
Harmison, Wm	Feb. 3, 1905	C 65	Thomas, John	March 29, 1905	C 97
Haworth, Geo	March 29, 1905	C 88	Vass, Robt	Dec. 12, 1904	C 53
Hescott, John	Jan. 16, 1905	C 62	Vater, Charles	April 6, 1904	C 66
John, David	Nov. 8, 1904	C 49	Walkem, Thos	Dec. 16, 1904	C 55
Johnson, Geo	May 9, 1904	C 124	Webber, Chas	Sept. 13, 1904	C 32
Johnson, Wm. R	March 1, 1905	C 75	Webber, Charles F	Sept. 13, 1904	C 33
Kerr, Wm	March 29, 1905	C 91	Whiting, Geo	May 29, 1905	C 117
Lander, Frank	Jan. 9, 1905	C 61	Wilson, Austin	Feb. 7, 1905	C 67
Landfear, Herbert	Jan. 27, 1905	C 63	Wilson, Thos	April 27, 1904	C 11
Lewis, Thos	Oct. 11, 1904	C 35	Woodburn, Moses	March 29, 1905	C 83
Malpass, James	Nov. 7, 1904	C 113	Yarrow, Geo	Nov. 3, 1904	C 46

CARIBOO DISTRICT.

CARIBOO MINING DIVISION.

REPORT BY C. W. GRAIN, GOLD COMMISSIONER.

I have the honour to submit herewith my report on the progress of the mining industry in the Cariboo Mining Division for the year ending December 31st, 1914.

As you will readily understand, it is somewhat difficult to write a report year after year on this district, in which mining has been carried on for so many years, and which is now looked upon by many as worked out. It has been particularly hard the last two or three years, when the mining industry has been more or less in a dormant state; although I am convinced that before very long it will again wake up and be as full of life as ever.

This district has now been reported on for a great number of years; in fact, as far back as 1859, when Governor Douglas reported on the district to the Colonial Secretary. Since then the district has gone through various periods of wonderful prosperity and periods of great depression; it has several times been looked upon as worked out; however, it still lives as a producer, though, of course, in a much smaller way than in the early days.

The transportation problem, the high rate of wages, the cost of supplies, and high freight charges still greatly retard the development of this district, but this problem will soon be solved; in fact, transportation facilities are improving all the time.

The completion of the Grand Trunk Pacific Railway to Fort George has made an appreciable difference in the cost of living by lessening the freight charges. The Pacific Great Eastern Railway is progressing rapidly, and on its completion we shall have a railway within sixty miles of Barkerville, and freight rates will be still further reduced.

The Cariboo District may be said to be divided into four parts—namely, the Quesnel Division, on which I shall not touch, leaving same in the hands of the Mining Recorder of that Division; the Fort George, the Tete Jaune, and the Barkerville sections, all subdivisions of the Cariboo Mining Division.

It is to this last-mentioned section of the district that I shall chiefly confine my remarks; as, actually living in it, I am in a position to know more about it than of the other two mentioned.

In the other two sections at present very little real mining-work has been done. A large number of mineral claims have been staked in the last two years, but very little development work done, as shown by the very few certificates of work applied for. I have also omitted to say anything as regards the value of these claims, as J. D. Galloway, the Assistant Mineralogist, visited these districts last season, and no doubt will make some report thereon, which cannot help but be a more reliable report than any I could give.

With reference to that part of the Division which may be called the Barkerville section, in which the mining carried on is almost entirely placer-mining, I would state that, although the water season started towards the latter end of April, no mines piped with a real full head before May. The winter snowfall was somewhat lighter than the previous year, but the water-supply depends more on the way the snow goes than the amount thereof. The manner in which the snow went this last year could hardly be improved upon; we had warm days, melting the snow well; this was offset by cold nights, which, whilst keeping up a good supply of water, prevented the snow melting too fast and making a superabundance of water, which could not be used, but would necessarily have to be let go to waste.

The several properties, locally known as the Hopp mines, worked as usual, being managed by Laurent Muller, with Melbourne Bailey as engineer. These mines are generally known as the *Stouts Gulch* mine, the *Lowhee* mine, and the *Mosquito Creek* mine.

At the *Stouts Gulch* mine some very good ground was handled and there were several good "clean-ups"; in one particular pit very rich gravel was struck. At one time it appeared that it would be the last season's work at the head of the gulch, but it now appears that the bed-rock has not yet started to pitch down towards the Lowhee creek side of the mountain, but that it is still rising, and from showings when the mine shut down for the winter it would appear that in all probability there will be another season's piping at the extreme end of the present pit, and, if this is the case, it is pretty sure to be with good results.

The *Lowhee* mine, on Lowhee creek, also had a good season, and although the main clean-up was good, it was somewhat smaller than Malcolm McKinnon, the foreman, expected, which expectations were based on tests and showings made during the run. At this mine there is usually a good fall clean-up, but this year the management was disappointed in this respect, the fall of 1914 being very dry, with practically no rain; therefore no fall run and no fall clean-up, a particular hardship on this claim, as there was good gravel all around the mouth of the flume, but not enough water to drive it into the flume.

The dam at Ella lake again demonstrated as regards this mine what a splendid thing it is to have a good reservoir to fall back on when water is a little scarce; many times this last season the *Lowhee* mine would have been piping with but half a head if there had not been the water conserved in Ella lake to fall back on. The dam was considerably raised last year, being now 80 feet high.

At the *Mosquito Creek* mine the usual season's work was put in; the season at this mine is always short, as the water-supply is very poor. Owing to excellent management the available supply is used to the utmost advantage and the mine is able to work with a very small staff. The clean-ups for the season 1914 were most satisfactory and, I may say, surprising, considering the ground worked.

If the water-supply would stand for a six months' piping season, this mine would be as good as could be wished for in a small way. The dry fall here worked more of a hardship than was the case at the *Lowhee* mine, the gravel being but a few yards from the mouth of the flumes, and one good rainy week would have made a great difference in the value of the output for the season.

At the *Point* mine, on Slough creek, owned by Loo Gee Wing, the Chinese merchant of Vancouver, a good season's work was put in under the management of Joseph Wendle, of Barkerville; until the season of 1913 this mine had been worked entirely by Chinese, just "gophering" around, here and there, with no system in the methods. Mr. Wendle took hold of the claim at the beginning of the season of 1913; at the end of that season great alterations were noticeable, and this year the improvement was more marked. Naturally this change has necessitated the performance of considerable unproductive work to get the mine into working shape. Last year the mine more than paid expenses; this season, considering the failure of the fall water-run, the mine did very well, and next year should do considerably better.

The old *Waverly* mine, on Grouse creek, owned by the Waverly Hydraulic Mining Company, the owners of the first lease granted in this district, carried on operations as usual, and I gather that this year there will be no need for assessment. It is a pity that the company cannot expend some money on the property and really open it up as it should be, as it is acknowledged that they are away above the pay, now having to use an hydraulic elevator. It is the general opinion that if this claim was opened up lower down, enabling them to get at the pay-dirt, and so that a good dump could be obtained, there would be no better property in the district.

The mines on Nugget gulch and China creek did not work during the season of 1914; I now hear that this property has changed hands, and that, in all probability, during the season of 1915 it will be opened up on a much larger scale than heretofore.

Considerable interest was taken last season in the boring, with a Keystone drill, which was carried on on Williams creek and the upper end of Willow river; this drilling was done on the properties of John Hopp under the management of John T. Towers, of Seattle.

Three cross-sections on Williams creek were put down, and one and a part of another on Willow river. Considerable delay was caused during the first part of the season by troubles connected with the casing, unsuitable material having been shipped in error from the Coast. This caused great trouble when it came to pulling the casing, and also caused considerable delay in the operations, which made the drilling somewhat expensive, gangs being unable to work, and, as considerable pipe was lost, new casing had to be shipped by express instead of by freight.

As deals in connection with the ground drilled are pending, it would be out of place on my part to mention the results of the drilling; nevertheless, without any breach of confidence, I think I may say that the results make us all feel very hopeful.

On Shepherd creek, near Eight-mile lake, in which vicinity the Thistle Gold Mining Company operated a few years ago and took out so much gold, R. D. Rees operated with a small force, and proved to his satisfaction that he has a good prospect and that the property will pay to develop; he has gold, but must contrive a better dump and obtain more water.

On the property of the Lightning Creek Mining Company near Stanley, work was carried on as usual, but with what results I am unable to state, as Mr. Bonner, the manager, has ignored my request for some sort of report on the season's work. I may say that my request for a report on the season's work in connection with the property of the West Canadian Deep Leads on Little Valley, of which company Mr. Bonner is also manager, met with the same answer.

As regards lode-mining, very little of this kind of mining was carried on in this part of the district, Seymour Baker doing practically the only work that was done on his three claims on Prosperine mountain. I understand from Mr. Baker that he has at last got on to the ledge, and that very careful assays show that the rock carries good values.

In the Fort George and Tete Jaune sections of the district a large number of mineral claims was staked and recorded, as was the case the previous season, and as is generally the case when a new railway is being put through the mountainous parts of this Province. I have been unable to obtain any information as to the value of any of these properties. Apparently, from the small number of certificates of work applied for, only a small amount of development work has been done.

From careful inquiries made of express companies and owners of properties, I would gather that as regards placer-mining, the output of gold for the Cariboo District (including Quesnel Division) was better than that of 1913.

OFFICE STATISTICS—CARIBOO MINING DIVISION.

Free miners' certificates (individual)	499
" " (company)	6
Mining leases granted	21
" applied for not yet granted	45
Placer claims rerecorded	38
" recorded	33
Mineral claims "	410
Certificates of work recorded	52
Leaves of absence granted	21
Conveyances and other documents recorded	88

Revenue.

Mining receipts, general	$6,892 35
Free miners' certificates	2,007 50
Water revenue	526 40
Leaves of absence	52 50
Miscellaneous receipts	73 50
Total	$9,552 35

CARIBOO MINING DIVISION.

FORT GEORGE SECTION.

The Deputy Mining Recorder of the Fort George section of the Division, T. W. Herne, submits the following notes on his section :—

Considerable difficulty was experienced in obtaining statistical returns from mining-property holders, who do not appear to recognize the fact that it is to their interest and to the interest of the general public to make a report on what development-work was done during the year, the nature of the ore being mined, and general prospects for this year. It is hoped before my next report is submitted that mine-owners will help to make the report of public interest.

Although there is very little actual lode or placer mining being done at present in this section of the Mining Division, there seems to be a very fair amount of prospecting going on, as indicated by the issuance of an exceptional number of free miners' certificates and the recording of a great many mineral and placer claims during the year, of which, in the case of mineral claims, some were relocations of ground formerly staked last season (1913), but the majority were new locations.

The actual output from lode or placer mining has been practically *nil*, as the district was, until the advent of the Grand Trunk Pacific Railway, practically inaccessible. Another factor which has retarded the mineral development of this district is that large tracts are covered to a greater or less extent with drift deposits which render the work of the prospector much more difficult than usual.

COAL.

Considerable prospecting for coal has been going on in this section, particularly in the vicinity of Mud river and in the vicinity of Bowron river, but a great number of the locations, although showing workable coal of fair quality, have been dropped owing to the financial stringency.

MICA.

The mica claims in the vicinity of Tete Jaune are attracting attention and some development-work was carried out during the year.

T. A. Wilson, manager of the *Albreda* group, reports as follows: "The *Albreda* group of mica claims are situate at the head of Camp creek, about thirty miles south of Tete Jaune, and about four miles back from the line of the Canadian Northern Railway. During the early part of the summer we built a good pack-trail from the Canadian Northern Railway to the claims for the purpose of taking in supplies and taking out samples.

"Development-work on the claims was done as follows: An open-cut was made on the east end of the group and a fine showing of mica was found, of the quality known as 'White Muscovite'; about 4 tons of mica was taken out, and about 4,000 lb. of this was packed down to the valley and thence hauled to Tete Jaune. Commencement was made on a tunnel on the west end of the group, with showings similar to that found in the open-cut, work being suspended at the end of August. The mica, which was hauled to Tete Jaune, is now being trimmed ready for the market. We hope during the coming season to do considerably more development work."

PLACER.

This class of mining is represented by a few hydraulic leases on a creek situate about four miles north of Prince George, but owing to the lateness of the season only a limited amount of development-work has been done on them.

On the west branch of Government creek, situate about forty miles south of Prince George, local men have formed themselves into a syndicate, of which J. Bernitz is manager and secretary, and, from his report, have acquired three and a half miles of ground. No actual development-work has been done, but they anticipate sinking boreholes on the ground next spring in order to test the ground thoroughly.

A few whites and Chinese were mining on the Fraser River bars, but no returns are available of the amount of gold produced.

OFFICE STATISTICS—FORT GEORGE SUB-OFFICE.

Free miners' certificates (individual)	1,041
" " (special)	6
Placer claims (sent to Barkerville for record)	10
Mineral claims " "	260
Certificates of work " "	23
Bills of sale " "	6
Powers of attorney " "	14
Placer leases " "	4
Partnership agreements " "	2

Revenue.

Land-sales	$144,670 48
Pre-emption fees	1,942 00
Certificates of improvement	386 00
Pre-emption cancellations	334 00
Leave of absence	356 00
Survey fees	4,226 26
Free miners' certificates	3,485 25
Trade licences	5,560 00
Liquor licences	1,400 00
Police Court fines	5,521 25
Small Debts Court	193 50
Law-stamps	1,003 00
Motor revenue	850 50
Game licences (non-resident)	200 00
Miscellaneous	1,016 32
Marriage licences	135 00
Water revenue	1,201 00
	$171,880 56

CARIBOO MINING DIVISION.

NOTES BY J. D. GALLOWAY, ASSISTANT MINERALOGIST.

The Cariboo Mining Division occupies an important place in the history of mining in British Columbia. In fact, British Columbia mining began with the discovery of placer gold in the Cariboo District in the early sixties, and for some time this was the only mining being done in the country. These placer operations centered around the old town of Barkerville, where, for years, many creeks yielded phenomenally rich pay. The placer production of the Cariboo District reached a maximum production about 1863; since that time the annual production has gradually decreased, although fluctuating up and down, to about $300,000 in 1913.

As the rich diggings were worked out, many extensive plants have been put in to handle the large quantities of low-grade ground left behind by the old miners, but in many cases these have been failures, chiefly because of inefficient management. There is now sufficient indication to warrant the assumption that, before long, some of these abandoned properties will be profitably worked by means of dredges.

The Quesnel river and its tributaries also have yielded and are still yielding placer gold. Here also large-scale workings have not as yet been very successful, but the future promises better results.

Lode-mining in the Cariboo has not as yet been productive of much in the way of results. The Barkerville region has experienced many quartz booms, but not yet have any mines been proven. It would seem that the placer gold in this section had its origin in the erosion and subsequent concentration of the gold from quartz veins in the immediate vicinity, and it would therefore be supposed that some of these veins would repay exploitation. The remnants of these quartz veins are now visible in irregular stringers and lenticular masses of quartz embedded in the schistose country-rock, but as a rule these visible quartz veins are low-grade in gold and are usually extremely irregular and discontinuous.

After finishing up field-work in the Omineca Mining Division, the writer visited a number of places in the Cariboo Mining Division, going first to Tete Jaune to examine the mica-deposits there; then to Fort George, where discoveries of free-milling gold quartz had been reported; and then into the Barkerville district to get some first-hand information regarding the placer mines. These will now be described in that order.

MICA AT TETE JAUNE.

The occurrence of mica near Tete Jaune has been known for many years, but practically no systematic prospecting or development-work has as yet been carried out. A number of claims have been staked from time to time and many are now held by annual assessment. The writer went to Tete Jaune at the end of September with the intention of examining some of the properties. The town of Tete Jaune, which during the construction of the Grand Trunk Pacific was quite lively, has now almost ceased to exist, and there is not even a stopping-place there.

Four miles up the track is Henningville, also a railway-construction town, which is rapidly approaching oblivion. The writer was fortunate enough to secure accommodation with Mr. Jowett, Stipendiary Magistrate, who has headquarters about a mile down the track from the station of Tete Jaune, and who very kindly extended the hospitality of his home to the writer and his assistant.

On arriving there it could be seen that the mica claims, which are situated high up on the rocky ridges of the mountains at altitudes of from 5,000 to 7,000 feet, were covered with snow.

The writer waited four days for the weather to improve, but it rained steadily in the valley, and this rain, of course, was snow in the hills. It was impossible to attempt to see anything of surface showings with such an amount of snow. Mr. Jowett has a complete record of weather conditions of the preceding year, and on looking this over it could be seen that it was altogether unlikely that the snow would leave the hills before the following summer; so the attempt to see the claims this year had to be abandoned.

The following general description of the claims is compiled from information obtained in conversation with Mr. Jowett and owners of the claims:—

The mica showings occur in the range of mountains on the south bank of the Fraser river; at this point the watershed of this range forms the boundary-line between the Cariboo and Quesnel Mining Divisions. A very large pegmatite dyke, or series of dykes, which is said to be twenty-five miles long and varying in width from 25 to 1,800 feet, is intrusive into the older rocks along the axis of the range, and extends from below Tete Jaune to Albreda summit, near the Canoe river. This pegmatite is, of course, not exposed continuously along this length, but is sufficiently so to consider that the different outcrops are linked up together, at least not far below the surface.

This pegmatite is the usual typical one consisting of large crystals of mica, feldspar, and quartz, with, in places, a fine-grained intergrowth of feldspar and quartz. The mica occurs in sheets up to 10 inches square and with a thickness, of numerous sheets together, of 1 to 2 inches.

The *Albreda* group of claims, owned by T. A. Wilson and partners, was worked for a short time this year, and in seven weeks three men took out about 2 tons of mica from a surface quarry. This mica was taken down to Jete Jaune, where it is now stored and was seen by the writer. This mica has a slightly brownish colour, but in the thin sheets is quite transparent. It is to some extent stained with iron and the sheets are often striated and flawed; it is certainly good commercial mica, but is not of the highest quality. About 50 per cent. of the 2 tons taken out would trim into pieces about 3 x 5 inches, with, of course, some larger than that; the balance would average up about 2 x 3 inches. It has an excellent cleavage and is not brittle, and would be easy to trim as desired. It is mainly a muscovite mica, but some of it is considerably stained with iron.

A group of claims on the south-east side of Sand creek is owned by a French company; some work was done during the past summer by this company, including the running of a short tunnel. Other claims are held by Vancouver people.

In conclusion, it seems to the writer that these mica-deposits are well worth serious investigation, and it is to be hoped that time will be available for a thorough examination next year.

FORT GEORGE DISTRICT.

The town of Fort George is situated on the Fraser river, 375 miles above Hope. It is a divisional point on the recently completed Grand Trunk Pacific Railway, and will also be one on the Pacific Great Eastern Railway when the latter is finished. The old town of Fort George is on the river-bank; this location being chosen because the river then provided the main means of communication with the outside world. Flat-bottomed, stern-wheel river-steamers run from Soda Creek to Tete Jaune, 180 miles above Fort George, and from Soda Creek southward good auto-roads continue to Ashcroft and Lytton, on the Canadian Pacific Railway.

Four years ago a new town, which is now known as Central Fort George, was plotted on the bank of the Nechako river, three miles and a half from the old town. The railway company, not to be outdone in the matter of townsite-plotting, which had become an extremely

fashionable pursuit, located the new town called Prince George, near the confluence of the Nechako and Fraser rivers, and about two miles distant from both the old towns, This new town has the decided advantage of possessing the railway-station, which will probably, before long, enable it to outdistance its rivals.

As before indicated, the writer's main business at Fort George was to investigate the reported free-gold discoveries near the town. Mr. Gross kindly consented to guide the writer over the properties, as no work was being done on them, nothing further than the annual assessment-work having been done during the summer.

The claims are located in a range of low hills running north and south and lying about six miles west of Fort George. These hills are not more than 700 to 800 feet higher than the valley-level of Fort George. They are the characteristic rolling flat-topped hills of the northern part of the Interior Plateau. The veins are rather irregular stringers and lenticular masses of quartz occurring in schistose rock which in places is a greenstone. It is a highly metamorphosed igneous rock which was originally a diorite or some kindred type.

Daisy Group.

The *Daisy* group, which consists of the *Daisy*, *Silent Treasure*, *North Star*, *Lincolnshire*, *Eva May*, *Victor*, *Mutt*, and *Eldorado* claims, is owned by Gross and partners. At the top of a small bluff several quartz veins are exposed, the largest of which is 5 feet wide and none of which appear to be very continuous. The quartz is massive, vitreous, and "hungry-looking," with no mineral in it except a few specks of reddish iron-rust stain, probably resulting from the oxidation of original iron sulphides. A sample taken across 4 feet of the large vein returned only a trace of gold.

At the foot of the bluff a tunnel, supposed to be a crosscut, has been run in 50 feet, which did not strike anything; this tunnel has really been driven parallel to the strike of the veins, which run about south-east.

About one mile south-west from this showing a claim owned by Steve Basher was examined. The showing here consists of a small quartz vein averaging perhaps 1 foot wide, which is developed by a shaft 25 feet deep. This shaft was full of water, but Mr. Gross says that the bottom shows 2 feet of quartz. A sample of the best-looking quartz on the dump assayed only a trace in gold.

Two miles farther to the south is located the group of claims owned by McBurney & McNurney, which was reported to have produced quartz specimens carrying visible free gold. The only working on them is a large open-cut and prospect-hole a few feet deep. Two parallel quartz veins crop out on the surface, a few feet apart, but rapidly converge and come together. The foot-wall vein averages about 2 feet wide, and the other is about 18 inches. Both veins are exposed at the top of a 6-foot prospect-shaft, but a small jog, or fault, shifts them slightly uphill and brings the foot-wall vein near the centre and causes the other to disappear in the hanging-wall. The vein-filling is entirely quartz, in places stained reddish and yellowish with iron oxide, but showing no metallic sulphides. A sample taken across 18 inches of the foot-wall vein in an open-cut at the point where free gold samples had been discovered assayed: Gold, a trace. Another sample taken across 30 inches in the bottom of the shaft returned: Gold, 0.8 oz.

The writer is unable to say whether or not free-gold specimens were actually discovered on any of the claims in this district, but the results of assays are certainly disappointing.

The veins also give little promise of being continuous in either depth or length, but are typical examples of the so-called "gash" vein.

BARKERVILLE DISTRICT.

The town of Barkerville is the centre of what has been the richest placer district in British Columbia. From two and a half miles of Williams creek and two miles of Lightning creek at least $30,000,000 of gold has been taken out and the end is not yet in sight. At the present time there are several large-scale hydraulic mines being worked, and also certain gravel areas are being tested with the view of putting in dredges.

It is unnecessary in this report to enter into a detail description of this district, as this part of British Columbia has been reported on at intervals from 1860 onwards. In fact, the early reports of the Mines Department consisted almost entirely of a description of, and tabulation of returns from, the Cariboo District. The last detail report on the district as a whole was made by W. Fleet Robertson, Provincial Mineralogist, in 1902, but since that time the general progress of, and information about, the district is given in the annual reports of the Gold Commissioner. In 1913 Mr. Robertson spent a week in the Quesnel section examining a few of the placer properties.

At the end of the field season of 1914 the writer spent ten days visiting some of the placer mines at Barkerville and Stanley; some abandoned quartz properties were also looked at.

The largest operator in the district is John Hopp, who is now working three large hydraulic properties—namely, the *Lowhee*, *Stouts Gulch*, and *Mosquito Creek* claims.

Lowhee Claim.

The *Lowhee* claim is situated on Lowhee creek and is now being worked towards the upper end near Stouts gulch, the lower part having been worked out in previous years. The channel is very deep and all of it was drifted out by the old-timers, who, however, left behind them enough gold to make pay-gravel for modern hydraulic-mining methods. The channel is 200 feet deep on the rims and about 150 feet in the centre, and 150 feet wide where it is at present being worked. The flume, which carries the gravel away from the face of the pit, is 2,900 feet long, and is paved throughout with wooden blocks 10 inches high and 12 to 14 inches in diameter. This flume is is 4 x 6 feet in cross-sections, and an auxiliary flume alongside, into which the drainage-water is diverted when cleaning up the main flume, is 3 x 3 feet. Water from the ditches is delivered under a head of 250 feet, and when ample water is available an 8- or 9-inch nozzle is used. The biggest handicap to hydraulic mining in this district is the shortage of water, and to conserve and utilize all the available supply Mr. Hopp has constructed a costly system of ditches and reservoirs.

Ella lake is the main reservoir, and in this and the system of ditches the water from Jack of Clubs, Lightning, and other creeks is conserved. A ditch ten miles long conveys the water from Ella lake to *Lowhee* and *Stouts Gulch* claims. At a point 300 feet above the *Lowhee* claim a penstock takes the water for this claim. The water leaves the penstock in a 44-inch pipe, and is successively reduced in 30-, 22-, 18-, 16-, and 15-inch pipes, and thence into a No. 6 Giant. The overflow from the penstock drains into the *Lowhee* dam, which supplies ground-sluice water for the *Lowhee* pit.

This year the claim was operated steadily (twenty-four hours a day) from March 15th to July 15th; then one shift a day until August 15th; and after that until the middle of October, intermittently every two or three days. Were water available it would be operated nearly steadily throughout the season.

Another obstacle to be contended with here is the number of large boulders that are encountered. These are bulldozed with dynamite and broken up into pieces small enough to be carried down the flume.

The gold is, for the most part, comparatively coarse, and most of it is caught in the first few boxes. No figures are available as to the value of the ground, amount moved, or costs, but it may be said that a satisfactory season has been had and that the clean-up was better than anticipated.

Stouts Gulch. As the name indicates, this claim lies along Stouts gulch, which runs up from Williams creek to the head of Lowhee creek. This claim has been worked for years and the worked-out pit is quite extensive. The old workings are at least 2,000 feet long, with a branch pit going 600 feet up Emory gulch. Work was continued this year in the face of the pit towards the *Lowhee* claim. The ground in Emory gulch is very hard and cemented, and really requires blasting for effective work.

This claim is a model one for hydraulic mining. The depth of gravel is 100 to 125 feet and it is nearly free from boulders. The Giant is advanced along the bed-rock from time to time to a convenient distance from the face. Wing-dams direct the flow of water and gravel from the face into the flume; these also being advanced as required. The whole operation is simple and quite inexpensive. Water is supplied at a head of 100 to 150 feet through a No. 2 Giant with a 6-inch nozzle.

Mosquito Creek. Mosquito creek is a short creek flowing into Willow river. A considerable area of the ground on this creek was worked in previous years, but a good deal still remains. The water-supply is very limited, making the season's run a very short one. To compensate for this the ground is much richer than the average hydraulic mine; some of it running as high as $6 a yard. It is interesting to note that this rich ground is not down in the bottom of the channel, but well up on the rim-rock. Water is supplied by a system of ditches which collect the drainage from Island mountain, and transmitted to the pit under a 100-foot head. Only a short continuous run is available during the early summer, and then after that it is necessary to allow the water to accumulate for two or three days in order to get sufficient for a few hours' run. This property is now controlled and operated by John Hopp, who reports a successful year.

Drilling Operations.

To describe the drilling operations it would be well to first describe the physical character of the country drilled—viz., Williams creek and Willow river. Williams creek flows right through the town of Barkerville in a northerly direction, and a mile below the town it turns to the west and flows into the Willow river. The channel of Williams creek has been pretty well worked out by the old-timers by means of drifting operations. This channel varies from nothing up to 100 feet in depth, and from the town of Barkerville down, the upper 20 feet now consists of tailings from old hydraulic workings farther up this and in tributary creeks. The continuation of the channel containing pay-dirt beyond Williams creek is a matter of considerable controversy, as it may have gone down into Willow river, as the water now goes, or it may have swung off into another valley.

The Cariboo Goldfields was a hydraulic proposition on Williams creek, a mile below Barkerville, which was operated for a time. The greatest difficulty there was the obtaining of a sufficient grade to carry off the tailings, and to this end, a bucket elevator was installed which at first was not a success. After overcoming certain mechanical difficulties, the company unfortunately ceased operations.

Practically all the ground along Williams creek down to and including part of Willow river has been secured by John Hopp and associates. Parts of this were drilled in 1913 by Mr. Dawson, representing Eastern capitalists. These results were said to have been unsatisfactory, but were not considered conclusive. A more systematic drilling campaign was carried

out during the summer and fall of 1914 by J. T. Towers. A cross-section of holes was put down across the Williams Creek channel just below Barkerville, another one 3,000 feet below that, and another 8,000 feet below. The drill was then moved down to Willow river and a series of holes commenced there. When the writer visited the district the drill was at the latter place, and operations had been stopped for the winter about that time.

The exact figures which would tell the results of this drilling are, of course, confidential and could not be made public. It may be said, though, that a large area on Williams creek has been partially proven to carry sufficient values to be called first-class dredging-ground. The pay values apparently do not extend all the way to Willow river, but the results at Willow river again show pay values, although sufficient drilling has not been done to show the extent of the area.

Before describing the actual drilling operations it will be well to consider the important features for the successful operations of a gold-dredge. These may be enumerated as follows :—

(1.) A sufficiency of gold, in a free state, to pay; this will, of course, vary with conditions.

(2.) A soft bed-rock for the dredge-buckets to work on.

(3.) A gravel-bed which has not too great a depth; at present somewhere about 80 feet would seem to be the maximum.

(4.) A sufficiency of gravel to admit of a large enough amount being earned to pay back both capital and interest of the cost of the necessary plant.

With the exception of No. (4), which is a basic postulate that may be applied to all forms of mining, these conditions may vary within considerable limits, and generally it may be said that the richness of the ground determines whether or not other unfavourable features can be overcome. For instance, with a rich deposit it is possible to operate with a deeper cut than on a low-grade deposit. Again, the gold might be contained in a layer of gravel some distance above bed-rock, and in this case the importance of having soft bed-rock would be minimized. The presence of many large boulders in the gravel-deposit adds considerably to the cost a yard of operating; in a deposit containing many boulders, therefore, higher values would be required than in one free from boulders, and vice versa. The amount of gold in the gravel can be closely approximated by careful testing of the ground, generally by drilling.

Along Williams creek and Willow river the bed-rock consists dominantly of soft schists and slates and presents ideal conditions for dredging, as the buckets could easily lift 2 feet of the rock bottom and thus get all the gold in the crevices. Also, as a rule, the ground is very free from boulders. The depth of ground is the most unfavourable feature of this section for dredging.

But there is, nevertheless, a considerable part of the area that is within the dredging limit. Also the depth to which the dredging can be carried is to some extent dependent on the values; that is, if sufficiently rich ground is found dredging could possibly be carried to 100 feet.

The Williams Creek area would require that a large type of dredge be installed; such a dredge could be roughly estimated to cost $500,000 when erected. This may seem high, but it must be remembered that all costs for freight, supplies, and wages are very high in the Barkerville district. Modern dredges are mostly operated by electric power; as there is no electric power in the district, some of the waterfalls would have to be hydro-electrically developed, which would mean a further outlay of capital.

It cannot be said that a sufficient quantity of ground has as yet been proven up on Williams creek to warrant the expenditure necessary for a complete dredge-installation, but in the event of a similar area being proven up on Willow river, then the two together might form

an attractive dredging proposition. The one electric-power plant and dredge would do for both areas; when the dredge had finished at one place it would either be dismantled and moved to the other, or, if any values were obtainable en route, it would dig out a channel for itself between the two.

The drilling so far done is simply preliminary prospecting, which would be followed later by a complete testing, by putting down holes every 100 feet. In this way the whole ground is mapped out in squares, and from the results contour-value maps are made up. The dredge-master then knows the conditions everywhere—where the deep ground is, and where the values are, etc.

The drilling operations have been carried out under the direct supervision of J. T. Towers, a specialist in drilling engineering, who showed great courtesy to the writer in explaining and describing the work. The drill used is a large-sized Keystone drill equipped with the usual outfit. Some difficulty was experienced in getting suitable pipe, as the ordinary cast-steel pipe crystallizes, under the repeated blows of the hammer, and either breaks off then or later when attempting to remove it. Wrought-iron pipe is the only satisfactory pipe, and to get this it was necessary to send to Pennsylvania; considerable delay was occasioned in freighting this in.

It may be worth while to describe the exact modern method of testing supposed placer-ground by means of a Keystone drill. The machine consists of an upright boiler and engine mounted on a frame running on wheels, and so arranged that the engine operates a hammer or weight up and down a guide on the same principle as a pile-driver. This weight is raised and then dropped by gravity on the butt of the pipe, which is, by the impact, driven into the gravel. The pipe used is 6 inches in diameter in the clear, and is made in 10-foot lengths. The joints are screwed together, and the upper section screws down until it rests on a flange around the inside of the lower section, the flange thereby taking the impact of the blow and not the screw-threads, which would soon be ruined by repeated hammering. The first length is equipped with a head similarly screwed on, which takes the blow of the descending hammer. When this length is driven down far enough, the head is unscrewed, another length screwed on, and the process repeated. The first section of pipe to be put down has the lower end flared out all round to form a cutting-edge which is 7¼ inches in diameter. This pipe-casing is generally driven down a foot at a time; theoretically, in close-packed gravel, an advance of one foot of the cutting-bit would give 1 foot, 6 inches of gravel in the pipe, but this varies considerably with different kinds of ground. After driving a distance of 1 foot, a bit is put down inside the pipe and the gravel churned up and then extracted by a suction pump. Wherever the drill is passing through ground that is thought to carry gold, the drill is only advanced a foot at a time; but when a layer which is known to be nearly devoid of values is being passed through, then advances of 6 to 8 feet are made before extracting the core. Invariably, when possible, the pipe-casing is driven ahead and the core extracted after, but if a large boulder is encountered it is necessary to put down a heavy bit and drill through it before the pipe can be driven ahead.

The gravel extracted is run through a rocker and carefully panned, a record for each advance being kept. In extracting the core, care is taken not to remove so much as to go deeper than the end of the bit; as a rule, an inch or two of a gravel cushion is left in the bottom of the hole to ensure that no material shall be drawn in from beyond the periphery of the hole. As the work proceeds exact measurements of the distance driven are recorded at each advance, amount of gravel extracted, and the cushion of gravel left behind. In this way the amount of gravel and values obtained along each section of the hole (whether one foot or more) is ascertained. The value of the gold colours obtained from panning the gravel from

each advance (say one foot) is estimated by eye, and then at the finish the total gold from the hole is weighed. It is significant of the accuracy of this eye estimation to say that Mr. Towers showed the writer a log-book of several holes, and in these the total gold in a hole by estimation did not vary from the weighed amount by more than 2 or 3 per cent. When it is considered that the total gravel in a hole of this diameter, $5\frac{3}{4}$ inches, and 100 feet deep, is just about 1 cubic yard, and that 25 cents a yard would be good-grade dredging-ground, it may be realized with what minute quantities of gold this eye estimation has to deal. The character of the material through which the pipe passes is carefully noted; also the time of drilling, which gives a good indication of the hardness and whether or not the gravel is cemented. In fact, every detail is noted and the log-books show a volume of information which is of great use later on if the ground is dredged.

The drill is generally kept going twenty-four hours a day, but, even if not in operation, a watchman is kept on it to prevent any possibility of "salting" the hole. When a hole is completed—that is, when it is down to bed-rock, or in some cases before that, when the ground is too deep—the casing is withdrawn and the "hole" disappears by filling in. The casing is removed by hammering up against the head instead of downwards, and removing a section at a time as it comes up. The pipe is much more liable to break at this stage than in the driving, owing to the unequal strains set up. If the pipe breaks much below the surface, it is generally impossible to recover and has to be abandoned.

In conversation with the writer, Mr. Towers expressed himself as being well satisfied with the results of the drilling so far done, and seemed very hopeful that the ultimate dredging of large areas of the Barkerville area would be accomplished.

Point Mine.

At the *Point* mine, on Slough creek, which is owned by Loo Gee Wing, a Chinese merchant of Vancouver, a very successful season's operations is reported. Under the management of Joseph Wendle this property has been equipped in a way which will permit of large-scale operations in an economical manner. The mine is situated a short distance off the wagon-road and about half-way between Stanley and Barkerville. Like all other hydraulic mines in the district, the water-supply on this property is not as great as could be desired, but during the spring and summer a full supply is available. The property has been worked for many years, but still has a large deposit of gravel left to be worked. It is a bench deposit of gravel along the south bank of Slough creek.

The water-supply is obtained from a small lake a short distance above Stanley, from which it is flumed to a point 250 feet above the pit. A No. 6 Monitor is used, which is fed by a pipe 15 inches in diameter and a 6-inch nozzle. The flume is 3 x 3 feet with a good grade, and there is plenty of fall for dumpage of the tailings.

Farther along and on the same bench-gravels a few Chinamen work some of the ground in a small way. They also hydraulic the ground, but only have enough water to run a small Giant with a 2-inch nozzle, and that only for a short time during the season.

LIGHTNING CREEK HYDRAULIC MINING COMPANY.

The Lightning Creek Hydraulic Mining Company's property is situated near the old town of Van Winkle, about two miles up Lightning creek from the town of Stanley. This property is managed by Lester Bonner, and has been financed by English capital. It has been operated now for three or four years, and is an attempt to hydraulic the stream-gravels of Lightning creek, which had, in part, been previously worked by the old-timers by drifting methods. The biggest handicap to be overcome is the securing of dumpage for the tailings, as the grade on the creek is slight. In the first work done a flume 2,000 feet long and 6 x 6 feet in size, with

a drop of 3 inches to 14 feet, carried off the gravel, but this year the mouth of this flume had become too high to be of service in cleaning up to bed-rock. In order, therefore, to raise the gravel up to the flume, an hydraulic elevator was put in which was expected to elevate to a height of about 45 feet. It consists of a large pipe with a smaller one entered at the bottom, from which a jet of water issues under considerable pressure; the suction and force of this water is supposed to carry the water and gravel up the larger pipe and discharge it into the flume. The larger pipe is 16 inches in diameter and the smaller one is 9 inches and discharges its water under a pressure-head of 280 feet. Unfortunately this elevator never worked successfully; it would possibly work with fine gravel or sand, but certainly will not with the coarse material in this pit.

When the writer visited the property the elevator was buried up nearly to the flume-level with gravel and a flow of water sufficient to make it impossible to sink a shaft and "dig out the elevator," as had been attempted. The season's clean-up could not be made, as there was no means of cleaning up the gravel, and so it is not known what values there were in the ground that was piped. A new scheme of attacking the proposition will have to be devised if the property is to be successfully operated.

CHISHOLM CREEK.

Chisholm creek is a small stream which comes into Lightning creek at the town of Stanley. As both Lightning creek and the tributary streamlets running into Chisholm creek had yielded much gold to the old-timers, it was considered likely that the deep ground of Chisholm creek should also yield pay-dirt. For this reason, therefore, the ground has been tested in past years by numerous shafts and drifts in different places, but it has been found that the gravel carries practically no gold at all. J. A. McPherson studied the lay of the ground for some time, and finally concluded that the present channel of Chisholm creek is a very recent one, and that the main channel during the period in which the auriferous gravels of the country were being distributed lay to the south of the present one. This supposed old channel is now partly covered by a hill which is further supposed to have slid over from the main hill.

Mr. McPherson controls this ground by means of a lease, and to some extent has prospected the ground by means of small-scale hydraulicking and drifting. This work, however, did not yield any conclusive results, and so Mr. McPherson has now succeeded in interesting Toronto capital in making a thorough test of the ground. This is to be done by means of a drill. When the writer visited the property the drill was not then in operation, but had been previously, when two holes had been put down.

One of these had reached bed-rock at a depth of 100 feet or thereabouts; the other one, which was farther into the hill—that is, away from the present bed of Chisholm creek—had been started at the end of a deep surface cut. It had not reached bed-rock, but was at least 30 or 40 feet deeper than the first hole; the appearance of the material from the bottom of the hole was said to indicate that bed-rock was within a few feet.

From the results of these two holes Mr. McPherson believes that his theory, that there is a gravel channel in this locality, is strengthened. Certainly, if the two holes represent the normal state of affairs, then they do go to prove that near the present channel of Chisholm creek there is a rim-rock with a deeper bed-rock inside. Further drilling will, of course, be carried out.

In regard to values, Mr. McPherson claims that fair pay-dirt was encountered in certain portions of the holes, but the main pay-shoot is expected to be on the bed-rock nearer the centre of the supposed old channel. In the event of such a channel really existing which fed

into Lightning creek near Stanley, it is a fair assumption to consider it likely that it would yield pay-dirt of a richness comparable with that of Lightning creek and the small tributaries farther up Chisholm creek.

In the event of a channel of pay-dirt being found in this locality it could be mined out by means of a long tunnel, and drifting therefrom, starting in just above Stanley.

WINGDAM.

On the property of the Lightning Creek Gold Gravels and Drainage Company on Lightning creek at Wingdam, some thirteen miles below Stanley, no work has been done during the year. This property is under the general management of C. H. Uverzagt, who at present is endeavouring to raise money to continue further operations.

This company is endeavouring to mine the deep gravels of Lightning creek by means of a deep shaft and drifts therefrom. The writer did not visit the property as no examination could be made, and nothing further could be learned by seeing the surface. The amount of gold existing in the gravels this far down Lightning creek has not been proven, so that, as yet, the property is in a speculative position. The depth of ground and heavy flow of water are handicaps to the operation of the property which will require the best of engineering skill to overcome.

QUARTZ-MINING IN THE CARIBOO.

The history of quartz-mining in the Cariboo is very different from that of the placer-mining in the same region. Instead of a continuous record of production, it is, with the exception of isolated instances, a record of unsuccessful attempts and failures. About every ten years from 1865 onwards has seen a recurring quartz boom which has invariably died away without leaving any operating mines. The last few years have not witnessed any activity at all, with the exception of a small amount of assessment-work; mostly on old abandoned and partially developed claims which have been restaked. In past years several stamp-mills were erected in the district, all of which are now in a dilapidated condition.

Many of the geologists and engineers who have examined the district think that the gold in the placers had its origin in the quartz veins and lenses of the district. Dr. Geo. Dawson says at least 3,000 feet of the country has been eroded and that subsequent concentration of the gold contained in this material in the stream-channels has formed the rich placers. From this it would naturally be thought that if quartz veins could be found in the district they would well repay exploitation. Numerous stringers, veins, and lenses of quartz occur throughout the schistose rocks of the district; it is indeed hard to find any considerable rock-exposure which does not show some quartz. But the quartz is generally low-grade, and, what is worse, it is very pockety; some places may yield rich samples, and then near by the quartz will be quite barren. The veins also are not regular, but are very discontinuous and broken up.

It is hard to give an opinion as to whether or not the quartz veins have been sufficiently tested to condemn the possibility of any of them being of economic value. It must be remembered that the cost of mining operations in this district has in the past been very high, and that it is still much higher than the average. With the completion of the Pacific Great Eastern Railway through Quesnel, the distance from Barkerville to a railway-line will be only seventy miles, and a very material difference in freighting costs will ensue. The workings of the old properties are in such a caved-in condition that it is practically impossible from an examination to find out anything about them; most of them require work done on them to clear them up in order to make an examination possible. The writer visited a few of these quartz properties, and these will now be described.

Proserpine Group.

This group is situated on the mountain to the east of Barkerville, and consists of three claims—viz., the *Proserpine*, *Proserpine West*, and *Proserpine South*. This group is owned by Seymour Baker and covers ground originally held as the old locations of *Ophir*, *Proserpine*, *Crown Point*, and *Forest Rose*. Adjoining this group is the *Wilkinson* claim, an old 600-foot location, Crown-granted and owned by the B.C. Company.

On the *Wilkinson* there is an old shaft full of water and said to be 100 feet deep. Judging from the dump, this shaft was sunk almost entirely in quartz; this quartz carries a little iron pyrites and arsenopyrite, but is, for the most part, very barren-looking. Two surface cuts show the vein to be split up into quartz stringers occurring in slate.

A short distance from this shaft the vein passes into the *Proserpine* ground. From the inside of a cabin a shaft has been sunk 67 feet, and from this 100 feet of drifting has been done. This working was also full of water, but Mr. Baker says that throughout the vein is irregular and mixed up with the slate rock. To judge from the dump very little quartz has been taken out. Two hundred feet to the south-east there is another old shaft 97 feet deep, apparently mostly in slate.

Another vein, striking north-west, occurs on the *Proserpine*, and is exposed by an open-cut 100 feet long. This vein is also split into stringers, several of which are 1 foot in width; the total width, of quartz and schist, being about 10 feet. Mr. Baker has done some work on this vein, including a shaft 14 feet deep which was unfortunately full of water. Mr. Baker says the bottom of the shaft shows from 3 to 4 feet of quartz. The values are very spotted, but from numerous assays Mr. Baker says that the arsenopyrite mineral carries about 12 oz. of gold to the ton; the free quartz carries nothing; the iron pyrites nothing; and the galena 100 oz. of silver to the ton. The galena is of such infrequent occurrence that no importance can be attached to it. It would appear then, at least in this vein, that the occurrence of arsenical iron was necessary in order to ensure pay-ore. The writer did not sample any of the workings as there seemed to be little to gain by it. Mr. Baker has an assay outfit in Barkerville with which he has tested numerous samples, and he is therefore in a position to give reliable information in regard to values. Mr. Baker considers that his property carries sufficient value to make it a low-grade milling-ore, but unfortunately he has not sufficient capital to carry out the necessary development. The only way to determine anything definite about this vein would be to carry out some more work and thoroughly sample the whole of it.

The old *Forrest* claim, which is now covered by the *Proserpine* ground, has an old shaft 60 feet deep sunk on a 4-foot quartz vein. At 40 feet the vein faulted up the hill, but was not followed. Mr. Baker pumped the shaft out and drifted a short distance on the fault and picked up the vein again. As usual, this shaft was full of water, but the vein is said to be 4 feet wide. Some of the quartz taken from beyond the break was lying on the dump, and off this a sample was taken which gave the following results: Gold, 0.2 oz.; silver, *nil*. A number of open-cuts show the vein on the surface to be split up, with lenses of slate mixed up with it in an irregular way.

Perkins Group.

This group, consisting of the *Cariboo*, *Perkins*, and *North Star* claims, is situated on Burns mountain, about three miles from Stanley, and is owned by Benjamin Perkins. The property was worked years ago by Mr. Beedy, and several hundred tons mined, transported down the hill, and put through a small stamp-mill.

There are several parallel veins from 6 inches to 3 feet wide and only a short distance apart. All the old workings are caved in and in such condition that no examination is possible. The property is now in a worse condition for examination than a new prospect

because, the surface croppings having been gouged out and the sides caved in, it is hard to find any place to get a good view of the vein. As far as can be seen on the surface, the veins strike nearly north and south, and between the veins there are branching spurs of quartz.

There seems little doubt but that some good ore was taken out by Mr. Beedy, but the possibility that there may be more could only be determined by doing fresh development-work. The present owner, Mr. Perkins, is an old-timer, past eighty years of age, and it may be imagined that, single-handed, he is doing very little beyond living in his cabin.

Even the shaft Perkins sank many years ago is in disrepair, but some of the quartz from it is lying on the dump. A sample of this assayed: Gold, 0.2 oz. Another sample taken from one of the old dumps returned: Gold, a trace.

Concentrates.

In the operation of the hydraulic mines in the district a small percentage of concentrates as well as the gold is collected in the sluice-boxes. These concentrates consist of the typical black sand—mainly magnetite—as well as various sulphides, such as galena, iron pyrites, and arsenopyrite, and in addition nails, lead shot, pieces of iron, etc. As might be expected, these concentrates carry high values in gold, which probably occurs partly in the sulphides and partly as "rusty" gold which will not amalgamate. These concentrates are put through a rough treatment by applying cyanide to brighten the gold and then by amalgamation. This treatment is not very efficacious, and, of course, does not extract the values from the sulphides. The residue is thrown away, as, so far, it has not paid the operators to bother with it further.

For the past five years Seymour Baker has been working out a cyanide scheme to treat these concentrates. He has a lease on the old Government reduction-works, a couple of miles below Barkerville, and has put in a small cyanide-leaching system. As yet Mr. Baker has not actually treated any of these concentrates in commercial quantities, but he hopes to be able to before long. The whole thing is, however, not of great importance, as the actual quantity of concentrates secured in the hydraulicking operations is small.

COAL AREA ON THE BOWRON RIVER.

There is an area of coal-bearing rocks on the Bowron river (formerly called Bear river), about forty-five miles due east from Fort George, on which a number of coal licences have been held for some time. Important sections are owned by A. E. Hepburn, M.E., of Vancouver.

The writer was unable to visit this coal area during the past season, but Mr. Hepburn kindly submitted reports on his property by Wm. Blakemore, C. F. J. Galloway, and James Ashworth, and from these reports the following synoptical notes have been compiled:—

LOCATION.

The property is situated in Cariboo District, about forty-five miles due east of Fort George. The Bowron river flows through it in a northerly direction in its course from Bowron lake to the Fraser. The property consists of fourteen sections of one square mile each, all held under coal and petroleum prospecting licence from the Provincial Government. All of these are now surveyed. The surface of the property is very regular and is free from evidence of much geological disturbance. It is covered with timber of a moderate size, suitable for mining purposes, and the general conditions are favourable for establishing a mining plant and conducting surface work all the year round.

GEOLOGY.

The coal-measures are generally considered as belonging to the Cretaceous period, but may possibly be Tertiary. The measures lie in a basin surrounded by mountains composed of igneous and metamorphic rocks, and, as the measures are very soft and easily eroded, they are exposed in only a few places, being generally covered by glacial and alluvial deposits. At

some points a green intrusive rock is seen, and from its relation to the coal-measures shales in the bank of the river it is evident that it is younger than the latter, forming, therefore, where it occurs, an element of disturbance.

The only exposures of the coal-measures that can be seen occur along the banks of the Bowron river. Shales predominate, but the measures also include conglomerates, sandstone, and coal-seams. An anticlinal structure is noted in one place, but it is believed that, unless where affected and tilted by the intrusion of the before-mentioned igneous rock, the measures will be found to lie nearly horizontal.

COAL-SEAMS.

The principal coal-exposures occur at the point called the "Hepburn Coal Exposures." Here the measures consist of shale with occasional beds of sandstone and conglomerate and numerous coal-seams dipping at various angles to the north-east. Speaking of these seams, C. F. J. Galloway says :—

"Of the coal-seams exposed, three are workable and it is highly probable that some of the other aggregations of thin seams may prove workable under large portions of the area by the thinning-out of the intervening shale-bands. The three workable seams have the following sections as measured by me :—

"*Big Seam.*

"Top part not seen.	Ft.	In.
Coal	3	4
Coaly sandstone	0	4
Coal	3	9
Shale	0	1
Sandstone	0	3
Coal	0	9½
Shale	0	3
Coal	0	6
Shale and coal	0	1½
Bony coal	0	3½
Shale	0	1
Coal	0	2½
Shale	0	0½
Coal	0	3½
Shale floor.		
Total	10	4
Total coal	9	2

"*Six-foot Seam.*

"In crosscut—

Roof not seen.	Ft.	In.
Coal	0	7
Sandstone / *Shale and coal*	0	3½
Coal	0	7
Clay-seam	0	0½
Shale, coal, and clay	0	3½
Coal	0	1½
Clay-seam	0	0¼
Coal	0	4
Sandy shale	0	1
Coal	0	6
Shale	0	2
Coal	1	10
Shale and coal	0	8
Sandstone floor.		
Total	5	4⅞
Total coal	3	11½

In bank—

Shale roof.	Ft.	In.
Coal	0	1½
Black shale	0	1
Coal	0	8
Shale	0	1
Coal	0	9
Sandy shale	0	4
Coal	0	8
Shale	0	½
Coal	0	8
Coal and shale	0	2½
Coal	0	4
Shale	0	0½
Coal	0	8
Black shale	0	1
Coal	0	3¾
Sandy shale floor.		
Total	5	0¾
Total coal	4	2¼

"*Eight-foot Seam.*

	Ft.	In.
"Sandstone roof.		
Coal and sandy shale	0	4
Shale	0	3
Coal (with three small shale streaks)	0	11
Soft shale	0	1¼
Coal	0	4
Clay-seam	0	1½
Coal	0	8
Sandy shale	0	1½
Coal	0	2¼
Shale and coal	0	2¾
Coal	0	8½
Clay-seam	0	0½
Sandstone	0	3½
Coal	1	5
Sandstone	0	2½
Coal	0	9
Coal and shale	0	4
Coal	0	8
Clay-seam	0	0⅛
Coal	0	11
Sandstone	0	5
Coal	0	1
Shale	0	1
Coal	0	8
Shale	0	6
Coal	0	3
Shale	0	1
Coal	0	4
Coal and shale	0	11
Shale floor.		
Total	11	11⅜
Total coal	7	8¾

"All the thin seams of clay will undoubtedly disappear when the seams are followed away from the surface, and no doubt also many of those described as shale, which are really hardened clay due to surface seepage, so that the seams may confidently be expected to show a much cleaner section in their normal condition.

"Below the 8-foot seam there are numerous benches of coal of similar quality. Where seen, these are all too much interbedded with shale and sandstone to be workable, but, considering the lenticular and variable character of the shale-bands observed, it is highly probable that over part of the area some of the shale-bands will thin out, causing the coal-benches to come together, forming workable seams. It is similarly possible that the three seams described, which are workable where exposed, may in places become too much split up to be economically worked, but it is, in my opinion, fair to offset against this the probability of other seams assuming a workable character, and to take the observed thickness as a fair estimate of the workable coal which may be expected to underlie the whole of the area covered by the coal-measures in the seams already proved.

"If the measures between the two lower seams do not either thin out so that they can be worked together, or thicken so that they can be worked independently, it is possible that you will only be able to work one of them, or, at any rate, that a portion of the coal contained in one will have to be abandoned.

"It is very probable, however, that the intervening measures will either thin out or thicken, showing similar variations to those among the Vancouver Island coal-measures."

QUALITY OF COAL.

In the reports on this property which the writer has had the opportunity of looking over a number of analyses of the coal are given. In no instance was it stated as to where and how the samples of coal were taken of which the analyses are given. It is, of course, evident that by taking a straight sample across any considerable thickness of any of the seams would result in obtaining a sample which would contain a considerable percentage of sandstone and shale-ash. In mining these seams a considerable percentage of shale would have to be removed from the coal before marketing, either by sorting of some kind or mechanical washing. In this connection C. F. J. Galloway says: "On account of the shale-bands it (the coal) will have to be washed before shipment, but this will present no difficulty."

Quoting from Mr. Blakemore's report: "I took a considerable number of samples of coal from the seams on the south side of the property and one from the northern exposure last referred to. A copy of Mr. O'Sullivan's assay report is attached. It determines that the whole of the samples represent a good-grade bituminous coal of coking quality, very valuable for metallurgical as well as steaming and domestic purposes. Nothing more need be said as to the quality of the coal, except that it is uniform and easily one of the best grades yet discovered in British Columbia."

The following are the above-mentioned analyses of Mr. Blakemore's samples:—

Sample.	Hygr. Water.	Vol. Com. Matter.	Fixed Carbon.	Ash.	Sulphur.	Calorific Value, B.T.U.
A	3.5	37.5	54.0	4.0	1.0	....
B	3.5	40.8	48.3	6.0	1.4	....
No. 1	6.0	37.3	54.3	1.0	1.4	....
No. 2	4.0	44.4	46.9	3.5	1.2	....
No. 3	4.0	41.8	50.3	2.5	1.4	....
No. 4	4.5	38.85	49.35	6.0	1.3	....
8-foot seam	3.0	40.5	48.5	7.0	1.0	12,312
6-foot seam	3.5	39.0	48.5	8.0	1.0	11,970
Big seam	3.5	41.5	50.0	4.0	1.0	12,517

The results of the analyses of four samples included in James Ashworth's report check fairly closely with the preceding ones. In the absence of any direct statement as to how these various samples were taken, it seems to the writer a fair assumption that they represent selected specimens of clean coal, at least as good as the best product that could be produced by a washery.

WORK DONE.

C. F. J. Galloway examined the property during the fall of 1911, and his report describes the work then done as follows:—

"During the summer of 1910 the tunnel shown on Plan 4 was driven for you by Mr. Wendle for a distance of 34 feet. A crosscut was then driven about 10 feet to the left and 14 feet to the right, proving the two smaller seams as shown in Section 2, Plan 7.

"The top of the 6-foot seam was not reached in the right-hand crosscut, a hole drilled in the face penetrating into the surface wash, so that it could not be driven any farther. This hole was plugged up, but Mr. Wendle reports a further 12 inches of coal as being proved by it.

"This is the only permanent mining-work which has been done on the property; the rest of the work done consisting of the open-cut referred to, and other exploratory work, and the construction of a substantial log cabin 12 x 14 feet, and a trail between the cabin and the tunnel."

Mr. Hepburn has supplied the following information which describes the workings done up to March, 1915:—

"Buildings on Property.—1 cabin, 12 x 14 feet; 1 cabin, 12 x 16 feet; 1 cabin, 11 x 13 feet 6 inches; 1 bunk-house, 16 x 20 feet; 1 stable, 14 x 24 feet; 1 stable, 14 x 16 feet.

"Tunnel driven in 60 feet by 5 feet wide, 7 feet high, with crosscut 10 feet left and 14 feet right, all in coal.

"The shale is rapidly disappearing and the coal is clean and hard.

"From tests recently made it is extremely low in sulphur and makes an excellent coke, It is a rich gas-coal and very pure. Titles perfect to date."

QUANTITY OF COAL.

In each of the reports on this property a very large tonnage of coal is estimated to occur. Inasmuch as the coal-seams are only exposed along the river-bank, and that practically no development-work has been done on them, these "estimated quantities" must be taken as pure "guesses," with little foundation on which to base them. As an illustration of the somewhat elastic method of computation in use, the following is taken from the report of C. F. J. Galloway:—

"As already mentioned, the coal-measures are only exposed at certain points along the river. While they undoubtedly underlie the wide bench land which is covered by alluvial deposits, their limits can only be roughly estimated as being defined by the surrounding hills of igneous rock.

"The outlines shown on the map (Plan 3) are therefore purely hypothetical, but may reasonably be taken as indicating the probable area underlain by coal-measures. . . .

"In view of the foregoing, the area which I estimate as being underlain by workable coal in the seams described within your holdings is 10½ square miles, or 6,720 acres, which, taking a thickness of 21 feet of coal, and allowing 1,200 tons (2,240 lb.) per foot per acre, which is sufficient to allow for faulty ground, losses in working, etc., this gives a total quantity of 169,344,000 tons."

Similarly, Mr. Blakemore estimates "a net production for the whole of the property of 189,000,000 tons"; while Mr. Ashworth says: "Assuming that this property has an area of 3,840 acres underlain by the big seam of 11 feet 6 inches thick, it may be expected to yield over 44,000,000 tons of coal."

TRANSPORTATION AND MARKET.

At present the property is reached by trail, so that very little serious development can be undertaken until some better transportation is provided; a good wagon-road at least being required.

The property is distant some fifteen to twenty miles from the main line of the Grand Trunk Pacific, and before it could be placed on a productive basis a branch line of this distance would require to be built. This railway would be an inexpensive one to build, as there would be but little rock-work and the grade is very easy.

A market for the coal is expected from the Grand Trunk Pacific, Canadian Northern, and Pacific Great Eastern Railways—the former of which is completed and in operation—and in addition a domestic market in the Cariboo district generally, especially the town of Fort George.

QUESNEL MINING DIVISION.

REPORT BY ARTHUR SAMPSON, MINING RECORDER.

I have the honour to submit herewith my report on mining operations in the Quesnel Mining Division of the Cariboo District for the year ending December 31st, 1914 :—

The mining industry in this district for the most part seems to be marking time pending the completion of the Pacific Great Eastern Railway, which is now under construction. There is every indication that the completion of this railway will bring about a revival of mining operations in this district, as it will make it possible to ship in machinery and supplies at a reasonable rate.

The Quesnel Forks and Keithley sections produced during the past year placer gold to the value of about $22,000. Through the express office at Quesnel Forks some $9,000 worth of gold-dust was shipped, of which the greater part was furnished by individual miners. It is difficult to obtain figures of production from larger producers, these almost invariably shipping direct to assay office by private agents.

The old mine at Bullion was reopened in the early spring; operations were confined to cleaning the hydraulic pit of slide material that had accumulated during the years the mine had lain idle. Only one of the ditch-lines was used in the these operations, and by the beginning of November the pit had been cleaned out and then work was suspended; between $8,000 to $10,000 is believed to have been the value of the gold recovered. The plans drawn up for the future working of this mine embrace the extension of the sluice-tunnel through the rim into the channel, so that the bottom gravels, averaging about 100 feet from the present working-level to bed-rock, may be worked; the repair of the water systems, involving entire reconstruction of various worn-out flumes, and the reconstruction of the mine-flumes and pipe-lines. When these plans have been carried out the Bullion mine ought again to be one of the largest producers in the Province.

The Morehead Mining Company, operating on Seven-mile creek, a tributary of the Quesnel river, shows promise, provided an adequate water-supply can be obtained. The extent of the gravels and their gold-tenure justify operation by a plant calling for 5,000 inches of water. Unfortunately, during the past season less than a third of this supply has been available, and that only for a limited period. The production during the past season, with a limited water-supply and a small crew, was about $5,000, a figure which is no criterion at all of the production this property is capable of. Plans, however, have now been made to increase the water-supply by tapping Eight-mile lake, and a large increase in the production is confidently looked forward to when these plans have been carried out.

At the mouth of Seven-mile creek the Water-tight Dipper Dredge and Mining Company, Limited, launched its dredge on December 2nd, 1914. This is the pioneer dredge on the river and is being watched with keen interest. It is a new type of dredge, its peculiarity being in the dipper itself, and it remains to be seen whether it is of the type best adapted for the handling of the material in the river, which is admirably suited to dredging, as the gravel-wash appears to be fine, with but few boulders of any great size. Tests made of the gravel-wash are reported to have given proof that they contain high gold values, and the season of 1915 should demonstrate whether this dredge is all its promoters claim.

In the immediate vicinity of Quesnel Forks, Captain F. M. Whitmarsh, who is operating some claims, has done some work on placer claims which are of promise, but on discovering an outcropping of coal he turned his attention to this, and proposes to prospect this thoroughly next year.

On Keithley creek Borland & Adams have been prospecting, and on Snowshoe creek Mr. Hyde has been at work, but no details are available. Chinamen hold several claims in this locality and have been doing well.

In the southern portion of this district a number of mineral claims have been staked near Timothy mountain, and some preliminary work done, but it is too early yet to obtain information as to the future prospects of these claims.

In the Harpers Camp section, on Black creek, Rutherford, Ross & Leach sunk several prospect-shafts and opened a pit, which gave encouraging prospects, but owing to the inadequate water-supply they had to suspend operations. They then surveyed out a ditch farther up the creek, and propose next season to complete this ditch, which will enable them to have a good head of water at all times.

The Horsefly Hydraulic Mining Company's property, located about five miles north of Harpers camp, is being operated by E. J. West, to whom I am indebted for the following information:—

The property is equipped with a hydraulic plant capable of handling 10,000 cubic yards in the twenty-four hours.

This season part of the time was spent in repairing the ditch-line, which is nineteen miles in length with a capacity of 3,000 miners' inches of water. Then a cut was run some 900 feet through the rim-rock to tap the bottom of the channel; this cut has an average depth of 70 feet.

The prospects encountered were very encouraging, and Mr. West expects good results from next season's operations. The sum of work was: Total time occupied in washing, 88 days; quantity of water used, 264,000 miners' inches; quantity of material washed, 616,000 cubic yards.

OFFICE STATISTICS—QUESNEL MINING DIVISION.

Free miners' certificates	130
Mineral claims recorded	55
Placer claims recorded	12
Placer claims rerecorded	12
Certificates of work	13

CASSIAR DISTRICT.

ATLIN MINING DIVISION.*

REPORT OF J. A. FRASER, GOLD COMMISSIONER.

I have the honour to submit my report on mining operations in the Atlin Mining Division of Cassiar District for the year ending December 31st, 1914.

There was a considerable influx of strangers last spring, and even of old-timers, to whom the camp appeared inviting in comparison to many places outside, so that there were more men than usual in the camp when mining operations were commenced. Unfortunately, a large percentage of the strangers were simply wage-earners looking for work, who had neither the means nor the experience necessary to prospect unexplored ground, so that when the companies and other employers had secured what labourers they required there was an exodus of the disappointed ones, which left us with rather fewer men in the district throughout the summer and fall than perhaps in any previous season.

Had the development-work contemplated been in operation there would have been employment for all who were willing and capable. Those conditions were emphasized and more keenly felt upon the declaration of war in Europe, as some of the operators who were vigorously prosecuting development-work were compelled to suspend operations because their credits were curtailed, or cut off altogether.

However, there was a good snowfall last winter and a fairly generous rainfall during the summer, which provided a good supply of water on most of the creeks throughout the greater part of the season, and as a consequence the output was somewhat in excess of that of 1913, and was quite encouraging to some of the operators. The construction of dams and reservoirs on some of the creeks this winter, or before the commencement of operations next spring, should contribute to an increased output upon those creeks at least next season.

There was an increase in revenue under some heads and a falling-off under some others, but, on the whole, an increase over that of 1913.

McKEE CREEK.

As anticipated in last year's report, a reorganization amongst the owners of the properties held on this creek was consummated, now known as the "Delta Gold Mining Company." This company, under the management of George Adams, commenced piping on May 10th and continued until October 18th, thus enjoying an operating season of nearly five and a half months of practically steady water, sixteen days longer than in 1913. During that period nearly 9,000 square yards of bed-rock was uncovered, and over 50 per cent. more gold recovered than was won in 1913 from over 11,000 square yards of bed-rock. In fact, the returns for the season of 1914 averaged nearly $5 a square yard of bed-rock uncovered. A force of from seven to eighteen men (an average of fourteen) was employed throughout the season.

I am pleased to be able to say that this company realized a handsome profit upon its expenditure this season, and is consequently encouraged to build dams for reservoir purposes near the head of McKee creek, which work is being prosecuted as far as possible this winter with the expectation of having it completed in time to intercept all the water tributary thereto for next season's operations, and a much increased output is anticipated in consequence.

There were no individual mining operations on this creek.

* *See also* Special Report by W. M. Brewer, M.E., page 82.

PINE CREEK.

On this creek the Columbia Mines Company, which appears to be a reorganization of the North Columbia Gold Mining Company, under the superintendence of A. D. Hughes and the general managership of J M. Ruffner, commenced operations very early in the spring, and with a force of from forty-five to fifty men and the usual array of Monitors, etc., operated on both sides of the creek throughout the season as in years gone by, but with much poorer returns than for a number of years previously. About midsummer a change was made in the management, and shortly afterwards Mr. Hughes withdrew from the superintendence of those operations to attend more closely to certain drifting operations which he was conducting on Spruce creek. I am unable to give more details, as none whatever were supplied me, but judging from appearances a change of procedure seems necessary to any prolonged operation in that vicinity by the company.

This company and its parent company, the Pine Creek Power Company, Limited, has large areas on Pine creek still untouched, much of which has never been systematically prospected, but whether this will now be done or not I cannot say, as no indication of future intentions has been communicated to me. The output this season so far as reported, although apparently sufficient to provide a margin of profit over cost of production, was rather disappointing.

The Pine Creek Flume Company, Limited, under the management of C. L. Queen, commenced operations on July 4th, and, with a force of about twelve men and one team of horses, did some ditch and dam building with a view to conveying and conserving the waters from Birch creek. Some other mining work was carried on for a time, but evidently with very unsatisfactory returns, for all operation, so far as the company was concerned, was suspended about October 1st and the manager shortly afterwards left the district. It would be unfair, however, to assume from the unsatisfactory reports of the operations of this company that the ground is barren, for very little real mining has been done up to date.

Some individual mining was carried on higher up on Pine creek, and a few men worked on Gold Run for the greater portion of the season. In the fall some old-timers who had worked on that stream years ago, and had left the district, returned to it and are operating there at present.

It is also significant that some ground on Pine creek which has been cursorily prospected from time to time for years, but not worked, has recently been located by old-timers.

There are from seven to ten men working on Gold Run this winter.

SPRUCE CREEK.

There were about 110 men, women, and children on Spruce creek for a good portion of the season, of whom about ninety-five were men, most of whom were engaged in mining and prospecting.

The Spruce Creek Power Company, Limited, did not operate hydraulically, but on a portion of its property A. D. Hughes, with an average of seven men, carried on underground prospecting-work from April 15th to November 4th, and succeeded in locating some very good "pay" towards the close of the season. During that time he repaired and rendered available about 800 feet of old tunnels and drove 600 feet of new tunnel, all of which will form part of his underground system should he continue, as he intends doing if the "pay" is found in even such quantities as were secured the latter part of the season, and much better returns are anticipated as they proceed into the benches. A small crew is working thereon throughout the winter.

On the *Gladstone* lease and adjacent claims James McCloskey continued drifting and sluicing throughout the season from May 1st till near the end of October. He worked a force of from two to thirty-two men, with an average of twenty-two, during that time, and recovered sufficient gold to clear operating expenses, notwithstanding that the expenses covered such deadwork as building wing-dams and cribbing his "tailings." He has three men prospecting on the property this winter, and intends resuming operations as early as possible next spring.

On the *Peterborough* lease and adjacent holdings H. O. Morse, with a force of from two to ten men (average five), carried on drifting operations with very fair results, and intends continuing throughout the winter. Should the weather not turn colder than it has been up to date, all such outfits as this will continue to sluice their gravel throughout the winter.

On the *Poker* lease Isaac Matthews did not work as vigorously as heretofore, and, in fact, suspended operations altogether for a considerable period, principally, I believe, on account of legal complications with neighbours, reference to which was made in last year's report. However, he has reported some work done during the season, the results of which indicate that his gravel averaged over $3 a cubic yard, and I am informed that a new pay-streak has been struck on his ground which averages $5 and upward a cubic yard; the width and extent of it is as yet unknown. It lies over 600 feet back from the creek on the left limit, and appears to be in a deeper channel than any hitherto discovered in that vicinity. There are from twelve to twenty men employed on that property at present.

The smaller operators on this section of Spruce creek who in past seasons contributed materially to swell the aggregate output were not actively operating there throughout this season, and some not at all. In fact, the returns from this creek have been gradually falling off, and for this season are the lowest in many years, but from the above evidences of existing values it is manifest that the creek is not by any means worked out, nor even abandoned, and this winter a number of the operators in question are again at work.

There are small outfits operating at intervals along the creek from this point up to Blue canyon, a distance of seven or eight miles, but very little is being done over part of that distance.

Near Blue canyon there is some ground from which the operators should secure very good wages if they would work, judging from the results recovered from very indifferent application, but the difficulty in securing an ample supply of water has hampered operations.

Just at Blue canyon Swanson & Pettit, with a few men, worked on their lease from May 23rd to October 25th, with indifferent success, but, as the most of their work was of a prospecting nature, they may be considered to have gained in the knowledge of what the ground does (or does not) contain as an equivalent for the money expended.

Just above Blue canyon A. G. Meyers, with a small cotton hose, prospected into the bench some distance beyond where "pay" was supposed to exist, and took out what was "better than wages" at $5 a day for the season.

Farther along above Blue canyon J. M. Ruffner and others located three leases, and in the fall put in a mile or so of ditch with which to convey water from the South fork to work the ground. This winter they have been engaged conveying hydraulic pipe and Monitors up to this point, and in the spring, as early as weather conditions will permit, we will doubtless see there another installation of hydraulic plant upon entirely new ground, from which good returns are anticipated—if sufficient water can be secured. Those parties have secured both Meyers's and Swanson & Pettit's ground and expect to make a handsome showing, and they will at least test the ground as it has not been tested hitherto.

There are about seventy-five people on Spruce creek this winter, of whom about sixty are engaged in mining.

The deep ground located on Spruce creek in 1912, to which reference has been made in preceding reports, has not been explored for various reasons, the principal being the lack of capital, but it is simply held in abeyance awaiting improved conditions, as the locators are as sanguine as ever as to the possibilities.

On Rose creek, which is tributary to Spruce creek above Blue canyon, some leases were located last summer, and the locators secured very satisfactory returns for the work done upon them. In fact, I have reason to believe that "better than wages" was secured by ordinary individual mining methods, and if water can be secured in sufficient quantity, very good results may be looked for.

BIRCH CREEK.

About fourteen men were employed on this creek during the season of 1914, and while some of the operators have not reported, I have reason to believe that results were not as satisfactory as in former years.

As in former years, a force of from five to nine men, with a minimum of five, under the superintendence of H. P. Pearse, operated with an hydraulic plant on the lower part of the creek from May 7th to October 12th, but the results were not as good as for some years past.

One reason for this falling-off was that as they moved farther up the creek they found the "pay" turning into the bench on the right limit, and in order to follow it they had to remove a much heavier overburden than in former years, and, notwithstanding the generally good supply of water, they were short of water and of pressure, so that they could not handle the gravel so effectively.

It is claimed, however, that 187,000 cubic yards was moved during the season. There was also a new reservoir built up-stream some distance, which will ensure a much better head pressure for next season's operations.

BOULDER CREEK.

About fifteen people spent the summer on this creek, of whom ten men were engaged in mining. The output, although not large in the aggregate, was several times greater than in 1913 or 1912. There are about fifteen men on the creek this winter.

RUBY CREEK.

On this creek the Placer Gold Mines Company, under the management of T. M. Daulton, commenced operations installing new sluice-flumes, etc., on April 19th, and piping on May 23rd, and continued until October 23rd, when they closed down for the winter. Before commencing to pipe, this company installed 2,000 feet of new sluice, which was paved with manganese-steel plates for its entire length. Those plates permitted of a much flatter grade than could be adopted with wooden riffles, which increased the dump-room and enhanced the duty of the water materially. This sluice was set at a 2.77-per-cent. grade and worked admirably.

A force of from thirteen to twenty-one, with an average of eighteen men, was employed throughout the season, and about 80,000 cubic yards of gravel was moved, the proceeds from which were very satisfactory, being about 50 per cent. better than for 1913 and nearly five times the amount recovered in 1912.

Before closing down a change in the position of the by-wash was effected, which will enable them to operate both sides of the creek and to work two Monitors instead of only one, as heretofore; this will naturally result in a much increased quantity of gravel being handled, and consequently a much larger output may be expected.

The water-supply was better than hitherto, and, on the whole, fairly satisfactory. I understand provision is being made this winter for the building next spring, of an additional reservoir, which will contribute still further to a much increased output.

No individual work worth mentioning has been done on this creek for some time.

WRIGHT CREEK.

About five men operated on this creek from May 18th to October 10th, and in that time moved nearly 15,000 cubic yards of gravel and cleaned about 2,500 square yards of bed-rock. The gold won therefrom amounted to more than double what was won in 1913 and about three times the winnings of 1912. The operators are thus encouraged to continue next season.

OTTER CREEK.

On upper Otter creek J. E. Moran with three others operated from April 20th to October 25th. A good part of this season was devoted to working over ground that had been worked in the early days of the camp by individual miners. This was done for the purpose of preparing for the opening-up of new ground, but the results were more satisfactory than for several seasons past, as the proceeds in gold recovered were nearly equal to that of the two seasons last put together. I expect continued operation next season.

On lower Otter the Mines d'Otter (formerly the Maluin Syndicate), under the managership of W. H. Brethour and the general superintendence of H. Maluin, and with a force of about fourteen men, continued working its way down to bed-rock by piping out the intervening material. Owing to the outbreak of the European war those operators were rather suddenly compelled to curtail expenditure, as the work was being carried on with French capital and supplies were cut off. Mr. Maluin, being a French reservist, had to return to France, leaving the prosecution of the work to Mr. Brethour. I understand they expect to strike bed-rock early next season, and are working to that end independently of the effect produced by the war.

There are four men on the creek this winter.

Nothing has been reported by the Lincoln Creek Syndicate, and, so far as I am aware, nothing was done on that property until fall, when one man undertook a "lay" upon it, and and he is working there this winter.

On Consolation creek one or two men have been working, but have not reported progress. They are there this winter.

The same may be said of Davenport creek, where three men have been engaged for some time tunnelling for bed-rock. Two men are there for the winter.

On Horse, Hemlock, and Cracker creeks, all tributary to Surprise lake, some men have been prospecting, but have not reported anything of moment.

On Wilson creek three men were mining in the old-fashioned way, but the results were not particularly encouraging. There is gold on this creek and in considerable quantities in places, but the valley is wide and the pay-streak erratic and difficult to follow.

On Burdette creek two or three men prospected for some time, and one man worked there throughout the season. He recovered some gold, but whether in sufficient quantities to encourage him to continue or not I cannot say, as I have not seen him recently.

O'DONNEL RIVER.

The amount of advertising given this stream on account of the very rich spots found at intervals upon its banks has engendered great expectations, and great results were anticipated from this year's operations, which, I regret to say, have been but very moderately realized—if at all.

There is undoubtedly "gold in plenty" in places on the stream, and, judging from the results reported by prospectors from time to time, the impression is seemingly justified that such "places" are not infrequent, but until the problem of water-supply and consequent cheap operation is solved, it will be difficult, if not impossible, to intelligently indicate the possibilities.

The O'Donnel Placers Company, which is an offspring of the North Columbia Gold Mining Company and allied interests, and which owns and controls a number of mining leases on O'Donnel, has the largest score to its credit for development, installation, and prospect work on the river, in the prosecution of which it reports having expended over $62,000 up to the close of last season. The company employed from six to sixty-four men, with an average of thirty, from January 1st to October 8th, and, among other things, ran 2,000 feet of tunnels and stripped over 12,000 square feet of bed-rock.

Besides mining by both hydraulic, hand-sluicing, and drifting methods, the company built long stretches of ditch and flume and installed two hydraulic elevators, but unfortunately the water-supply upon which it was in part depending is alleged to have failed before the elevators (or one of them, at any rate) could be tested, and that branch of its operations was early closed down. The company's winnings from the gravel handled, although aggregating a snug sum, was not sufficient to cover its expenditure for the season, but the prospects are good for the future.

The outfit whose prospecting successes and "rich strikes" were so widely advertised and paraded does not appear to have become inordinately wealthy as a result of its operations, and yet wonderfully rich spots had been encountered in the drifts and tunnels; the "reason why" may not be entirely attributable to the condition of the ground nor to environment. I regret to say that the results from this and other adjacent property are not at all commensurate with the expectations created generally by the representations of the holders thereof, and in consequence of which people were induced to come into the district, to their loss and disappointment.

I am pleased, however, to be able to report that the results of systematic prospecting on other parts of the stream have revealed the existence of very good "pay," and apparently in such quantities as to justify the installation of plants, some of which, I believe, will be in place, if not in operation, before another season has passed.

Considerable prospecting was done on Bull, Fox, Feather, and other tributaries of O'Donnel, and in some cases the prospectors seemed well satisfied; in others they found but indifferent results.

There are over forty people on O'Donnel this winter, many of whom are mining or prospecting on their own or other people's holdings.

About seventy leases have been located on O'Donnel and adjacent streams during 1914, in addition to about one hundred located thereon previously.

MINERAL CLAIMS.

On the *Engineer* group of mineral claims Captain Alexander employed a force of eleven men from June 17th to the middle of October, during which period he added to the development-work already performed about 200 feet of rock tunnel, 70 feet of upraise, and 40 feet of winze from the tunnel. He also milled about 110 tons of rock, which yielded about $100 to the ton. There will be four men working there throughout the winter.

None of the other mineral properties throughout the district have been worked beyond what was necessary to keep them in good standing, except, perhaps, on the *Big Horn*, where Fred Lawson worked from the middle of April to the middle of October.

Noel Laverdière has also been engaged in development-work on his properties for some months.

Many mineral-property holders here are awaiting the advent of capitalists who will undertake the development of their properties, but all such expectations received a set-back when war was declared, so that nearly all such holders are merely marking time and awaiting the turn of the tide.

Some coal has been located in the neighbourhood of the Inklin river, but nothing has yet been done towards its development. Notwithstanding repeated inquiries about its quality and extent, nothing has been done towards the development or utilization of the deposits of hydromagnesite which lie adjacent to the townsite of Atlin.

All these, however, may receive due and speedy recognition as soon as the war is over, and with the return of brighter times there may possibly come into the district a railroad from the south, the preliminary steps towards which have already been taken.

Following is a statistical report of the revenue collected during the year 1914:—

OFFICE STATISTICS—ATLIN MINING DIVISION.

Free miners' certificates (individual)				606
" " (companies)				6
" " (special)				6
Placer records				31
Placer rerecords (representing 292 claims)				273
Leases located				72
" issued				37
Leaves of absence (representing 183 claims)				47
Groupings filed				6
Abandonments recorded				2
Bills of sale (placer)				20
" (hydraulic)				126
" (mineral)				11
Mineral records				49
Certificates of work				141
Groupings filed				5
Certificates of improvement (recorded)				8
Crown grants issued				10
Certificates of improvement (advertised, not yet issued)				3
Gold reported (companies)	12,909 oz.	Value		$200,631 00
" (individuals)	5,575 "	"		88,809 00
Totals	18,484 "	"		$289,440 00
Royalty paid by companies				$4,009 75
" " individuals				1,158 40
				$5,168 15
Lode mines				207 50
Total				$5,375 65

Camp of O'Donnel Placer Co., Ltd.—O'Donnel River.

Revenue collected during 1914.

Land sales	$ 620 00
Land revenue	6 00
Water revenue (rentals)	852 00
Timber royalty (cordwood)	137 50
Free miners' certificates (individuals)	2,770 50
" " (companies)	545 00
" " (special)	90 00
Mining receipts (lease rentals)	6,845 00
" (lease deposits)	1,440 00
" (other sources)	2,149 10
Leaves of absence ("Placer Act")	335 00
Licences (liquor)	780 00
" (trade)	250 00
Fines and forfeitures	326 50
"Marriage Act"	40 00
Law-stamps	33 30
"Taxation Act"—	
Real-property tax	3,132 95
Personal-property tax	2 95
Wild-land tax	23 55
Income-tax	16 90
Mineral-tax	5,375 65
Acreage-tax	1,081 50
Interest	1 90
Total	$26,855 30

ATLIN MINING DIVISION.

REPORT BY W. M. BREWER, M.E.

ATLIN LAKE SECTION.

The geography and general characteristics of this Mining Division have been very fully described by the Provincial Mineralogist in the Reports of the Minister of Mines for 1900, 1905, and 1911, as well as by D. D. Cairnes in Memoir No. 37 of the Canadian Geological Survey, so that any introductory description by the writer of this report is deemed unnecessary. The town of Atlin was the scene of a disastrous fire during the spring of 1914, when the main business section of the town was burned down, but by autumn this section was rebuilt.

The mining operations carried on during 1914 in the Atlin Mining Division were confined almost entirely to the creeks which have been the annual producers of placer gold since 1899. Except on O'Donnel river and Spruce creek, all of the work done was by hydraulic mining by corporations, each of which controls a sufficient number of leases and water rights to warrant the expenditure of large capital for plants, dams, water-ditches, and flumes.

The attempts made in 1904 to introduce dredges into this district have not been repeated, although it would appear that such a method of mining should be successful in certain parts of the district.

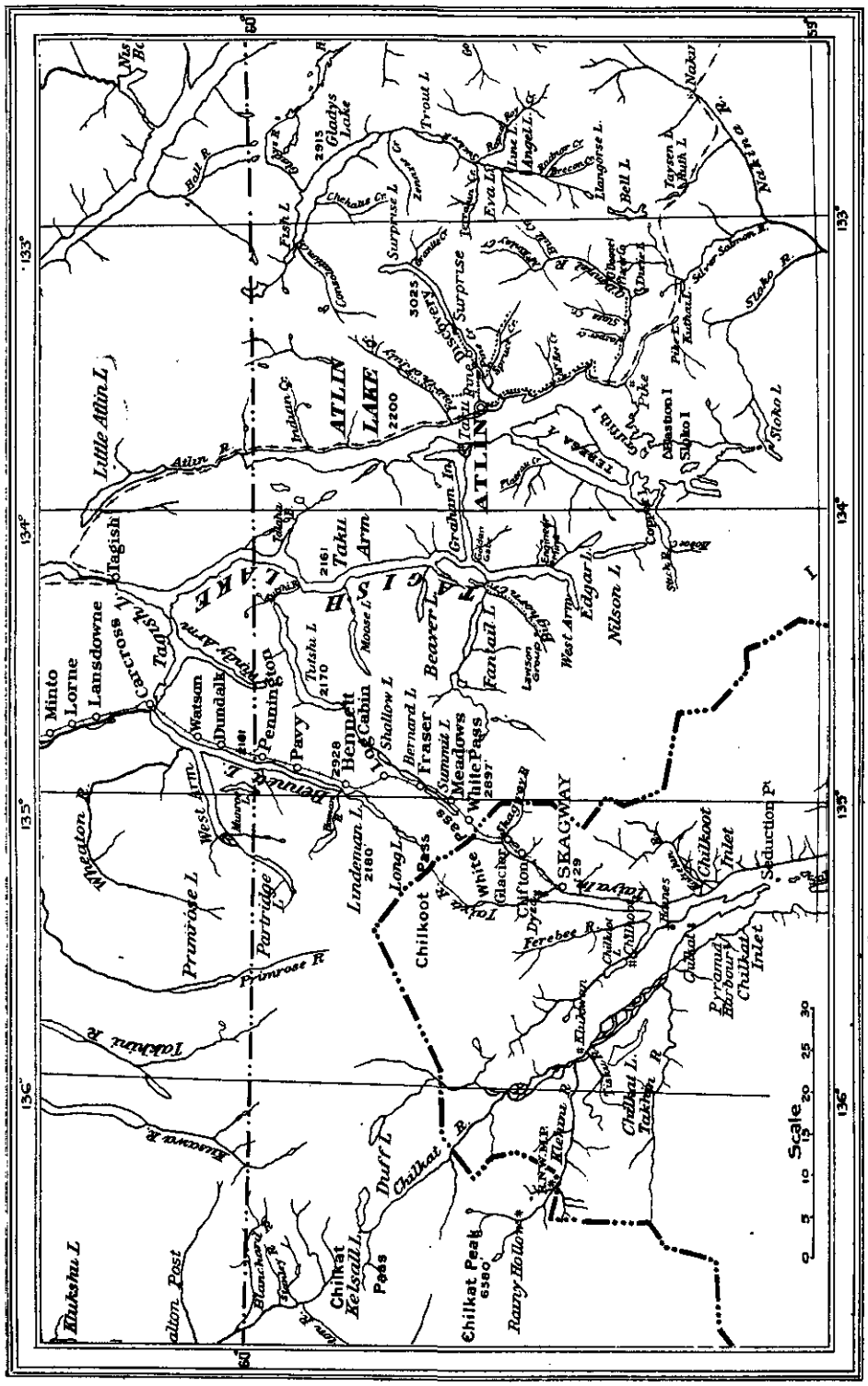
This suggestion is made because near the head of Spruce creek, on Slate creek, and between the headwaters of that creek and the O'Donnel river, as well as on the bars of that river, the writer's attention was called to extensive areas of ground which carry some values, apparently insufficient to pay for ordinary sluicing and shovelling-in by hand, but presumably sufficient to pay by handling on a large scale.

For various reasons, such as lack of gravity-dumpage or inability to obtain water under pressure, this ground is not suitable for hydraulic mining, but may be found adaptable to dredging provided the bed-rock is suitable and the boulders do not interfere with operating the dredge.

O'DONNEL RIVER.

This stream, which is about fifty miles in length, flows in a general south-westerly course into Atlin lake, entering it on the east side at a point about twenty miles south from the town of Atlin. Leases had been located previous to the season of 1914 from a point about nine miles above the mouth for a length of about twenty-three miles up the river.

Prospectors discovered placer gold on this river previous to 1904, and staked individual claims, which they later abandoned because the operations were not profitable. During 1904 leases were granted on the main river, but it was not until 1912 that bed-rock was reached by development-work, when it was found at a depth of 94 feet by Robert McKee, who, as manager for the Canadian-Alaska Exploration Company, was carrying on operations with a Keystone drill on the *Gold Hill* group of leases situated about sixteen miles above the mouth of the river. The unexpected depth of bed-rock caused a suspension of operations, but later prospecting along the bench, about 40 feet higher elevation than the bed of the stream, resulted in the discovery of a pay-streak which caused somewhat of a stampede during 1913 and the location of a number of leases. It was not until the summer of 1914, however, that any quantity of placer gold was recovered, as it was late in the autumn of 1913 before any water system had been installed; this was done by J. M. Ruffner, who had bonded the *Gold Hill* bench claims and group of leases.


ATLIN MINING DIVISION
WESTERN PORTION
ATLIN LAKE
TAKU ARM
Little Atlin L.
Tagish
Minto
Lorne
Lansdowne
Carcross
Watson
Dundalk
Pennington
Pavy
Bennett
Cabin
Shallow L.
Bernard L.
Fraser
Summit L.
Meadows
White Pass
SKAGWAY
Lindeman L.
Long L.
Chilkoot Pass
Chilkoot
Glacier
Clifton
Dyea
Ferebee R.
Chilkoot Inlet
Seduction Pt.
Primrose L.
Partridge
Primrose R.
Tokshin R.
Duff L.
Chilkat R.
Chilkat Pass
Chilkat Peak
6360
Rainy Hollow
Chilkat L.
Takhin R.
Klehini R.
Porcupine
Haines
Pyramid Harbour
Chilkat Inlet
Takhin
Kluk
Alton Post
Blanchard R.
Kelsall R.
Kluk L.
Fish L.
Gladys Lake
2915
Trout L.
Surprise L.
Surprise
3025
Eva L.
Lux L.
Angel L.
Langhorse L.
Bell L.
Bell R.
Tyr R.
Tyrrell R.
Tarven L.
Ruth L.
Nahlin R.
Silver Salmon R.
Stako R.
Stako L.
Pike
Kuthai
Pike L.
Johnston I.
Stako I.
Tutshi L.
Tutshi R.
Tagish L.
Tagish R.
Atlin R.
Atlin
Indian R.
Graham Inlet
Golden Gate
Engineer
Copper R.
Edgar L.
Nilson L.
West Arm
Fantail L.
Beaver L.
Moose L.
Lawson Creek
Big
Scale
0 5 10 15 20 25 30

As the grade of the bed of O'Donnel river is flatter than usual in mountain streams, water for sluicing by hydraulic methods has to be brought in by ditches and flumes from Canyon and Berry creeks, tributaries of O'Donnel river.

Canyon creek flows into the river from the north-west and forms a confluence with the river about three miles above the point where the "pay" had been discovered. This fact necessitated the construction of a ditch two miles and three-quarters in length and a flume 1,600 feet in length to deliver water at 200-foot head.

Berry creek flows into the river from the east and empties about one mile and a half below the point where the "pay" had been discovered. A ditch one mile in length, with 600 feet of flume and a pipe-line half a mile long, comprised the construction-work found necessary to deliver this water at 260-foot head. It is estimated that these two sources furnish about 1,000 miners' inches of water.

In addition to the discovery of pay-gravel on the benches, J. M. Ruffner also found "pay" during 1913 in some of the bars along the river-bed, but, in order to work by hydraulic methods, it was necessary to change the course of the river by cutting a diversion-canal, and also to install an elevator to stack the tailings, as the grade of the river-bed is too flat to carry them away. This work, as well as testing with an Empire drill, was finished late in the season of 1914 under the superintendence of Frank Breeze, who succeeded J. M. Ruffner as manager of the North Columbia Gold Mining Company as well as of the O'Donnel Placer Company Limited.

O'Donnel Placer Co., Ltd.

This company was organized by J. M. Ruffner during the winter of 1913-14 to take over the *Gold Hill* and other leases he had previously bonded, and several miners were engaged to make crosscuts or drives into the river-bank to search for the pay-streaks in the bench about 50 feet higher elevation than the bed of the river. This work resulted in exposing gold-bearing gravel in three ancient channels where the bed-rock has wavy lines with dips at varying angles and sometimes quite deep, but at other times shallow.

The bed-rock on which most of the gold is found is a yellow clay similar to that described by the Provincial Mineralogist in the Minister of Mines Report for 1904, and designated by him as the "old yellow channel," noted as occurring on lower Pine and Spruce creeks, and his theories then expressed have been demonstrated by the work on O'Donnel river to be correct. From his report the following abstracts are made:—

"Since the previous visit of the writer (in 1900) the development of the camp has rendered clear many points which were previously little more than indications, and, as such, were given in the Report of 1900. The conclusions then arrived at have been almost exactly borne out by the subsequent work; the area of the field remains the same; the evidence is strengthened that Pine and Spruce creeks at one time joined about Stephendyke and then debouched to the north, towards Trond gulch, emptying into a lake, which then covered all the flats at the Half-way House, and that the present course of these streams below this point is of recent cutting. The 'old yellow channel' has developed along the lines then indicated, but to an extent not then hoped for.

"In 1900 the Provincial Mineralogist attempted to ascertain the direction of flow of this yellow dirt, by taking levels at various points, and while these levels were not conclusive, they indicated a flow, which subsequent work has confirmed, giving a grade to the deposit conforming in direction to the flow of Pine and Spruce creeks, but it is so slight (between 1 and 2 per cent.) that it is difficult to believe that the heavy material in the deposit would be carried by a current produced by such a grade; and, further, the workings of the hydraulic pits, etc.,

notably that of the North Columbia Company on Pine creek, expose a face in which the heavy boulders and angular fragments are so deposited together as to render it extremely improbable that this deposit is an '*old channel*' in the usual meaning of that term—viz., the bed of an ancient stream.

"In Cariboo, and elsewhere in British Columbia, where the placer deposits occur, the 'old channels' contain in themselves the evidence of the direction of their flow; and this is shown by the more or less uniform size of their constituents, by the rounded or flat water-worn form and faces of the gravel, and above all, by the 'shingling' of the flatter stones in the deposit, while the gold is usually on bed-rock or in some defined stratum.

"All of such evidence of flow is lacking in the old 'yellow deposit' of Atlin, and, while some of the boulders are large and rounded, many are angular, the flat ones often standing on edge, as though so dropped into mud, in still water. The greater part of the deposit consists of granite fragments, now almost decomposed, with resultant clay (kaolin) and grains of silica. While the gold here is found for the most part near bed-rock, though not necessarily *on* it, it occurs some height above—more or less throughout the deposit. The characteristics of the deposit did not seem to admit of its having been caused directly from glaciers. The evidence is such as to force the conviction that this deposit was not formed in rapidly running water, but that it was dropped in comparatively still water on a bottom (bed-rock) such as that of a lake or sea, with a *slope*, but not a *channel*. As to exactly how the dirt was deposited, there is room for various theories, but the most probable seems to be that glaciers, carrying in there bases the dirt, slid into a sea or lake and, driven by wind or current into this bay, there melted, the dirt dropping to the bottom, gradually forming the deposit in question.

"This is further borne out by the fact, reported by the Superintendent, that in the *Deeks* pit, on Pine creek, during the hydraulic working, a layer of seashells was found in and near the top of the yellow dirt. This layer was very local, and did not extend to the adjoining pits, and was, unfortunately, all washed away before the Provincial Mineralogist visited the camp.

"It is not very clear where the glaciers were formed, as certainly no quartz has been found in the vicinity which would justify the belief that it is the *madre de oro*."

The bed-rock itself carries only traces of gold, as is shown from assays made of samples taken from the pay-streaks in the drifts. The work of crosscutting the bench has been carried to a distance of 700 feet on the up-stream drive and about 600 feet on the down-stream drive, with about 200 feet between the drives or crosscuts which have been connected with drifts on the pay-streaks. These pay-streaks were exposed in the up-stream drive at 63 feet, 165 feet, 284 feet, and 433 feet in from the bank of the river, but in the down-stream drive the first pay-streak is missing and the remaining three are exposed at 150 feet, 355 feet, and 510 feet in from the bank.

The system of mining that has been followed consists of drifting on the pay-streak and removing the gravel from above the bed-rock to the height that it carries commercial values, usually 6 or 7 feet, and extending the drifts to the width found profitable in a somewhat similar method to that adopted in opening rooms in a coal-mine on the long-wall system. The gravel roof and walls are found to stand well without timbering. The dumps from the drifts were sluiced during the past summer with satisfactory results.

In addition to this work, test borings with an Empire drill were made on a bar about half a mile north from the drifting, and a diversion-canal cut in order to straighten the main river-channel, and afford an opportunity for hydraulic mining on that bar during the season of 1915, as well on the bar directly below the drifting.

The fact that all tailings will have to be stacked by an elevator, on account of the flat grade of the bed of O'Donnel river, will, of course, to some extent handicap operations by hydraulic methods in the river itself, by increasing the cost of handling the gravel. This lack of grade will also increase the cost of the construction of ditches and flumes to carry water and deliver it under sufficient head, as all of the water required must be taken from tributaries of the river, necessitating quite long ditches and flumes or pipe-lines, as has already been the case on the leases owned by the O'Donnel Placer Company, Limited.

Other Leases.

The success of the operations on the *Gold Hill* leases encouraged other holders to prospect during 1914 and endeavour to locate extensions of the pay-streaks in the ancient channels, and, could water have been easily obtained, there is no doubt but that much more activity would have been manifested. The extent of the pay-streaks lengthwise has not yet been fully determined. One at least of these pay-streaks has been found to extend to the south on to the adjoining lease, where the O'Donnel Partnership, consisting of five partners, has been working during 1913 and 1914 continuously in good "pay" after driving 600 feet to where the pay-streak was exposed. Charles Miller is mining on a lease about one mile south from the Ruffner ground, and reports satisfactory results.

To the north from Ruffner's work, in 1914, drift mining was being carried on at four points along the O'Donnel river, on the west side, as follows: At the mouth of Gold creek, about half a mile north from Ruffner's drift, where Carpenter and Rasmussen are working on a "lay" from Ruffner; about half a mile farther north by Titus and Boddy, who are also working on a "lay" from Ruffner; about four miles farther north and about one mile above the mouth of Canyon creek, where the Fitzgerald Brothers are drift-mining on their own lease; and at the mouth of Feather creek; sixteen miles above Ruffner's camp, where the Nolan Brothers are also drift-mining on their own lease. The operators of all the leases that were being worked during the past season reported satisfactory results.

During the season of 1914 there was nothing particularly new to record with regard to McKee, Boulder, Ruby, Birch, Wright, Otter, and Spruce, the other producing creeks in the Atlin Mining Division, except that from near Blue canyon to the head of Spruce creek, also on Slate creek, and other tributaries of O'Donnel river, considerable prospecting was carried on, and some placer gold mined from ground that has received but little attention in the past. As the creeks mentioned have all been most fully described annually in the Minister of Mines Reports since 1900, the writer does not deem it necessary to refer at length to them in this report.

The operators on Boulder, Spruce, McKee, and Ruby creeks expressed themselves as especially well satisfied with the results of their work during 1914, not only so far as the actual production was concerned, but also because of the fact they had been able to do considerable testing and development work which had demonstrated very promising possibilities for the future.

On all of the streams in the Atlin Mining Division, except on the O'Donnel river its tributaries, and on Spruce creek, such organization has been effected as places each creek practically under the control of one company or syndicate, thereby ensuring the most satisfactory results, because of the absence of friction between competing interests and the opportunity of adopting every economy in carrying on operations.

No discoveries on hitherto unexplored creeks in the district were reported; in fact, the absence of prospectors was noticeable, but there is still quite an extensive area surrounding the borders of the Atlin camp proper, as it may be termed, that is to-day practically unexplored.

PROPOSED RAILWAY CONNECTIONS.

During 1914 a preliminary survey for a railroad was made from Taku inlet, on the south-eastern Alaska coast, to Atlin, a distance of about 120 miles, but on the outbreak of the war all activity was suspended until such time as normal conditions prevail with regard to investments in new enterprises.

The fact that the preliminary survey showed that the construction of such a railroad was feasible led to the renewal of some activity by owners of mineral claims, the product from which must eventually be shipped to outside smelters, but on which the present freight rates are prohibitory. It also has led to some inquiries with regard to the deposits of magnesite near the townsite of Atlin.

Magnesite Deposit.

This deposit was fully described by the Provincial Mineralogist in the report of the Minister of Mines for 1904. Since the outbreak of the war in Europe the manufacturers in the United States who use magnesite have been unable to obtain the usual supply from Austria and Greece, and, as deposits of sufficient purity for commercial purposes are of rare occurrence, there is a possibility that in the near future the Atlin deposits, because of the remarkable purity of the mineral found therein, may receive such attention as will result in development on a commercial scale; in fact, a Vancouver syndicate is now investigating the proposition. Previously, though, because of the lack of all-rail transportation facilities and the high freight rates it has been impossible to mine this magnesite and market it in competition with the imported mineral.

MINERAL CLAIMS.

Fourth of July Creek.

Big Canyon Group.

This group consists of the *Hurrah, Nellie, Barber, Tom, Big Canyon No. 1,* and *Big Canyon No. 2* mineral claims, owned by Thomas Vaughan, John Malloy, and Mrs. Evan Lambert, of Atlin. This property is situated about fifteen miles north from the town of Atlin, on the east side of Fourth of July creek, which empties into Atlin lake about five miles north from the town. Crater creek, a tributary of Fourth of July creek, flows through the *Big Canyon No. 1* claim from south-east to north-west, and it is on this claim that all the development-work has been done.

The country-rock is a coarse-textured, light-coloured granite, porphyritic in some places, and often containing feldspar crystals more than an inch in length. Several dark-green, fine-textured diabase dykes occur as intrusions in the granite, and some of these dykes are mineralized, carrying chiefly galena, arsenical pyrites, iron pyrites, and zinc-blende in a gangue of calcite and quartz. In places these minerals fill fissures and other cavities in the dykes, but often occur as replacements of the brecciated dyke material.

There are four prominent mineralized dykes occurring on the *Big Canyon No. 1* mineral claim at an elevation of about 3,800 feet. These are designated as: No. 1 or the upper dyke, which crosses the eastern end of the deep canyon that forms the bed of Crater creek; No. 2 dyke occurs about 50 feet west from No. 1 in the same canyon; No. 3 occurs about 300 feet west from No. 2 dyke, and outcrops on the south side of Crater creek; No. 4 dyke occurs across the creek from No. 3 and outcrops along a very precipitous hillside, the wall of a deep canyon that forms the bed of the West fork of Crater creek.

Nos. 1, 2, and 3 have their lines of strike parallel to each other, N. 40° E., with their dips varying from 80 degrees, towards the north-west, to vertical. No. 4 dyke has its line of strike nearly east and dip nearly vertical.

On the No. 1 dyke, which shows a distinct mineralization for a width of more than 30 feet, two adits have been driven with the line of strike of the dyke; one of these adits is on the southerly side of the creek; this was examined for a distance of 60 feet; the remaining length, said to be 90 feet, was too badly caved in; the other, on the opposite side of the creek, could not be examined because the portal had been filled in by an enormous rock-slide, but Thos. Vaughan, one of the owners who accompanied the writer, informed him that the length of this adit was 100 feet and that it follows the line of strike of the ore-body, demonstrating the maintenance of continuity towards the north-east.

In the adit examined, which is nearly 100 feet below the outcrop, it was found that the mineralization was not confined to the material filling fissures and cavities, but that a large proportion occurred as replacing brecciated dyke material, so that, while the widest fissure did not exceed 12 inches, which generally contains lenses of solid mineral, there were also nodules and kidneys of galena and pyrite scattered through all of the material removed in driving the adit. The same conditions were also exposed in the roof and floor; consequently, concentration must be adopted in any operations carried on, and the results will demonstrate the commercial value of the property. There is ample water-supply for power as well as for concentration. A sample taken as representing the average of the ore as it might be sorted for shipping assayed: Gold, trace; silver, 49.4 oz.; lead, 41.2 per cent.

In dyke No 2 there is a pronounced fissure, averaging about 2 feet in width, filled with calcareous quartz carrying some galena, arsenical pyrites, and iron pyrites, but on this no work has been done.

Dyke No. 3 is 8 feet wide, and well mineralized with galena, arsenopyrite, and iron pyrites in a gangue composed of dyke material, quartz, and some calcite. A large open-cut had been made at the bottom of the very precipitous side of the deep canyon, the bed of Crater creek, but this was so filled with slide-rock that no critical examination or sampling was possible.

Dyke No. 4 has been somewhat developed by sinking a shallow shaft on the outcropping, where ore is exposed in narrow fissures of the same character and apparently about the same grade as was found in the adit on dyke No. 1. An attempt to crosscut this ore at a depth of about 60 feet was made by driving an adit in the granite country-rock for a distance of 60 feet, but this had not been carried far enough to expose the ore-body.

This property impressed the writer as possessing very promising possibilities if adequate transportation facilities were installed, such as an aerial tramway to Atlin lake.

Imperial Group.

This group, consisting of the *Lucky*, *Liverpool*, *Nanaimo*, *Paris Exhibition*, and *Unknown* mineral claims, is at present owned by W. H. Moore, of Nanaimo, and James Stokes and T. H. Jones, of Atlin. The claims are Crown-granted, and the property, which is better known locally as the *Munro Mountain* claims, was very fully described in the Reports of the Minister of Mines for 1900 and 1904; also in Memoir No. 37 of the Geological Survey of Canada, by D. D. Cairnes, published in 1913. As no new work has been done since 1904, it is not deemed necessary to repeat the description in this report, although the property was visited by the writer.

Taku Arm.

Taku arm, which lies from south to north, is one of the headwaters of the Yukon river; it has its head about thirty-five miles south-west from the town of Atlin and enters Tagish lake about sixteen miles easterly from the town of Carcross, where the White Pass Railroad crosses the foot of Bennett lake, and thus affords the opportunity for water transportation from the railroad to Taku, at the head of the short portage between Taku arm and Atlin lake.

South end of Taku Arm—Atlin M.D.

Several groups of mineral claims were located in 1898 and 1899 in the mountains on both east and west sides of Taku arm near the southern end, amongst which are the *Engineer*, *Northern Partnership*, *Gleaner*, *Kirtland*, *White Moose*, and *Big Horn* or *Lawson* groups.

The Engineer Group.

This property contains the *Hill*, *Plato*, *Engineer No. 1*, *Northern Partnership No. 1*, *Northern Partnership No. 2*, *Daisy*, *Brook*, *Fraction*, *Mickey*, *Northern Partnership No. 3*, *No. 4*, and *No. 5* mineral claims grouped as the *Engineer* mines, and at present owned by Captain James Alexander, who resides on the property. The White Pass Railway's stern-wheel steamer "Gleaner," which plies between Carcross and Taku portage, en route to Atlin, makes regular calls at the camp, although that is situated about ten miles south from the regular steamer route through Golden Gate.

The mineral claims are staked in one block, but in two tiers; the five first named, forming the western tier, are located in a line from north to south, with the western boundary-line in the water paralleling the shore for a distance of nearly a mile and a half. The eastern tier of claims is made up of the remaining five mineral claims and the fraction; these are also staked in line from north to south, with the western boundary-line adjoining the eastern boundary of the first-named tier. The eastern boundary of the property is along a ridge of about 500 feet higher elevation than the shore, and which forms the foot-hills of a high mountain range that is the divide between Taku arm and Atlin lake.

The history of this property is interesting because of the several unusual features connected with its development since the original locations were made in 1899 by a party of locating engineers working for the White Pass and Yukon Railway, which discovered a narrow stringer of quartz, carrying particles of free gold, outcropping close to the water on the shore. The locators then organized the Engineer Mining Company of Skagway, Alaska, and began development-work by sinking on the quartz-outcrop on the shore to a depth of 20 feet, which was abandoned because of the excessive inflow of water. The next attempt at development was the erection of a head-frame and shaft-house and the sinking of a two-compartment shaft to a depth of 70 feet. The location of this shaft was on a bluff about 50 feet higher elevation than the shore, and about 40 feet east from the first shaft sunk. A crosscut adit was also driven about 300 feet in length, with the portal located on the shore about 300 feet north from the shafts. This was driven for the purpose of crosscutting a wide vein filled with iron-stained quartz that outcrops on a bluff at 130 feet higher elevation than the shore-line and about 300 feet east from it. The construction of a 2-stamp, triple-discharge Joshua Hendy mill was also commenced by the company, but was not completed.

In 1906 active work was suspended because the funds was exhausted and the results were not considered sufficiently satisfactory to attempt to raise more money. Consequently, the original locations were allowed to lapse, but were later restaked by Edwin Brown and partners, who, in 1907, sold out to a syndicate composed of Captain James Alexander, John Dunham, B. G. Nichol, and K. Wawrecka, under the firm-name of the Northern Partnership. These owners started prospecting adjoining ground, and after discovering some other veins, located the *Northern Partnership Nos. 1*, *2*, *3*, *4*, and *5* mineral claims; they also finished the construction of the mill, and treated a few tons of high-grade ore by amalgamation.

Captain Alexander about two years ago acquired the interests of his partners and has since continued prospecting and developing on a more comprehensive and systematic policy than had previously been pursued, with the result that he has found ore-bodies hitherto unknown that carried such high values in free gold as to produce, by treatment in the 2-stamp

mill, bullion to the value of about $26,000 during 1913 and about $20,000 during 1914, but during the latter year he was only working a few men, as the property was being examined by the engineers of a corporation that was contemplating purchasing it.

The *Engineer* group of claims was examined and reported on by the Provincial Mineralogist in 1904 and 1910, his report being published in the Minister of Mines' Reports for those years, and also by D. D. Cairnes, of the Canadian Geological Survey in 1910, whose report is published in Memoir No. 37, issued in 1913. All of these refer to the work done by the old company, and the examinations were made previous to the performance of the development-work hereinafter described, the most important of which is located about 1,000 feet easterly from any work done when either of these examinations were made; in fact, the best showings on the property were only found about two years ago, after thorough and systematic prospecting-work had been done by the present owner.

The geological formations at and in the vicinity of the *Engineer* mines are, according to the report of D. D. Cairnes, of the Canadian Geological Survey, "predominately Jura-Cretaceous, finely textured greywackes, shales, and slates of the Laberge series, which range from brownish and dark green to almost black in colour, and are probably to a considerable extent pyroclastic in nature. These beds have been invaded by dykes of andesite and granite porphyry, and are in places faulted, folded, and considerably distorted, but have a general strike about N. 63° W. and dip to the north-east at an average angle of 35 degrees. Most of the ore-bodies occur in the dark to almost black, finely textured Laberge members."

The writer found two well-defined series of vein-structure, and in all nineteen veins were examined, on which more or less work had been done. The outcroppings of sixteen of these are mentioned in the Reports of the Minister of Mines for 1910, and of D. D. Cairnes in Memoir No. 37, already referred to.

The veins which comprise the first series radiate from two central hubs or bodies composed, principally, of quartz, the exposed dimensions of each of which covers an area exceeding 200 feet square. There is a large proportion of shale and slate mixed with the masses of quartz. The veins which comprise the second series are well-defined isolated fissures which apparently have no relationship to the masses of quartz mentioned, but are usually found in close proximity to intrusive igneous dykes, which sometimes form one or other of the walls of the vein.

The No. E or most recently discovered vein belongs to the second series of veins. This has never been mentioned in any previous report because it is one of those discovered since the examinations referred to were made. It is a clean-cut well-defined fissure in slate country-rock with excellent walls, and a few inches of talcose gouge separating each wall from the ore-body. The surface outcroppings and the vein-filler to a depth of about 20 feet are composed principally of quartz and calcite, but with more or less brecciated slate and shale intermixed, usually banded. The quartz is considerably stained with iron oxide and pans free gold, but the vein-filling shows little other metallic mineralization until greater depth is reached; then antimonial sulphides occur as kidneys or bunches in the quartz-calcite gangue, with calcite often found to predominate, especially at the deepest level, reached about 120 feet below the surface. This vein on the surface averages about 6 feet wide, has its line of strike N. 23° E., and dips at an angle of 85 degrees towards N. 67° W.

On the surface this vein has been exposed by trenching, from about 6 to 8 feet deep, for a length of about 800 feet on the *Northern Partnership No. 2* mineral claim, or from a point on its northern boundary, 250 feet from the eastern line, diagonally across the claim towards the south-west corner. An adit has been driven drifting along the vein for 250 feet. The

portal of this adit is in a swampy gulch where the most northerly outcropping of the vein so far known was found. The height of the backs above the adit vary from about 20 feet near the portal to a maximum of 75 feet at a point about 150 feet from the portal where a winze has been sunk 40 feet deep below the floor of the adit. Down this winze the vein maintains perfect continuity, with the same characteristics found in the adit. The vein-matter between walls varies in width from 6 feet to about 3 feet. Of this width, about 12 inches is made up of practically solid mineral and represents the richest portion of the vein. The mineralization is antimonial sulphide in a quartz-calcite gangue. The wider portion of the vein is chiefly made up of brecciated shale and slate which, with scattered particles of minerals, are cemented together with quartz and calcite. This carries variable values which are free milling, but apparently of low grade; however, no attempt to sample this portion of the vein was made because of its variability.

A sample taken across 12 inches in width and five feet in length at the bottom of the winze assayed: Gold, 71.5 oz.; silver, 50.5 oz.

Another sample taken from the adit about 100 feet beyond the portal and representing the ore associated with calcite gangue assayed: Gold, 14.96 oz.; silver, 9.9 oz.

Another sample taken from the face of the adit and representing 12 inches on the hanging-wall side assayed: Gold, 8.4 oz.; silver, 5.6 oz.

It has been generally assumed that this ore contained tellurium, but the Assistant Assayer reported that in the samples assayed there was no evidence of tellurides.

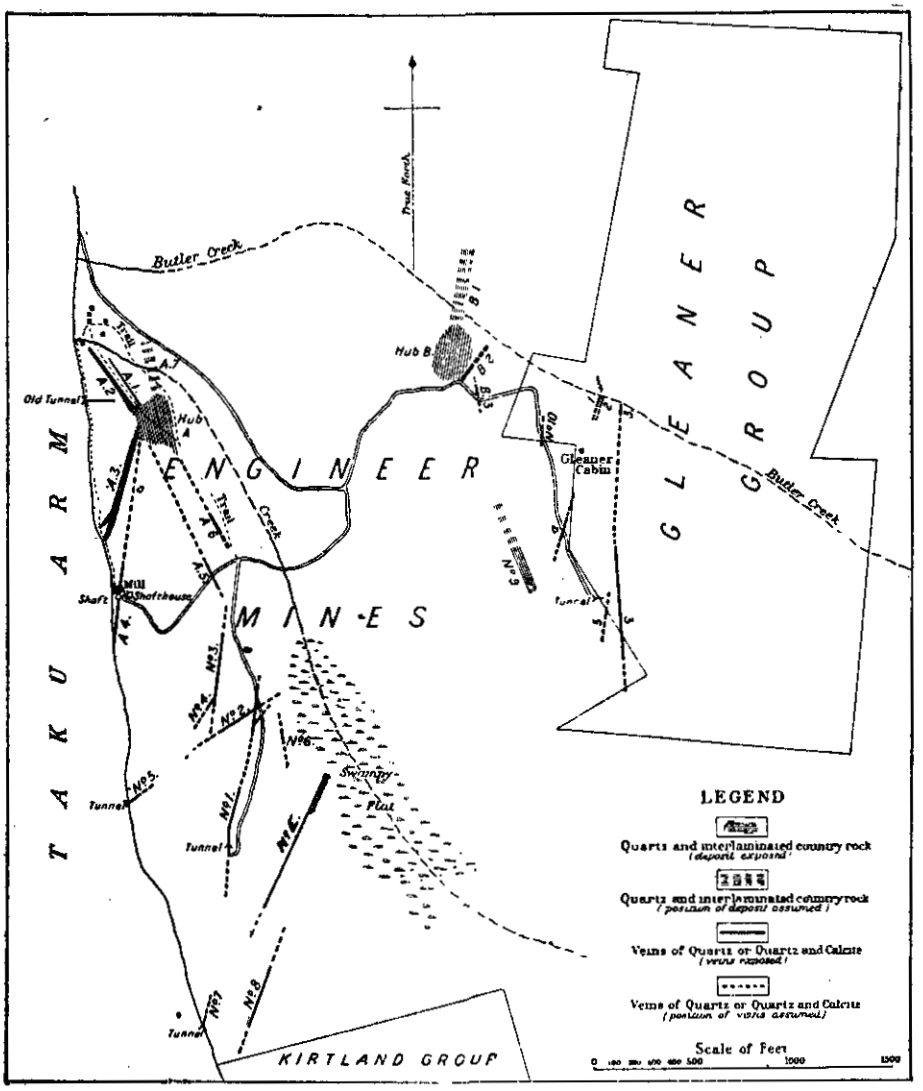
The bullion produced at the *Engineer* mine during 1913 and 1914 was the result of treating the ore from the vein above described in the 2-stamp mill. All the ore treated was that taken out while driving the adit and sinking the winze, together with the product from an upraise to the surface above the winze, and a short stope in each direction from the upraise.

There is a possibility that this No. E vein may eventually be proven to be a north-easterly extension of a vein, known as No. 8, which also belongs to the second series and outcrops near the south-west corner of the *Northern Partnership No. 2* mineral claim, or about 1,500 feet from the portal of the adit on No. E vein, but no connection has yet been established; in fact, there is a space of nearly 300 feet wide where no outcroppings have been located, and where the overburden is very deep. The line of strike of the No. 8 vein is N. 15° E. and dip at an angle of 79 degrees towards N. 75° W.

There has been considerable new work done on the No. 8 vein during the past three years, consisting of driving an adit about 40 feet long, in addition to trenching from 8 to 10 feet deep for a length of about 400 feet along the strike of the vein.

This vein is in places 12 feet wide on the surface, but varies very much. The vein-filler is composed chiefly of brecciated shale and slate cemented together with quartz and calcite. Particles of free gold, visible to the naked eye, are frequently seen in the quartz, but there is practically no other mineral showing at a depth so far reached.

The walls are well defined, both being slate, and there is a talcose gouge a few inches wide separating the vein-filler from each wall. Panning tests show that the values are quite variable, and any sampling other than in a thoroughly systematic manner, which was not



Diag. 4. Map showing the vein outcrops on the Engineer mines property, and on the Gleaner group, Atlin mining district, B.C.

From Memoir No 37, Geological Survey.

practicable, would be very misleading. Some of the ore mined from the development-work was milled with satisfactory results.

On the other veins the development-work has been principally confined to surface open-cuts and trenching, which totals about 4,000 feet in length, while the total length of underground work reaches nearly 1,000 feet, which includes 300 feet of adit and 90 feet of shaft, work done by the original company.

A large proportion of this work has been done on quartz veins, about the average values of which but little is known, except that usually panning tests have shown more or less free gold, while in some instances, notably on the vein known as No. 5, which outcrops in the face of a perpendicular bluff at the water's edge, many particles of gold, visible to the naked eye,

are seen in a width of 8 inches of the vein. The full width of the vein-matter between the well-defined walls averages about 18 inches, on which an adit has been driven for a distance of 40 feet. This No. 5 vein is another representative of the second series and cannot be traced to have any connection with the extensive masses of quartz before referred to, but is closely associated with an intrusive igneous dyke.

No systematic sampling was attempted on any of the veins, as such was not practicable; in fact, in the writer's opinion, the only satisfactory method of sampling would be by actual mill tests of large samples, which could be easily done in the 2-stamp mill. Such sampling would demonstrate what proportion of the large quantity of quartz occurring on the property is available for treatment on a commercial scale.

The Kirtland Group.

This group contains six mineral claims owned by Captain W. Hawthorn, R.N., and Thos. Kirtland, of Atlin. The *Jersey Lilly* mineral claim, one of this group, adjoins the southern boundary of the *Engineer* property, and from there the *Kirtland* group extends southward along the east shore of Taku arm a distance of approximately 8,000 feet. The geological formation of the *Kirtland* property is the same as on the *Engineer* mine, and the veins that have been found resemble those found on that property.

The only work, except prospecting, that has been done on the group is located on the *Jersey Lilly* mineral claim, where two shallow shafts about 10 and 14 feet deep respectively were sunk a short distance from the southern boundary of the *Engineer* mine. These are on two distinct quartz outcroppings. The 10-foot shaft exposes a vein with its strike north-east and dip 88 degrees towards north-west; it is about 3 feet wide and filled with quartz. An average sample taken across the full width assayed only traces in gold and silver. The location of this shaft is about 250 feet south from the *Engineer* line.

The 14-foot shaft is located about 25 feet south from the same boundary-line, and exposes a vein averaging about 5 feet wide, filled principally with quartz, but with considerable brecciated shale and slate, especially in the centre of the vein. The vein has its line of strike N. 23° E., dipping 76 degrees towards S. 57° E., and has been traced on the surface for a distance of about 200 feet, showing the same characteristics for that length.

Only one sample was taken which represented an average of the vein in the shaft, and after assaying showed only traces of gold and silver.

The Gleaner Group.

This group consists of three mineral claims and a fraction that are situated to the east of and adjoining the *Engineer* mine. As no work has been done for several years past and none of the owners were in the vicinity, the property was not examined by the writer, but, from the report of D. D. Cairnes in Memoir No. 37 of the Canadian Geological Survey, the following information is gleaned: That the rock formations on the *Gleaner* claims are the same as on the *Engineer* mine. Also that there are five veins occurring on the property; these are filled with quartz and intercalated layers and fragments of wall-rock which constitute the entire vein-filling with the exception of small amounts of native gold, iron pyrites, and iron oxide.

Lawson Group.

This group of six mineral claims is situated about twelve miles from the shore of Taku arm, on the west side of Big Horn creek, which empties into the west side of Taku arm about ten miles north from the *Engineer* mine. The group is owned by Fred Lawson, who resides on the property, Thos. Kirtland, William Powell, Robt. Pelton, Dan Sullivan, and Agnes A. Lawson. As the season was late and, from the most reliable information that could be obtained, snow covered the surface of the property, which would have prevented a thorough examination, the writer did not visit it.

Memoir 37, Canadian Geological Survey, contains a full description of this group. A brief synopsis of that report is as follows: That the rock formations on this group and vicinity, with the exception of occasional dykes, consists of fine-textured, greenish amphibolites, micaceous as well as sericitic schists and quartzites. The veins are lenticular in structure and lie practically always conformable to the foliation planes of the enclosing rocks, and generally have their lines of strike about N. 15° E. The largest quartz lens noted by Mr. Cairnes is described as being located on the *Big Horn* claim. This, he says, is over 200 feet in length and from 4 to 24 inches in width, and is composed of quartz, which is in places rust-stained and carries small quantities of galena, chalcopyrite, pyrite, and native gold. Some specimens he says, were seen in which particles of gold existed, which were as much as $\frac{1}{20}$ inch in diameter, and in other places small leaves and flakes of gold were noted up to $\frac{1}{8}$ inch across.

Since the examination made by Mr. Cairnes in 1910 the writer was reliably informed that the owners had extended the development-work, and also that Mr. Lawson had installed a 1-stamp mill on the property, in which he had successfully treated some of the high-grade quartz.

The Provincial Government in 1910 constructed a wagon-road from *Kirtland*, on the shore of Taku arm, up the valley of the Fantail river to Bighorn creek, and thence up the valley of that stream to the lower terminal of the aerial tramway on the *Lawson* group, and it was over this road that Mr. Lawson and his partners hauled the machinery for the 1-stamp mill, cable and other equipment for the aerial tramway.

RAINY HOLLOW.

This district was reported on by the Provincial Mineralogist in the Minister of Mines' Reports for 1900 and 1907. Since the last date the transportation facilities have been very much improved between Haines Mission, Alaska, on Lynn canal, and the Rainy Hollow camp. Wagon-roads have been constructed by the United States Government up the Chilkat river from Haines to Klukwan, near the junction of the Chilkat and Klehini rivers, where a good bridge has been built across the Chilkat river; thence up the Klehini river to Pleasant camp. From Pleasant camp the British Columbia Government has built an excellent wagon-road to Rainy Hollow, in which camp the Klehini river has its source.

As all of the prospectors who had been in Rainy Hollow camp during the summer had left at the time of the writer's visit—September 3rd—Captain M. C. O'Connors, one of the pioneers of the district, was engaged as a guide to the several mineral claims, and a week was occupied in examining the development-work performed since 1907.

During the summer of 1914 a small stampede of placer-miners occurred to the Klehini river, where more than 100 creek and bench placer claims were located, but, as no one found gold in sufficient quantities to earn wages, these had all been abandoned.

As the geography of the Rainy Hollow camp was described in the Minister of Mines' Reports for 1900, page 765, and 1907, page 43, it is not necessary to repeat it.

During the examination it was found that few mineral claims had been located since 1907, and but comparatively little new development-work had been done in the camp; that practically all of the mineral claims located had been Crown-granted or Crown grants applied for, and the owners were waiting for purchasers to invest. On some of the properties there had been additional development-work performed since the visit of the Provincial Mineralogist in 1907, which is described in the following report.

Maid of Erin. The *Maid of Erin* mineral claim, owned by Martin Conway, William Burnham, and Richard Kennedy, is situated on the west slope of Mineral peak at an elevation of 3,500 feet. Outcroppings of bornite and chalcocite copper ores in a garnetite gangue are found over an area of about 200 feet in length by about 100 feet in width on the summit of a limestone butte. The strike of the ore in the main workings or No. 1 open-cut is north and dip to west at an angle of 20 degrees; in the No. 2 open-cut, 20 feet north-east from the No. 1, the strike is N. 52° E. and dip at an angle of 72 degrees towards S. 38° E.; in the No. 3 open-cut the strike is east and the dip at an angle of 56 degrees towards the south; in a shaft 15 feet deep situated 60 feet easterly from the face of No. 1 open-cut the strike is N. 72° E., with the dip vertical.

The No. 1 open-cut has been made 8 feet wide at the entrance by 36 feet long towards the south-east to the face, which is 6 feet deep, then turned to the left, or towards north-east, for about the same distance by 10 feet wide, with the face 6 feet wide by about 8 feet deep. These dimensions appear to be nearly the boundaries of this ore-body, which has an average thickness of 3 feet of high-grade ore, the genesis of which is from replacement of a portion of the limestone.

The high grade of the ore is shown by the following assay returns from a sample taken, which represented a fair average of the ore-body exposed in the open-cut; Gold, 0.03 oz.; silver, 33 oz.; copper, 22.5 per cent. In the Minister of Mines' Report for 1900 assay returns from a sample of outcroppings are: Gold, none; silver, 44.2 oz.; copper, 34 per cent. In the Report for 1907 the following assay returns from samples from the same ore-body are: Gold, trace; silver, 50.2 oz.; copper, 29.2 per cent.; and gold, trace; silver, 60.8 oz.; copper, 37.9 per cent.

In all of the openings where the ore dips at a steep angle, it occurs as narrow stringers more or less mixed with garnetite filling the fissures in the limestone. The rock formation along the westerly side of the limestone is made up of a contact-metamorphosed limestone, with the underlying rock apparently a granodiorite, and no other discoveries of mineral have been reported from that direction. To the east, for nearly a mile from the workings on the *Maid of Erin* claim, the country rock is limestone.

This property possesses sufficient merit to warrant systematic development-work, from the results of which would largely depend whether capitalists would be justified in building a railroad into the camp.

Elise. This mineral claim is located to the east of and adjoining the *Maid of Erin*, and is owned by the same owners as the latter. There are several outcroppings of bornite ore occurring in limestone, apparently by replacement. The work done has been confined to the necessary assessment-work. Ore has been exposed in several places, but the work is shallow and lacks such system as would demonstrate the value of the claim from a commercial standpoint.

Empress. This mineral claim adjoins the *Elise* on the east, and is owned by Mrs. Clara Smith, of Minneapolis, Minn. On this claim there is a gossan-outcropping about 4 feet wide which is quite persistent along its line of strike, N. 20° W. This vein has been exposed in two open-cuts along the line of strike, each about 50 feet long by 8 feet deep, and separated from each other by about 650 feet. The iron mineral—which is probably oxidized pyrrhotite—occurs filling a fissure in limestone and shows no indication of carrying copper or other valuable mineral to the depth the work has been carried.

Corona. This mineral claim is situated to the east from and adjoining the *Empress* mineral claim, and is owned by Samuel Weitzman, of Haines, Alaska. There are several outcroppings of iron gossan, with practically the same general line of strike as those on the *Empress* mineral claim, but no work has been done on any of the outcroppings, although several open-cuts have been made in the limestone country-rock.

Hibernian. This mineral claim adjoins the *Corona* mineral claim on the east, and is owned by Dan Sullivan, one of the pioneer prospectors of the camp. At an elevation of 2,900 feet there is an outcropping of iron gossan 20 feet wide occurring at the contact between limestone and altered argillites, with the former on the north-west or hanging-wall side of the mineral. The line of strike of the mineral is N. 50° E. and its dip is 43 degrees towards the north-west.

Three open-cuts have been made to expose the mineral; the No. 1 cut is 20 feet long by 6 feet deep; the No. 2 opening, which is situated about 100 feet north-east from the No. 1, is 8 feet square by 8 feet deep; and the No. 3 cut, which is situated about 20 feet to the south-east of No. 2, is 5 feet deep at the portal, 12 feet long, and 10 feet deep at the face.

The iron mineral, which resembles that on the *Empress* claim, is copper-stained and carries some galena and pyrite in places. A sample taken representing a fair average of the mineralization assayed: Gold, trace; silver, 1.3 oz.; copper, trace.

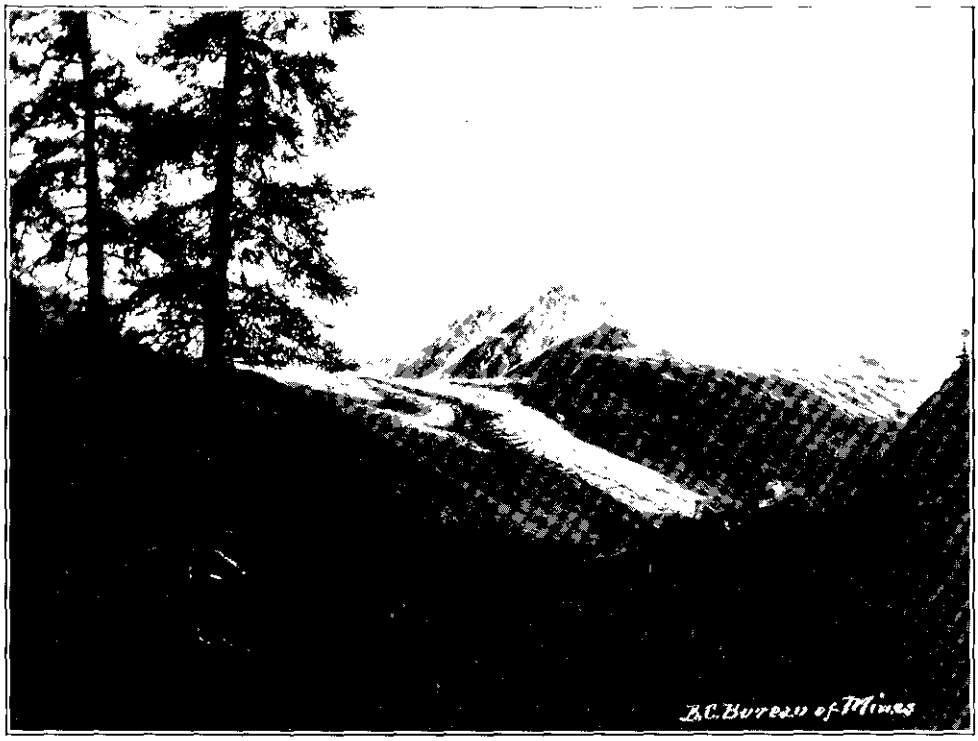
Jarvis. This mineral claim is situated on Jarvis creek about 1,500 feet N. 30° E. from the north line of the *Hibernian* mineral claim, and is also owned by Dan Sullivan. Jarvis creek, which is a tributary of the Klehini river, carrying a considerable volume of water, has its source in a group of glaciers on the north side of the summit of Mineral mountain, about one mile and a half north-westerly from the *Jarvis* mineral claim, through which it flows.

On the north-east side of the creek, at the summit of a bluff that forms one wall of a deep canyon, which is the bed of Jarvis creek, there occurs an outcropping of gossan filling a fissure between the contact of limestone and hornblende gneiss. An adit has been driven 60 feet along the line of strike of the fissure in a S. 80° E. direction. The portal of this adit is located at an elevation of 2,600 feet, and on Jarvis creek just above high-water line in the deep canyon. The vein averages 2 feet wide and dips at an angle of 50 degrees towards the north. The mineralization consists of nodules of galena and iron pyrites in quartz gangue.

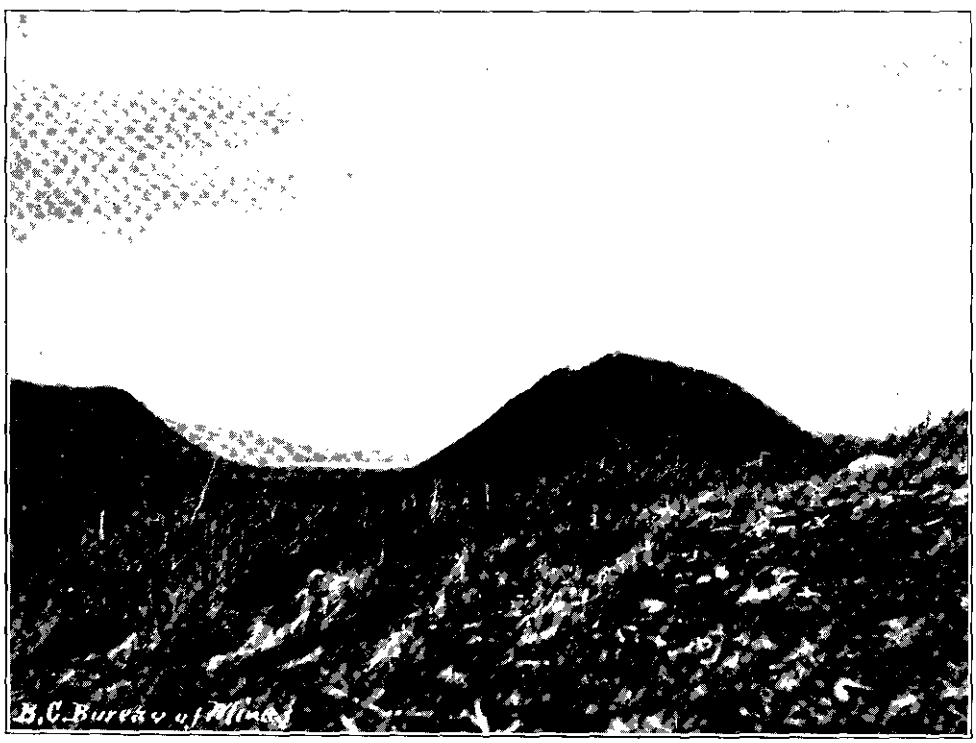
An average sample taken across 2 feet 3 inches in the face of the adit assayed: Gold, trace; silver, trace. Another sample which represented about an average from the dump of ore saved during the progress of work assayed: Gold, trace; silver, 9.6 oz.; lead, 12 per cent.

Victoria. This mineral claim is situated near Jarvis creek, adjoining the *Jarvis* mineral claim on the north, and is owned by Martin Conway, Richard Kennedy, and William Burnham, of Skagway, Alaska. Near the contact between crystalline limestone and altered argillites, on a ridge at an elevation of 2,850 feet, the limestone is considerably fissured, and these fissures, which are quite narrow, are filled with iron-stained brecciated material carrying some galena, chalcopyrite, and zinc-blende, but, so far as could be seen, not any body of mineral that could be considered of commercial value.

From a gulch about 50 feet below the surface a crosscut adit has been driven 70 feet long, but, although this adit crosscuts two narrow fissures, no ore of commercial grade has been exposed. The same conditions were found in a shallow shaft sunk on the summit of the ridge, as well as in two open-cuts.



Fourth of July Creek—Atlin M.D.



O'Donnel River—Atlin M.D.

War Eagle. This mineral claim joins the *Victoria* on the north, and is owned by the same parties. At a point about 800 feet in a N. 10° E. course from the work on the ridge on the *Victoria* claim there occurs an outcropping of iron gossan 30 feet wide by about 50 feet long, with its line of strike N. 55° E. and dipping at an angle of 51 degrees towards N. 35° W. The hanging-wall of this body of mineral is crystalline limestone, and foot-wall an igneous dyke. The mineralization appears to be from the alteration or pyrrhotite or iron pyrites. A large open-cut has been made below the outcropping, but no change was noticeable in the mineralization.

Majestic. This mineral claim is situated on the north side of Wilson creek, a tributary of Klehini river, emptying into it about half a mile south-east from the mouth of Jarvis creek. The owners are Conway, Kennedy, and Burnham, of Skagway, Alaska. Wilson creek flows through a deep canyon with precipitous walls, and on the north-east side, at an elevation of 3,100 feet, there occurs a bluff made very prominent because of an outcropping of gossan, 30 feet wide, between crystalline limestone and a diorite dyke. The line of strike of this outcropping is N. 10° E. and its dip at an angle of 69 degrees towards N. 80° W. The diorite dyke is about 100 feet wide, apparently an intrusion into the limestone, and has its line of strike conformable with that of the gossan-outcropping.

The work on this occurrence consists of an open-cut 20 feet long by 30 feet wide, by 20 feet high at the face, in which the mineralization shows no change in characteristics from those of the outcropping. Free gold is the only probable value it is likely to carry, and as it failed to show any from panning, no sample was taken for assay.

New York. This mineral claim, which is situated adjoining the *Majestic* claim on the north, is owned by Captain M. C. O'Connor, of Haines, Alaska. At the contact between crystalline limestone and hornblende gneiss there occurs a vein from 6 to 8 feet wide filled with gossan, which can be traced for several hundred feet on the surface, along a general N. 15° W. line of strike. Several open-cuts have been made, which, while demonstrating the continuity, have failed to show the occurrence of any mineral of commercial value.

Adams. This mineral claim is distant 1,000 feet in an easterly direction from the *New York* claim, and is also owned by Captain M. C. O'Connor, of Haines, Alaska. There occur two well-defined leads on this claim, the gossan-outcropping of which can be traced on the surface for several hundred feet. One of these is 30 inches wide and is situated on the east side of the claim; this is called the No. 1 lead, and is made up of epidote and zoisite, with a little graphite. The other, named the No. 2 lead, occurs about 600 feet from the west side of the claims at an elevation of 3,500 feet, and reaches a maximum width of about 28 feet at one point, about 350 feet distant from the south end line of the claim.

The No. 1 lead, which has its line of strike N. 18° E. and dip vertical, has been opened up at several points by open-cuts and trenches, where the mineralization is an iron mineral, and, so far, shows no other metallic contents. This occurs at the contact between crystalline limestone on its east side and hornblende gneiss on the west side.

The No. 2 lead occurs between two igneous dykes; that on its east side is quartz porphyry, while the dyke on the west side is a diorite which has been intruded into the limestone country-rock. The line of strike of the No. 2 lead is N. 20° E., with its dip almost vertical, but appears to be slightly inclined towards the N. 70° W.

About 800 feet north from the south end line of the claim the quartz-porphyry dyke, which is about 50 feet wide, shows as an intrusion cutting through the diorite dyke, which is 15 feet wide, the line of strike of the former being variable, but usually N. 10° W., and of the latter N. 30° E., and nearly paralleling the lead.

The mineralization in the No. 2 lead is galena and iron pyrites in a garnetite gangue, with the galena usually occurring as kidneys or lenses in the gangue, but at one point near the south-easterly boundary of the lead where a long deep open-cut has exposed the maximum width there is 3 feet of nearly solid galena. A sample chipped across this 3 feet which represented a fairly good average of the cross-section assayed; Gold, trace; silver, 8 oz.; lead 53.5 per cent. The work done on this lead consists of five large open-cuts within a distance of 450 feet along the strike.

Custer. This mineral claim is situated south from and adjoining the *Adams* mineral claim, and is owned by Tim Creedon, of Haines, Alaska. On a bluff at an elevation of 3,200 feet there is considerable gossan-outcropping, in which an open-cut 15 feet long by 6 feet wide has been made with an adit 10 feet long beyond the cut. At the portal of the adit the mineralization occurs at the contact between crystalline limestone and a diorite dyke with the dyke on the east side, but at the face it appears as though the dyke had turned the line of strike of the mineralization and cut it off. On the surface, beyond the face of the adit, and at a level about 40 feet higher, gossan-outcroppings carrying such minerals as copper pyrites, galena, zinc-blende, and iron pyrites are found on both sides of the dyke, with the line of strike N. 50° E.

This work was done at this point because it was assumed that the mineralization was an extension of the lead on the *Adams* mineral claim, but sufficient work has not yet been done on either claim to establish any continuity between the two occurrences. No sample was taken, because it was evident from the appearance of the mineralization in the adit that any attempt to obtain an average sample until more development-work has been done would possibly be misleading.

Wonderful. This mineral claim is situated adjoining but in a south-westerly course from the *Custer* mineral claim, and is owned by Conway, Kennedy, and Burnham, of Skagway, Alaska. A long adit was driven on this claim several years back, but could not be examined because of its caved condition. This had evidently been driven in order to develop a contact mineralized zone between crystalline limestone and altered argillites, with its line of strike north-east and dip north-west, but nearly vertical. As the adit could not be examined no samples were taken.

In addition to driving the adit, several open-cuts had been made, in all of which the same character of gossan as is found on the *Custer* and *Adams* mineral claims is exposed, but it is not possible to trace any continuity between the several so-called leads until considerably more development-work has been done.

Three Guardsmen Group. This group of mineral claims is situated about four miles north-east from the *Custer* mineral claim. It contains fourteen mineral claims, and is owned by Al. Smith, Hugh McDonald, Dan Sullivan, Frank Saucier, Lineal Smith, Jim Irving, Chas. Murphy, Frank Murphy, Scotty Jennings, and C. Clayton, local prospectors, with headquarters at Haines, Alaska. E. S. Wilkinson, B.C.L.S., of Victoria, who had been surveying this group of mineral claims during the past summer, had just broken up his camp and left, having finished his work previous to the arrival of the writer, who met him en route to Skagway. From him it was learned that none of the

owners were in Rainy Hollow; also that the work done was restricted to regulation assessment-work. For these and the further reason that storms had covered much of the higher levels with snow, this group of claims was not examined.

In addition to the mineral claims described and mentioned in this report, there are about thirty other locations in the Rainy Hollow camp, some of which have been Crown-granted, but, as none of the owners were on the ground, and from the most reliable information obtainable the conditions with regard to mineralization were similar to the properties examined, which are considered the most promising in the camp, the writer concluded his work, as the weather was most unfavourable, and returned to Haines.

The impressions that prevail in one's mind after examining carefully the conditions of the Rainy Hollow camp are that without railway connections for transporting ore, machinery, and supplies, the future of the camp is not very promising. The owners of the properties are men of small means unable to stand the cost of development-work while, on the other hand, unless sufficient tonnage of ore is available to furnish freight it will be very difficult to enlist capital into the enterprise of building a railroad; so that a deadlock exists which up to the present time has been impassable, although four different organizations have attempted to float a company to construct a railroad, about forty miles of which would be in United States territory and about twelve miles in Canadian territory.

STIKINE AND LIARD MINING DIVISIONS.

REPORT OF A. W. DODD, ACTING GOLD COMMISSIONER.

I have the honour to submit the annual report on mining operations in the Stikine and Liard Mining Divisions of Cassiar District for the year ending December 31st, 1914.

In the amount of gold recovered, placer-mining has shown a marked increase over the year 1913.

On Thibert creek the Boulder Creek Mining Company's properties made by far a better showing than previous years under the supervision of F. M. Fenton, an hydraulic superintendent, and there is every indication, now that the difficulty with slides, with which the property has been handicapped in the past, has been overcome, that returns will be larger in the future.

On Dease creek the Dofflemyre property, consisting of the *Wonder*, *Red-top*, *Jumbo*, *Manhatten*, *Mohawk*, and *Combination* leases, has been purchased by Geo. Murphy, of Seattle, who had a number of men employed all season prospecting the ground; a Star drill was brought in, but, owing to the lateness of its arrival, was not used this season; it is the intention to resume operations on these properties in the spring by boring and the installing of an hydraulic plant.

On Mosquito creek good prospects were obtained by Adsit and partner, and seven new leases have been applied for.

A number of men have been at work on McDame creek with an Empire drill under the direction of W. M. Ogilvie, and satisfactory results have been obtained.

MINERAL CLAIMS.

More activity has taken place in mineral claims than previous years. About thirty-five miles below Telegraph Creek on the Stikine, seven claims have been located adjoining the Dixon & Bodel property, on which a number of men have been at work all season; considerable stripping was done and two open-cuts run, exposing a seam 5 feet wide of silver-lead ore, assays from which run as high as: Silver, $72.24; lead, $9.60. A mill test of 1,000 lb. of the ore was sent to the Granby smelter, but up to the present no returns have been received; this ledge can be traced a considerable distance by outcroppings, and an option on the property has been secured by J. G. Galvin, of Seattle.

At Clearwater a tunnel has been driven on the *August* and *Mountain Goat*, the property of Lewis Kirk; assays on these show good values in copper, silver, and gold.

On the Iskut river the Iskut Mining Company has had nine of its eighteen claims Crown-granted, and sufficient work being done on the remainder to cover assessment; it has also recorded four new claims.

OFFICE STATISTICS—STIKINE AND LIARD MINING DIVISIONS.

Revenue collected from free miners' certificates	$	636 50
" " mining receipts		1,492 25
" " other sources		2,339 35
Total	$	4,468 10

SKEENA DISTRICT.

SKEENA AND BELLA COOLA MINING DIVISIONS.

BY J. MCMULLIN, GOLD COMMISSIONER.

I submit herewith the official statistics of the Skeena and Bella Coola Mining Divisions for the year ending December 31st, 1914.

I am not making any further report this year, as the whole district was covered by Mr. Brewer's Report.

OFFICE STATISTICS—SKEENA AND BELLA COOLA MINING DIVISIONS.

Free miners' certificates	497
Mineral claims recorded	213
Certificates of work issued	374
Certificates of improvements issued	60
Bills of sale, etc	70

Revenue.

Free miners' certificates	$2,522 00
Mining receipts	2,282 00
Total	$4,804 00

SKEENA MINING DIVISION.

REPORT BY W. M. BREWER, M.E.*

INTRODUCTORY.

Prince Rupert, the western terminus of the Grand Trunk Pacific Railway, is a distributing centre for the Skeena and Omineca Mining Divisions. It is the natural starting-point for any one visiting the Skeena River valley and other portions of the Skeena Mining Division, because it is the seat of Government Agency for that section of British Columbia, as well as being the ocean terminus of the transcontinental railway.

On receiving instructions from the Provincial Mineralogist, on May 17th, 1914, to make examinations of the mineral resources of the Skeena valley and adjacent mountains, a start was made from Prince Rupert and the work carried east as far as Lorne creek, a distance of 130 miles by railroad.

In the immediate vicinity of Prince Rupert the metamorphic rocks are designated by R. G. McConnell, of the Canadian Geological Survey, as the Prince Rupert formation. Originally these rocks were mostly argillaceous, siliceous, and calcareous sediments, but they have been intensely altered and converted into mica and hornblende schists and crystalline limestones, with occasional areas of diorite or gabbro. These igneous rocks were intruded prior to the folding of the region and are now represented by coarse hornblende-schists.

*This report covers a small amount of territory which, although lying along the Skeena river, is in the Omineca Mining Division.

East from Prince Rupert the schists have an easterly dip varying from 30 to 70 degrees towards the granite batholith of the Coast range and a north-north-west strike approximately parallel to the western edge of the batholith.

The Grand Trunk Pacific Railway enters the Skeena valley proper at a point nearly opposite to Port Essington, or about twenty-five miles south-east from Prince Rupert. It then follows the valley for a distance of 154 miles from that point in a north-easterly direction to Hazelton, which was, in the past, the head of navigation for stern-wheel steamers.

For about the first sixty miles above Port Essington the rocks traversed belong to the Coast range—coarse-grained granites with some included schists, in which but few discoveries of mineral have been reported up to the present time.

Near the 95-mile post on the railroad, where the Kitsumgallum river empties into the Skeena, is apparently the eastern boundary of the main Coast range, with the Kitsumgallum valley bordering it on the north side of the Skeena and the Lakelse valley on the south side. This great trench, four to five miles wide in places, extends northward to the Nass river and southward across the Coast range to the sea at the head of Kitimat arm, and, according to McConnell, represents an old, partially abandoned valley of erosion, possibly robbed by the Skeena.

East from the Kitsumgallum a second wide range of high mountains, mostly built of schist and granite, is crossed. These connect to the south with the Coast range, and, McConnell says, may be considered a spur from it.

The examination of the mineral resources along the Skeena river and in the mountains adjacent to it on either side of the river really commenced at the Kitsumgallum river, distant from Prince Rupert ninety-five miles, and extended up the Skeena river as far as Lorne creek, or Ritchie Station on the Grand Trunk Pacific Railway, 130 miles from Prince Rupert. Before reporting in detail on the several properties examined, a brief résumé will be given of the general characteristics of this section, a small portion of which is included in the Skeena Mining Division and the remainder in the Omineca Mining Division.

The railroad-station near the mouth of the Kitsumgallum river is named Terrace. The elevation at this point is 241 feet above sea-level.

The Skeena valley, near the confluence of the Kitsumgallum, is some four or five miles wide, and is one of the best-settled sections on this division of the railroad. The settlers are, generally, giving much attention to agriculture, especially to the cultivation of several varieties of berries and vegetables, for which they find a good market in Prince Rupert and Juneau, Alaska.

The Kitsumgallum River valley narrows about two miles above the mouth, but a good wagon-road has been built on the first bench at about 200 feet higher elevation than the valley. Much of the bench land has been cleared, and is being cultivated for a distance of about six miles from the Skeena river, but beyond that point the country is heavily timbered with hemlock, spruce, white fir, and cottonwood, with occasionally areas of considerable extent covered with red cedar.

No rock-outcrops occur near the road until a point fourteen miles distant from the village of Terrace is reached, when some granite ridges are crossed, and from that point to about two miles below the head of Kitsumgallum lake the country-rock is all hornblendic granite, which, in some places, has a gneissic structure; especially is this noticeable towards the head of the lake. Igneous dykes of very fine-grained rock, black in colour, often occur as intrusions in the granite.

Kitsumgallum lake, the source of the Kitsumgallum river, is a sheet of water about ten miles long north and south, by an average of two miles wide; the lake is fed from the waters of the Cedar and Beaver rivers, and their tributaries, which flow into the lake at the north end.

About two miles from the head, or north end, of the lake the rock formation changes to a garnetiferous, micaceous, hornblende-schist, then to diorite, and from that to a slate; this slate is first seen on Hall creek about one mile below the head of the lake. The line of strike of these rocks is N. 60° W. and the dip varies, but the average angle is 55 degrees towards N. 30° E.

From the head of the lake to Cedar river, its confluence with the Little Cedar, a distance of about fifteen miles, the rock formation is apparently, for the most part metamorphic slate, but, from the wagon-road, no exposures can be seen except at some creek crossings.

No occurrences of mineral have been discovered south of a point about two miles below the head of the Kitsumgallum lake, but from that point to near Lava lake, on the summit between the Skeena and Nass rivers, about twenty-two miles farther in a northerly direction, prospectors claim to have found gold-bearing quartz, placer gold, silver-lead-zinc ores, and coal. About sixty sections have been staked for coal licences. All of these occurrences will be described later in this report.

East and north-east from Kitsumgallum lake there is a high range of mountains which forms the watershed between the lake and Skeena river, and is known locally as Goat or Maroon range. The highest peak has an elevation of at least 8,000 feet above sea-level, while several others are from 6,000 to 7,000 feet.

It is in this range of mountains that Hall, Douglas, and Clear creeks, which flow into Cedar river and Kitsumgallum lake, head, as do also Lorne, Fiddler, Hardscrabble, and Phillips creeks that flow into the Skeena river.

The fact that the creeks mentioned were worked for placer gold some forty years ago is interesting, as well as the further fact that gold-bearing quartz is found in the mountains near the heads of these creeks.

Apparently, so far as is at present known, the boundaries of the mineral-bearing section of the west side of the Skeena river in this portion of the watershed may be roughly outlined by a line drawn slightly west of north from the mouth of the Kisumgallum river to Lava lake, a distance of about forty-five miles; thence north-east towards the Kitwanga river for a distance of about thirty miles; thence south-east to the Skeena river at Woodcock Station on the Grand Trunk Pacific Railroad, 145 miles from Prince Rupert, covering an area of approximately 1,200 square miles, and including all of the Kitsalas mountain range which extends in almost an unbroken chain paralleling the west side of the Skeena river.

The rocks of this portion of the Skeena River Division for the most part consist of a wide belt of volcanics, associated with some sedimentary rocks, which have been grouped together by R. G. McConnell as the Kitsalas formation. They are repeatedly intruded by gigantic dykes and stocks, and, in places, are somewhat schistose, but the alteration is nowhere so complete as in the rocks flanking the batholith on the west. Ordinarily they are greenish to purple massive rocks, spotted with large, rounded, and irregular areas of epidote, and lined along fracture-planes with the same material. The formation is made up near the batholith of porphyrites, tuffs, and coarse fragmentals, welded closely together and seldom showing traces of bedding or banding.

A narrow strip along the north-eastern portion of this mineral-bearing zone, or that portion lying between mile-posts 123 and 145 on the Grand Trunk Pacific Railway, should not be included in the Kitsalas formation, but belongs to the "Hazelton group" of McConnell.

The beds of the Hazelton formation overlie the semi-crystalline Kitsalas formation. The Hazelton rocks are mostly tufaceous, but, unlike those of the Kitsalas, they are well bedded and banded and are seldom much altered, except in the immediate vicinity of intrusive masses.

On the east side of this portion of the Skeena river the mineral-bearing area, so far as present indications show, is enclosed by boundaries which approximately extend from Woodcock, on the Skeena, south-easterly to the Telkwa river; thence south-westerly across the Kitnaiakwa river to Kitimat arm; thence northerly up the Kitimat river and down the Lakelse river to its mouth, near Copper City. In this area is included the mountains adjacent to the Zymoetz and the Kleanza rivers and other tributaries of the Skeena.

The rocks in this section, generally speaking, belong to the Kitsalas formation, but, in places, especially in the vicinity of the Kitnaiakwa river, there are vast belts of feldspathic sandstone and shales of a deep-red colour, as well as grey sandstone and some beds of conglomerate, which apparently belong to the Cretaceous period instead of the Triassic, in which McConnell tentatively places the Kitsalas formation.

Roughly speaking, this mineral-bearing zone has about the same extent—some 1,200 square miles—as the area already referred to on the opposite side of the Skeena river, and is, in fact, the south-eastern extension of that mineral-bearing area. The general trend is from south-east to north-west; the dip of the sedimentary rocks is at varying angles from about 30 degrees to nearly vertical, usually towards N. 29° E.

The mountains on the east side of the Skeena river, especially those forming the watershed between the Lakelse and Zymoetz rivers and between the latter and Kleanza creek, are extremely precipitous, very rugged, with narrow summits and many sharp saw-tooth-like peaks which reach altitudes exceeding 7,000 feet. The deep gulches on the northerly slopes are filled with deep snowslides until late in the summer, and in some instances glaciers have formed near the summits on which the snow and ice never disappear, but on the southerly slopes the snow usually goes off, even at high altitudes, early in the season. During the past summer, after the middle of May, the snow did not interfere below 3,000 feet elevation.

Numerous opportunities are offered for the development of water-power on several of the tributaries of the Skeena river, situated within the boundaries of this mineral-bearing zone, especially on the Zymoetz, Kleanza, and Kitsumgallum rivers, as well as on Phillips, Fiddler, Eliza, Chimdemash, and St Croix creeks. All of these streams have heavy gradients, some showing a difference in altitude of 2,000 feet between their heads and mouths, while all carry large volumes of water.

The timber-supply for lumber is fairly good; for mining timbers and fuel it is excellent. The varieties are chiefly hemlock, spruce, balsam, and cedar.

As many of the prospects are located above timber-line, it would be necessary in such cases to haul mine timbers up the mountains, sometimes to a height of 1,000 feet vertically above timber-line, with the slope of the mountain 33 degrees, but such conditions are exceptional rather than usual.

The fact that excellent crops of berries, vegetables, and hay can be raised within short distances of the locations of the mineral prospects is important, because under such conditions both the mining operator and ranchman will be mutually benefited.

The roads and trails are so located through this section of the Province that travelling is comparatively easy, so pack-horses can be taken to within short distances of the claims.

In this mineral belt on both sides of the Skeena some quite thorough and systematic prospecting has been done; forty years ago the first discoveries of placer gold were made on Douglas and Lorne creeks, while considerable work was done on quartz veins as far back as

1894, but lack of adequate transportation facilities handicapped the operations, so that from about 1898 until about 1908, when the Grand Trunk Pacific Railroad was being graded, but little prospecting was carried on. Since the latter date, however, there has been a number of energetic prospectors working along the belt. It would seem, however, from observations made during last summer, that in this field there are ample opportunities for a much larger number to engage in the work, as the discoveries made since last June prove that this mineral-bearing belt has only so far been scratched.

The writer is under very great obligations to many of the prospectors, especially to J. D. Wells and M. C. Kendal, of Kitsalas, and James Darby, of Usk, who were untiring in their efforts to aid him in making a thorough examination of the district.

KITSUMGALLUM LAKE.

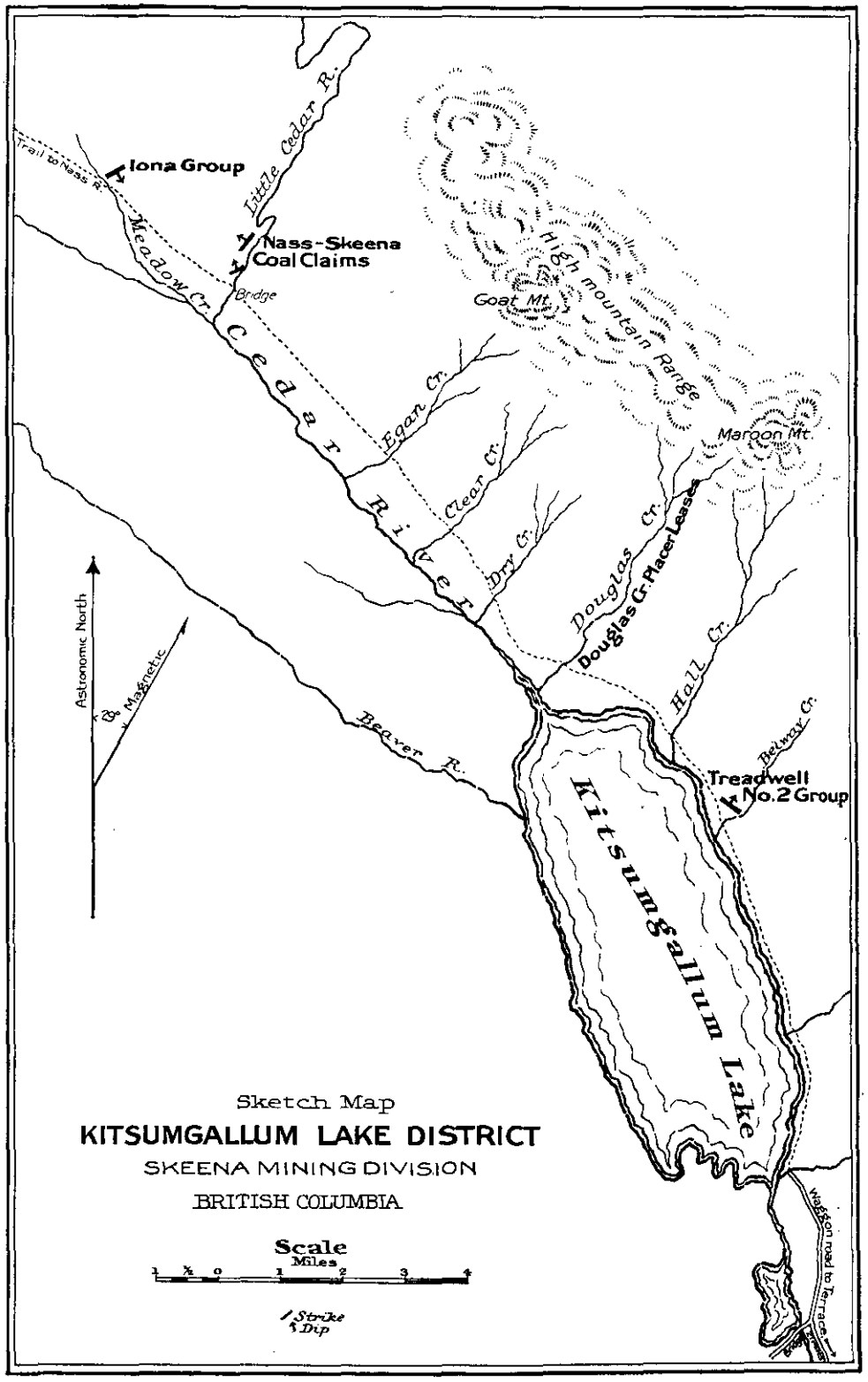
Treadwell Group.

This group consists of two mineral claims named *Treadwell No. 2* and *Juneau*, which are owned by Joseph Belway and Alexander McLaren. This property is situated about twenty-six miles northerly from the village of Terrace, and about two miles below the head of Kitsumgallum lake. The location-line of both claims is along the east shore of the lake, with the northern boundary of the *Treadwell No. 2* claim forming the southern boundary of the *Juneau* claim. All of the work has been done on the *Treadwell No. 2* claim.

A short distance south from this property the country-rock becomes more gneissic and micaceous, especially near the ore-body on the foot-wall side, the change from coarse-grained hornblendic granite to metamorphosed argillites and schists having taken place a short distance southerly from the southern boundary of the *Treadwell No. 2* claim. The line of strike of the schists is apparently north, and the dip 30 degrees towards the east, but there has been so much disturbance near the line of contact that it is very difficult to decide which are the original bedding-planes and which are cleavage-planes caused by shearing and pressure. The line of strike of the ore-body is N. 60° W., and the dip where a shaft has been sunk is 55 degrees towards N. 30° E.

There is no well-defined vein-structure; the values, which are principally in free gold, occur in narrow stringers of quartz which form veinlets and lenses in a portion of the schist zone, where rather well-defined cleavage-planes are assumed to be walls. The difference between the barren schist country-rock and the mineralized schist is somewhat difficult to recognize, for apparently the only distinction is that the schist carrying values is a shade darker in colour, is more garnetiferous and has more quartz veinlets as interlaminations in it. At places along the surface, the outcroppings when crushed and panned show particles of free gold, and at some other points, notably in one prospect-hole 200 feet distant from the main work and along the line of strike, N. 60° W., which also appears to be the strike of the mineralized zone in the schist, there are narrow stringers of bornite, some stain of copper carbonates, and iron pyrites.

Judging from some old caved-in openings, said to have been made forty years ago when placer-miners were working on Douglas and Hall creeks, it was presumed that values occurred in the schist along the lake-shore, and that the line of strike followed the shore-line in a nearly north-and-south course, but this work was evidently abandoned because sufficient values could not be found to warrant continuing. A sample taken across six feet of this schist in the face of an old open-cut assayed: Gold, 0.18 oz.; silver, 0.7 oz. This open-cut is situated a short distance southerly from a shaft on the lake-shore referred to later in this report. Another sample taken from a narrow quartz stringer in the schist near the old workings assayed: Gold, trace; silver, trace.


Trail to Nass R.
Iona Group
Little Cedar R.
Nass-Skeena Coal Claims
Meadow Cr.
Bridge
Cedar River
Egan Cr.
Clear Cr.
Dry Cr.
Douglas Cr.
Douglas G. Placer Leases
High mountain Range
Goat Mt.
Maroon Mt.
Hall Cr.
Bellway Cr.
Beaver R.
Treadwell No.2 Group
Kitsumgallum Lake
Astronomic North
Magnetic
Sketch Map
KITSUMGALLUM LAKE DISTRICT
SKEENA MINING DIVISION
BRITISH COLUMBIA
Scale
Miles
1 ½ 0 1 2 3 4
Strike
Dip
Wagon road to Terrace

A few years ago, Joseph Belway, foreman of the road-gang, making a trail along the east shore of Kitsumgallum lake, in blasting the rock discovered particles of free gold visible to the naked eye. This work exposed a strata for about 60 feet along the trail that panned free gold and demonstrated that the line of strike was N. 60° W. instead of north; the width is undetermined—it may reach a maximum of 30 feet in places, judging from panning some of the outcroppings. At a shaft sunk on the lake-shore near the No. 1 post of both claims an average sample taken across 8 feet assayed: Gold, 0.42 oz.; silver, 0.5 oz. This sample was from as deep a point as could be reached, the shaft below being full of water, for the reason it had been sunk so near the lake-shore when the water in the lake was low that it had filled up when the water raised.

Close to the point where the sample was taken particles of free gold, some of them as large as pin-heads, could be easily seen with the naked eye embedded in quartz veinlets in the schist in the open-cut at the collar of the shaft, but any metallics were carefully rejected from the samples.

Development-work consisted of the shaft referred to, said to be 10 feet below the level of the lake, with an open-cut made into the rock above the collar of the shaft, about 8 feet square by 5 feet high at the face; an open-cut about 500 feet from the shaft, in a S. 60° E. direction, about 8 feet long and from 3 to 4 feet deep; an open-cut, where blasting was done in making the trail, about 50 feet long and 4 feet wide; an open-cut about 500 feet southerly from the shaft, from which the owners proposed driving a crosscut adit in an endeavour to locate the ore-body in the mountain, at a depth of about 50 or 60 feet.

DOUGLAS CREEK.

Douglas Creek Development Syndicate.

This property consists of seven hydraulic leases, each one-half mile square; the locations take in all of the creek for a distance of about three miles and a half up from near the mouth. Douglas creek rises in a high range of mountains situated easterly from Kitsumgallum lake, and flows in a general south-westerly course, emptying into the north end of the lake. No evidence of former placer-mining operations were seen below a point about one mile above the mouth, which is also above the first falls on the creek, where there is a sheer drop of about 20 feet; but above that point there are quite a number of ruins of old cabins in various stages of decay, while the number of old caved-in shafts situated on the benches and the piles of old tailings are silent witnesses to the extent of the work done by the pioneer placer-miners.

The creek is some ten or twelve miles long and, except through some short canyons, will average about half a mile wide, including low benches. The grade of the creek-bed averages about 300 feet to the mile, but there are several falls of from 20 to 50 feet sheer drop.

The pioneers appear to have done good work, and must have taken out a good deal of "pay" as there are evidences that work was carried on for several seasons, which is confirmed by information received from miners who worked on this creek thirty or forty years ago; there are still a few of these men alive, notably Captain Madden, who to-day operates the Government ferry across the Skeena river at Usk. Some prospecting done by the writer during his examination proved that there is still some "pay" in this creek-gravel, as every pan yielded one or more fairly heavy "colours," and it is quite possible that the holders of the leases will find, by systematic prospecting on bed-rock, sufficient pay to warrant hydraulic mining.

The large boulders above the lower falls, about one mile above the mouth of the creek, would seriously interfere with any dredging, but from that point down to the mouth there is a chance that dredge-mining might be carried on successfully.

During the spring of 1914 the leaseholders had some prospecting-work done on the right limit just above the lower falls, where bed-rock was reached at a depth of about 4 feet. This

bed-rock is very hard, massive, and quite smooth, so that there would have been little, if any, chance for gold to be held on it. At another point about half a mile farther up the creek on the right limit a shaft was sunk last spring to a depth of 23 feet without reaching bed-rock. At that depth the water flowed in so rapidly that further sinking was abandoned; other prospect-holes were sunk with the same experience.

On the left limit of the creek above the first falls there are indications of an ancient creek-channel that might prove to carry "pay" enough to warrant hydraulic mining. Systematic prospecting is necessary to prove whether or not the gold is sufficient to warrant operations. If so, there is opportunity to obtain plenty of water at high pressure, either from the upper portion of Douglas creek or from Hall creek, which heads in the same mountain range as Douglas, and also empties into the north end of Kitsumgallum lake. The facilities for dumping tailings are good, and apparently the quantity of gravel available will amount to a very large tonnage.

LITTLE CEDAR RIVER.

Nass-Skeena Coalfields.

In the autumn of 1913 discoveries of coal-outcroppings in the banks of the Little Cedar river were made by G. F. Moncton and P. Chesley, of Vancouver, who were working in the interests of a syndicate formed in Vancouver. Later some sixty sections of land were staked and licences applied for. During the past summer the locators have been employing a force of men prospecting the ground staked, and were so engaged when the camp was visited on June 3rd and 4th, 1914. Owing to the discoveries having been made so recently and the large extent of the territory to be prospected within a limited time in order to enable Mr. Moncton to decide on the sections which were the most desirable to retain, only superficial work been been done, consisting of open-cuts where coal-outcroppings occurred; consequently the examination was necessarily very preliminary.

Little Cedar river, which has its source on the summit of the divide between the Skeena and Nass rivers, flows in a generally south-easterly direction and empties into the main Cedar river, which flows into the north end of Kitsumgallum lake. The Government trail from Kitsumgallum lake to Ayansh, on the Nass river, crosses the Little Cedar River on a good bridge apout twelve miles northerly from the head of the lake, and it was near this point that the examination was made, during which much assistance was given by both Mr. Moncton and Mr. Chesley, to whom thanks are due for many courtesies.

Coal-seam No. 1.—The coal-outcroppings occur along the steep, west bank of the Cedar river; apparently these outcroppings represent six distinct seams of coal, but further work may show that some of these are duplications from folding or faulting.

So far as could be judged, the coal-measures occupy a synclinal fold and are represented by sandstones of the Cretaceous period, and belong to an isolated field, possibly extending over a width of about two miles and a half and of undetermined length.

The coal outcropping first examined occurs at an elevation of 1,000 feet above sea-level, at a point about half a mile northerly from the bridge. There, an open-cut 12 feet wide and 12 feet high at the face had been made in the river-bank about 20 feet along the strike of the coal-seam.

The strike and dip of the measures at this exposure are very difficult to determine, but appear to be as follows: Strike, N. 70° E., dipping 50 degrees towards N. 20° W.

The floor underlying the coal is a black, graphitic slate, and the roof is sandstone. There is much black shale and a parting of sandstone 12 inches thick, mixed with the coal, which has an aggregate thickness of about 4 feet in the 12-foot face. This coal may prove to be one seam as work progresses, but at the surface the sandstone-parting looked so well defined as to

suggest the occurrence of two seams, the lower one being 18 inches thick; this is considered to represent the lowest seam in the field. Above this is 12 inches of sandstone, then 30 inches of coal mixed with a good deal of black shale; above this is a sandstone roof overlain by surface sand and gravel.

It is possible that much of the black shale may cut out when the work is carried beyond the surface into more solid material, as after picking into the surface of the cut the percentage of clean coal was found to increase quite materially, while the percentage of shale decreased.

A sample taken across the lower coal-seam, 18 inches thick, below the sandstone-parting, analysed: Moisture, 3.6 per cent.; volatile combustible matter, 3.4 per cent.; fixed carbon, 31.4 per cent.; ash, 61.6 per cent. Another taken across the 30-inch coal-seam, above the sandstone-parting, analysed: Moisture, 4.0 per cent.; volatile combustible matter, 2.0 per cent.; fixed carbon, 45.0 per cent.; ash, 49.0 per cent.

Coal-seam No. 2.—At a point about 200 feet farther north and 60 feet higher vertically, on the river-bank, another coal-outcrop occurs which apparently represents a separate seam higher in the measures. A small open-cut has exposed a thickness of 3 feet of fairly clean-looking coal. This seams shows the same strike and dip as the seam already described; the roof and floor are both sandstone.

A sample taken across this 3 feet analysed: Moisture, 4.0 per cent.; volatile combustible matter. 2.0 per cent.; fixed carbon, 57.5 per cent.; ash, 36.5 per cent.

Coal-seams Nos. 3, 4, and 5.—Following up the river-bank in a general No. 30° E. direction, there are indications of the occurrence of three other seams, but no work had been done on any of these, so that all that could be seen was merely surface showings indicating the occurrence of coal.

Coal-seam No. 6.—About 800 yards distant from No. 1 seam in a general N. 30° E. direction, and about 200 feet higher elevation, just above a sharp bend in the river, a coal-seam outcrops that is considered by Mr. Moncton to represent the sixth seam in the series, in ascending order. While the line of strike of this seam is the same as that of the other seams, yet the dip is much flatter, being at an angle of 22 degrees.

Some work has been done to expose this seam, by open-cutting, preparatory to driving a slope on the coal, an examination of which showed that the seam was 3 feet thick, of fairly clean-looking coal lying between sandstones.

A sample taken across the 3 feet analysed: Moisture, 5.8 per cent.; volatile combustible matter, 4.2 per cent.; fixed carbon, 67.3 per cent.; ash, 22.7 per cent. The percentage of ash carried by each of the samples analysed, the results of which have been given in the foregoing, it is only fair to state, are all average samples of the thickness stated, without sorting or washing to eliminate impurities.

The following analysis is from a sample of coal brought to the Provincial Assay Office by G. F. Moncton, which he stated he took from the No. 6 seam at a later date than that of the writer's visit: Moisture, 4.0 per cent.; volatile combustible matter, 3.2 per cent.; fixed carbon, 63.8 per cent.; ash, 29.0 per-cent.; non-coking.

MEADOW CREEK.

Iona Group.

This group of claims is located about three miles north-westerly from the Cedar River bridge and on a large creek, locally called Meadow creek, because of the extensive beaver meadows along its course. The group contains four mineral claims, named as follows: *Alta, Redo, Iona,* and *Montague.* A brecciated zone in the slate country-rock contains ore-bodies made up of quartz containing chalcopyrite, galena, zincblende, iron pyrites, and, possibly, grey-copper.

This zone has been exposed in a deep open-cut, No. 1, at an elevation of 1,250 feet, where the ore outcropped on the surface of the *Iona* claim. The brecciated zone—or vein, as it may be termed—is bedded in a graphitic slate country-rock; the dip is at an angle of 65 degrees towards the south and the strike is N. 80° W. conformable with the dip and strike of the slate.

So far as can be ascertained from an examination of the ore-bodies where they are exposed, it appears as though there was more than one, with a lenticular structure, and that the lenses lie *en eschelon* to each other, or with thin edges overlapping similar to the shingles on the roof of a house, and with wedge-shaped sections of country-rock lying between the overlapping sections of the ore-bodies.

In this open-cut the ore has been broken down from the slate foot-wall, leaving that wall exposed for the length of the cut—25 feet—along the strike. In the face, at the easterly end of the cut, the ore-body is solid and 3 feet wide, but in the westerly face the ore-body shows the indications of lenticular structure, because next to the foot-wall there is 2 feet of solid ore; then 1 foot of slate country-rock; then 1 foot of ore; then the permanent hanging-wall, which, at this point is a cherty slate. In the floor of the cut, which is about 8 feet below the surface, the solid ore is next the foot-wall and about 18 inches wide; the balance of the floor was so much covered with muck and broken rock that it was impossible to see it, consequently there may be a greater width of ore than mentioned.

Two samples of the ore exposed in the No. 1 open-cut were taken; both were from the dump, because the "ore in-place" was too hard to sample with a prospecting-pick. No. 1, a grab sample, about an average of the dump, assayed: Gold, trace; silver, 56.4 oz.; copper, 4.8 per cent.; lead, 6.1 per cent.; zinc, 19.4 per cent. No. 2, a selected sample, assayed: Gold, trace; silver, 177 oz.; copper, 9.2 per cent.; lead, 22.4 per cent.; zinc, 22.8 per cent.

The lenticular structure of the ore-bodies is also shown at a point a short distance westerly from the open-cut No. 1, already described, where another long cut (No. 2) has been made, in which is exposed a lens of ore having its line nearly at right angles to the strike of the country-rock, but the open-cut was so shallow the dip could not be determined.

An adit has been driven in graphitic slate in a N. 10° W. course, with its portal at about 50 feet lower elevation than the open-cuts. This was evidently driven in the expectation of crosscutting the ore-bodies exposed in the open-cuts, but has not yet been driven far enough to intersect the ore-body exposed in the upper or No. 1 cut, and the portal is located too far to the north to hope to intersect the body exposed in No. 2 cut, because if that body maintains continuity along its strike it lies south from the portal of the adit.

Development work consists of an adit driven 36 feet in length. No. 1 open-cut is 25 feet in length along the strike of the ore by about 8 feet high at the face and about 12 feet wide. No. 2 open-cut is really a shallow, narrow trench 20 feet in length along the strike of the ore.

JOHNSON CREEK

Egan's Claims.

One of the tributaries of Little Cedar river, known as Johnson creek, has received considerable attention from prospectors during the past season, and some nice specimens of silver-lead-copper ores were found as float in the creek-bed, but, so far as could be learned, only one ledge had been located up to June, 1914, and that was by A. Egan, a pre-emptor, whose land is situated on the main Cedar river about eight miles from the head of Kitsumgallum lake.

These claims were not examined, as only one assessment had been done on the claims, which are situated high up in the mountain range at the head of Johnson creek, with rather deep snow covering the surface, and no trail to travel by, the trip necessitating a walk occupying over seven hours by the best walkers in the camp.

The writer was, however, informed by the owner that he had during the season of 1913 sent some samples of ore to the Government laboratory for assay. On inquiry of the Government Assayer, it was found that the samples assayed as follows: No. 1, a sample of quartz and pyrite: Gold, 0.02 oz. No. 2, a sample of quartz and pyrite: Gold, 0.02 oz.; silver, 24.2 oz.; copper, 3.3 per cent.; lead, 27.3 per cent.

MAROON MOUNTAIN.

In the high levels of Maroon mountain near the head of Hall creek, which flows south-easterly and empties into the north end of Kitsumgallum lake, is another section that was receiving a good deal of attention from prospectors during the season of 1914, and several were camped at the head of Kitsumgallum lake waiting for the snow to go off the mountain, which rises to an elevation of nearly 7,000 feet above sea-level.

Some specimens of float and surface outcroppings were shown that were said to have been found in the autumn of 1913 on that mountain which certainly looked as though the ore carried some gold associated with silver, lead, and a little copper. Of course, at the present time, the serious development of the mineral resources of this section must necessarily be slow because of lack of transportation facilities to the railroad.

LAKELSE VALLEY.

The Lakelse river flows from Lakelse lake north-westerly into the Skeena at a point about eighty-three miles from Prince Rupert, or twelve miles below the railway-station at Terrace. The Lakelse valley also includes the valleys formed at the mouths of Eliza and William creeks, which empty in at the head of Lakelse lake.

The valley in places is four or five miles wide and forms really the south-eastern extension of the wide depression which extends from Ayansh, on the Nass river, to tide-water at the head of Kitimat arm, with quite low summits between the Nass and Skeena and tide-water. Looking from the summits of the mountain range at the head of Eliza creek, a full view of this magnificent valley can be obtained, stretching from north-westerly to south-easterly farther than can be seen with the aid of a powerful field-glass.

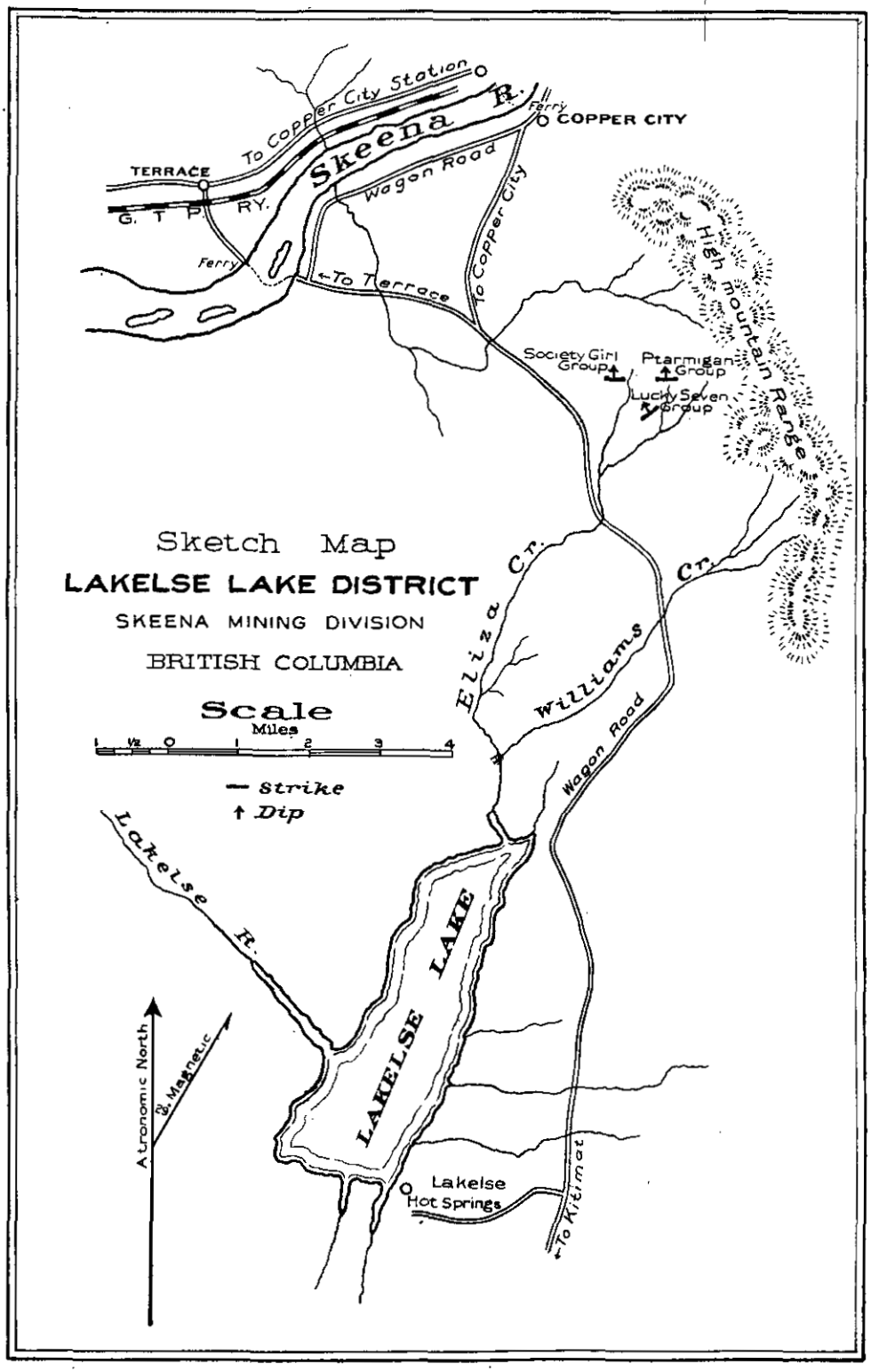
The Lakelse valley is bounded on the north-east side by a high range of mountains known as the Thornhill mountains, in which head Eliza and William creeks with their tributaries. This mountain range forms a portion of the watershed of the Zymoetz river, and is also the dividing line between the Skeena and Omineca Mining Divisions.

Lakelse Hot Springs.

Ferries across the Skeena river have been built from both Copper City and Terrace, while good wagon-roads extend up the Lakelse valley to the south end of Lakelse lake, where the hot springs are located, a distance of about eighteen miles. These springs cover an area of about half an acre and the water near the centre has a high temperature. The elevation is 300 feet above sea-level and 16.53 feet above Lakelse lake. The springs were discovered in 1894 by M. C. Kendal, a prospector, while making a trip from the head of Kitimat arm to the Skeena river, but their existence was known to the Indians at a much earlier date. Superstition is said to have caused the Indians to avoid the locality in early days, and is said to have marked a dividing line beyond which the Skeena River Indians never travelled to the southward, nor the Coast Indians to the northward.

The owners, H. N. Boss and J. Bruce Johnson, have erected a commodious log building for a hotel and bath-house. The water is brought from the springs through an open wooden flume 1,200 feet long, and during my visit the temperature of the water as it flowed into the bath reached 118° Fahr.

A sample taken by the writer from as near the centre of the spring as it was possible to reach analysed as follows: Total solids, 83 grains to the gallon, principally lime, with a little soda and magnesia in the form of chlorides and sulphates, but contains no potash or lithia.


To Copper City Station
Skeena R.
Ferry
COPPER CITY
TERRACE
G. T. P. RY.
Wagon Road
To Copper City
Ferry
←To Terrace
High Mountain Range
Society Girl Group
Ptarmigan Group
Lucky Seven Group
Sketch Map
LAKELSE LAKE DISTRICT
SKEENA MINING DIVISION
BRITISH COLUMBIA
Scale
Miles
½ 0 1 2 3 4
— Strike
↑ Dip
Eliza Cr.
Williams Cr.
Wagon Road
Lakelse R.
LAKELSE LAKE
Astronomic North
Magnetic
Lakelse Hot Springs
←To Kitimat

THORNHILL MOUNTAIN—ELIZA CREEK.

Society Girl Group.

This group consists of the *Society Girl* and *Silver Belle* mineral claims, and is owned by Walter Bell and Dan Mason, of Copper City. The No. 2 post of the *Society Girl* is set at an elevation of 4,400 feet above sea-level, or 4,100 feet above, and directly overlooking Lakelse valley. The angle of declination is 32 degrees, as taken from near that post from the edge of a cliff overlooking the south slope of Thornhill mountain and the valley below. The distance from either Terrace or Copper City to the *Society Girl* group is about eight miles.

Ore-bodies.—In a pass at the summit of Thornhill mountain range, with higher peaks to the north and south, some ledges of quartz were found which contained iron pyrites, some galena, and arsenical pyrites. These ledges are very strong and persistent, and can be traced by their outcroppings along a general line of strike east and west across several bare rocky knolls for a distance—in one instance at least—of nearly 1,500 feet, but while all the indications favour the theory of continuity, yet the spaces between the bare cliffs are filled with slide-rock from the higher peaks, so it can hardly be stated that the continuity is maintained without qualifying the statement by this explanation.

The quartz-outcroppings occur on the *Society Girl* claim at elevations from 4,500 to 4,700 feet above sea-level, and open-cuts have been made at the several points where the ore outcrops.

The quartz ledge, which can be traced from point to point nearly across the claim, appears to fill a fissure at the contact between a diorite foot-wall and andesite hanging-wall, with the vein material between varying in width from 2 feet 6 inches to 5 feet.

An average sample chipped off across a width of 2 feet 6 inches in one of the open-cuts assayed: Gold, 0.2 oz.; silver, 0.5 oz.

The rock which forms the hanging-wall has in many places small particles of pyrite altered to specular iron scattered through it, which has caused much discussion amongst prospectors. A sample of this rock sent to McGill University for classification is described as follows:—

"This is a cream-coloured rock of close grain, with yellowish stains on weathered surfaces, and bearing cubical pseudomorphs of black, shiny hæmatite after pyrite, up to $\frac{1}{8}$ inch in diameter. The rock presents a very striking appearance to the eye.

"Under the microscope the rock is seen to be composed entirely of feldspar and hæmatite. The feldspar includes both orthoclase and plagioclase, the former being predominant in amount. It occurs in short stumpy laths with a tendency to crystal shapes, though often showing allotriomorphic outlines. A tendency to radial arrangement is seen, but it appears to be connected only with the plagioclase, no case of radial arrangement or orthoclase being met with in the section examined. The feldspars are very fresh.

"There is no quartz in the rock, which from its structure is a dyke rock, and would therefore be called a quartz-free aplite. It shows strong affinities to the bostonites, though lacking the typical structure of the type. Field relations would help in deciding the question as to which group it should be placed in, and doubtless a chemical analysis would throw light on the question."

Another sample taken from a wide, heavily iron-stained quartz ledge that occurs about the centre of the *Society Girl* claim assayed: Gold, 0.03.; silver, 0.7 oz.

On the *Silver Belle* mineral claim, the north-west corner of which forms the south-east corner of the *Society Girl* claim, some quartz-outcroppings occur very similar in appearance, as regards mineralization, to those on the *Society Girl* claim, and suggest the occurrence of parallel ledges. These should be systematically prospected, but up to the time of the examination, all the work on the group had been confined to the *Society Girl* claim.

Ptarmigan Group.

This group consisting of the *St. Paul* and *Ptarmigan* mineral claims, is owned by Fred and Bert Michand and Mrs. Firestone. The *St. Paul* claim joins the *Society Girl* on the north-easterly side of the latter, while the *Ptarmigan* claim lies adjoining on the north-westerly side of the *St. Paul*, but at a much higher elevation, as the boundary-lines at this point cross the extreme summit of Thornhill mountain and extend down the north slope of the mountain, which at the time of the visit was covered by a deep snowslide that also covered the open-cut work done in the summer of 1913; so that, while the *St. Paul* claim could not be examined, the *Ptarmigan* could be.

On a rocky cliff, at an elevation of 4,700 feet above sea-level and near the No. 1 post of the *St. Paul* claim, there occurs an outcropping, about 12 feet wide, of quartz containing iron pyrites, galena, and arsenical pyrites. The strike is east and the dip 46 degrees towards north.

Sighting from this outcropping along the line of strike across the adjoining *Society Girl* claim, the line intersects the points where outcroppings occur on that claim, and, although the great quantity of slide-rock that covers the low gaps between the outcroppings renders it impossible to establish unbroken continuity, yet it would appear possible that this outcropping may be connected with those on the *Society Girl* claim, and be an extension of the lead.

The length of the outcropping exposed is about 30 feet, and the open-cut work had exposed a face of ore nearly 10 feet high of the same general character as that found on the adjoining *Society Girl* claim.

A typical but not necessarily an average sample of the ore-body, taken by the writer, assayed: Gold, 0.36 oz.; silver, 1.5 oz.; copper, 0.5 per cent.

Lucky Seven Group.

This group of mineral claims is located on the south slope of Thornhill mountain, and covers the mountain-side from an elevation of about 2,000 feet to an elevation of about 4,000 feet. The group comprises three mineral claims—the *Diamond*, *Lucky Seven*, and *Beaver*—and is owned by Olson and Dahl, of Copper City.

Ore-bodies.—There are apparently three veins exposed on the *Diamond* and *Beaver* claims; these are designated as Nos. 1, 2, and 3. The lines of strike are nearly parallel; No. 1 being N. 60° E.; No. 2, N. 60° E.; No. 3, N. 50° E. The angles of the dips are not parallel, as the dip of No. 1 vein is at an angle of 45 degrees towards the north-west; the dip of No. 2 vein is at an angle of from 20 to 35 degrees towards the south-east; and the dip of No. 3 vein is at an angle of 60 degrees towards the south-east.

No. 1 vein outcrops at an elevation of 3,400 feet above sea-level along the west bank of a small creek which flows from the summit of Thornhill mountain through the north-west corner of the *Diamond* mineral claim. This vein is from 8 to 15 inches wide where it has been exposed in an adit drift along the strike, and the same width on the dip as exposed in a series of open-cuts which show the continuity of the vein both below and above the adit level for about 150 feet measuring along the incline of the dip, and 100 feet vertical measurement.

The ore carries iron pyrites and grey copper in a barytes-quartz gangue, and fills a fissure in a green-coloured granitoid, hornblendic rock. A sample representing an average of the ore across 8 inches in the adit assayed: Gold, 0.14 oz.; silver, 108.7 oz.

No. 2 ore-body, which the owners consider to be the main vein, occurs to the east from No. 1 vein. This outcrops in another creek that flows parallel to that on which the No. 1 vein occurs. No. 2 ore-body has been exposed on both the *Beaver* and *Diamond* mineral claims by

a series of ten open-cuts for a distance of about 350 feet up the mountain-side. The lowest exposure is at an elevation of 2,700 feet above sea-level and the highest at about 3,000 feet.

The ore carries iron pyrites and some little galena in a quartz and barytes gangue. The width varies from 2 to 8 feet, averaging about 3 feet. The vein is a strong fissure in a green-coloured granitoid, hornblendic rock, and shows many indications of maintaining persistent continuity.

A sample taken from No. 6 open-cut across a width of 2 feet, representing an average of the ore-body at that point, assayed: Gold, 0.46 oz.; silver, 5.4 oz.

Several well-defined dykes of igneous rock similar to diorite occur as intrusions in the country-rock, and at one point at an elevation of about 3,000 feet a dyke cuts through the ore-body.

No. 3 ore-body occurs on the *Beaver* claim and has been exposed in an open-cut at an elevation of 2,400 feet on the side of the trail leading from the valley to the summit of Thornhill mountain. This ore-body consists of a quartz ledge 3 feet wide where it is exposed, filling a fissure in diorite country-rock. In the quartz at the point where the open-cut has intersected the lead there is no evidence of mineralization beyond iron-stains, and the owners found no values there; but at a point 150 feet lower elevation and about 300 feet horizontally in a S. 50° W. direction, where a crosscut adit has been driven 40 feet, an ore-body carrying values is exposed at the face, which is presumed to be the same as is seen in the open-cut on the mountain-side, as the line of strike, dip, and character of the vein are all similar.

From an outcrop about 50 feet lower than the adit a sample taken by the owners assayed: Gold, 0.75 oz.; silver, 6 oz.; but they did not claim that this sample represented an average of the lead.

Development-work.—On the *Beaver* mineral claim the following work has been done: An adit driven 40 feet, at an elevation of about 2,200 feet, to intersect the No. 3 ore-body; an open-cut about 6 feet long made across the same body; an open-cut about 20 feet long, exposing the No. 2 ore-body at an elevation of 2,700 feet.

On the *Diamond* mineral claim the development-work consists of: An adit, driven as a crosscut in the country-rock, 63 feet in length, at an elevation of 2,850 feet above sea-level; an adit on the No. 1 ore-body has been driven 18 feet in length as a drift at an elevation of 3,400 feet; a series of open-cuts on the No. 2 ore-body varying in length, the longest of which is No. 8 cut, in which the ore-body is exposed for 25 feet.

On the *Lucky Seven* mineral claim no work has been performed.

ZYMOETZ RIVER.

Starting from Copper City, at the mouth of the Zymoetz river—or, as it is sometimes called locally, the Copper river—a wagon-road has been constructed up the vally on the south side of the river for a distance of about two miles, where a substantial bridge spans the river. Here the road forks; the right-hand fork continues as a pack-trail along the south side of the river, while the left-hand fork crosses the river and continues as a pack-trail towards the north to Kitsalas canyon and village, the oldest settlement on the Skeena river between Port Essington and Hazelton.

The trail along the south side of the Zymoetz river continues up the river on that side for about three miles farther to the east, to a point where the river flows through a long box canyon which is spanned by a bridge that in June, 1914, had been condemned as dangerous. This portion of the trail, according to R. H. Jennings, the Road Superintendent, would be abandoned as soon as a new trail had been built on the north side of the Zymoetz river to the main bridge at the forks of the wagon-road.

After crossing on the second bridge the trail is located on the north side of the Zymoetz river for a distance of about twenty-five miles to the big bend of the river. The course of the river here changes from a southerly flow from its source near Hudson Bay mountain to a westerly course to its confluence with the Skeena river near Copper City.

The rock formation in this locality is chiefly granite and diorite, but near the 5-mile post on the trail there is a change to the Kitsalas formation, as classified by McConnell, consisting of volcanics associated with some sedimentary rocks.

The first occurrence of mineral seen occurs about half a mile east from the bridge at the head of the Zymoetz canyon, where the river forms magnificent falls with sufficient flow and head, it is claimed, to furnish about 80,000 horse-power if properly developed.

Copper Falls Group.

This group consists of two mineral claims—the *Copper Falls No. 1* and *No. 2*, owned by J. D. Wells and E. T. H. Hamblet, of Kitsalas village. *In a chloritic schist country-rock there are two parallel stringers of quartz* containing some copper mineral. These occur in fractures having their lines of strike N. 75° W. and dipping N. 15° E. at an angle of about 50 degrees.

Although neither of the stringers is wide enough to warrant the assumption that it would pay to mine, considerable prospecting-work was found to have been done; this consisted of a *deep open-cut at the outcrop and two adits, one to the east of and about 20 feet below the* outcrop; the other almost directly under the open-cut and about 30 feet below. The upper adit had caved in and could not be examined; the lower adit has been driven 30 feet as a crosscut. At a point 10 feet in from the portal one of these stringers had been exposed, and 20 feet beyond, at the face, the second stringer had been cut.

Some small pieces of bornite and chalcocite were found in each of these stringers, yet a sample taken as representing the full width of about 3 inches, upon assaying, yielded only traces of gold, silver, and copper, showing that what little mineral was associated with the quartz gangue was not sufficient to make the property of commercial value.

About half a mile east from the Zymoetz falls a belt of slate was found underlying limestone, with its strike north-west and dip north-east. This limestone is also found on the south side of the river, where some mineral claims have been staked but no work done. The extent of the limestone could not be determined, as it was only exposed on the trail on a hillside for a short distance; where the trail crosses a wide flat all rock formation is hidden by the soil.

Between the 6- and 13-mile posts from Copper City no occurrence of mineral has yet been discovered on the north side of the Zymoetz, but outcroppings of copper ore have been reported on the south side.

Near the 13-mile post, where a very extensive area was burned over by a forest fire some years ago, the *Dardanelle* group of mineral claims was examined.

Dardanelle Group.

This group consists of four mineral claims known as the *Trail*, *Trail Frac.*, *Independent* and *Dardanelle*. The owners are Archie Carmichael, James Crocker, Geo. W. Kerr, and Amos Ross. The claims are located from west to east, the *Trail* being the most westerly, with the *Trail Frac.*, *Independent*, and *Dardanelle* adjoining towards the east in the order named.

Ore-bodies.—A series of fissure-veins filled with quartz containing minute particles of galena, iron pyrites, and occasionally a little bornite and copper glance, occur on this property. The country-rock is a greenstone-schist, very much sheared and slickensided near the veins. There are some dykes of quartz porphyry occurring as intrusions in the country-rock, and one of these dykes at one point forms the foot-wall of a vein and the hanging-wall of another. The veins are very strong, have well-defined walls, with a few inches of talcose gouge separating the vein-matter from the walls, and the fissures cut the schistosity of the country-rock.

The work, consisting of about 100 feet of open-cuts, adit, drift, and shaft, is described later in this report. The work indicates the occurrence of four veins, with lines of strike at angles varying from each other and their dips at angles varying from 58 to 75 degrees. The line of strike of No. 1 vein is east; that of No. 2 vein is N. 70° E.; that of No. 3 vein is N. 75° E.; that of No. 4 vein is N. 65° E. The dip of No. 1 vein is at an angle of 63 degrees towards north; that of No. 2 vein is at an angle of 72 degrees towards N. 20° W.; that of No. 3 vein is at an angle of 75 degrees towards N. 15° W.; that of No 4 vein is at an angle of 58 degrees towards N. 25° W.

These veins all occur within a comparatively narrow zone, and further work may prove that instead of four veins there are only two, or possibly only one, and that the variations in the lines of strike and the angles of the dips are due to the intrusive dykes which were observed cutting through the country-rock.

On the No. 1 vein an open-cut 18 feet in length, followed by No. 1 adit driven on the vein for 35 feet, shows a body of mineralized quartz 3 feet wide, with both walls of greenstone-schist. An average sample taken across the face of the adit assayed: Gold, 0.1 oz.; silver, 0.3 oz. Another opening, in which apparently the same vein is exposed, is an open-cut (No. 2) 15 feet long by 8 feet high at the face, situated at a point 200 feet east from the No. 1 adit and at an elevation about 50 feet higher up the mountain-side.

A quartz-porphyry dyke occurs as an intrusion at this point and forms the foot-wall of the vein. The body of quartz is 3 feet wide at the face of the open-cut, but the mineralization is somewhat less. It appears as though a dyke has cut through the vein between the adit and No. 2 cut.

At a point about 15 feet south-easterly from, and on the same level as, No. 2 open-cut, but on the opposite side of the dyke, a vein occurs filled with quartz, having the dyke for its hanging-wall and greenstone-schist for its foot-wall. This vein has been exposed by an open-cut (No. 3) about 10 feet long, showing the vein to be 18 inches wide. On the same level, about 50 feet farther to the south-east, a small open-cut (No. 4) exposes another body of mineral, 3 feet wide, composed chiefly of iron pyrites in a quartz gangue, filling a fissure in the greenstone-schist.

About 10 feet south-easterly from the foot-wall of the No. 4 vein another quartz-porphyry dyke occurs as an intrusion in the country-rock, and at about 100 feet in an easterly direction this dyke cuts across the vein, which can be followed by its outcroppings along the strike N. 75° E. for about 500 feet, and on the *Trail Frac.* mineral claim.

The No. 5 opening is a shaft 12 feet deep on the *Trail Frac.* at an elevation of 500 feet higher than No. 1 open-cut and adit, and about 1,800 feet distant from it in an easterly direction. In this shaft is exposed a vein filled with quartz containing some iron pyrites. The foot-wall of this vein is a quartz-porphyry dyke, and the hanging-wall a greenstone-schist. The vein is well defined and averages about 4 feet 6 inches in width, with a few inches of talcose gouge separating the quartz from each of the walls. The quartz in this vein has a "ribbon-structure," and in some of it fine particles of free gold are visible. The outcroppings can be followed for some little distance along the strike on both sides of the shaft. An average sample, taken with hammer and moil across 4 feet at the bottom of the shaft, assayed: Gold, 0.22 oz.; silver, 0.8. oz.

No work has been done on the *Independent* or *Dardanelle* claims. Judging from the appearance of the vein-matter where exposed, it would appear as though it would be a good concentrating proposition, which, with an ample water-power from a near-by creek, could be operated at a minimum cost.

The samples quoted in this report, while they represented averages at the points mentioned, cannot be considered as representing the average of the whole body of mineralized quartz exposed on the property, as such sampling was not practicable.

SALMON RIVER.

The main trail from the *Dardanelle* group of mineral claims continues in an easterly direction up the Zymoetz river, some distance back on a bench which was the scene of a big forest fire in 1912.

Between the 15- and 16-mile posts, but on an abandoned trail, a belt of crystalline limestone occurs, about 200 feet wide, having diorite for the southern boundary and feldspathic sandstone for the northern. The line of strike of the strata of the limestone is N. 80° E. and the dip, where it could be seen, is nearly vertical.

From the 16- to the 18-mile post the rock formation, having been burned over, is well exposed. The rocks belong to the Kitsalas formation, as classified by McConnell, and are made up of volcanics with some sedimentary rocks.

From the 18- to the 21-mile post, near the crossing of the Salmon river, a tributary of the Zymoetz river, the trail crosses extensive flats covered with a fine growth of red cedar, with occasional specimens of yellow cedar, and on these flats the rock formation is hidden.

The North West Group.

There are seven mineral claims in this group, named in the order they are staked, from south-east to north-west, as follows: The *Coronation*, *Doctor*, *Lucky Four*, *North West*, *Omineca*, and *Red Seal*, with the *Hopeful* staked south-west from and adjoining the *North West* claim. The owners of the group are T. H. Large, J. Dyer, M. H. Large, and E. J. Large, of Prince Rupert. All the work has been done on the *North West* claim.

It was expected, from information received, that some of the owners would be found working on the ground, but this was not the case on June 18th, when the property was visited, as they had been there earlier and packed in supplies, but had returned to Prince Rupert for more supplies; consequently, in the search for the workings and outcroppings unaided, some may have been overlooked.

The property is situated at the head of Salmon river, about four miles, in a northerly direction, from a trapper's cabin on a branch of the main trail known as the 21-mile cabin. The most important showings occur at an elevation of 3,700 to 4,000 feet above sea-level on the southerly slope of a high mountain range that forms the divide between the Zymoetz river and the headwaters of Kleanza creek. A fairly good pack-trail connects the 21-mile cabin with the camp on the property, consisting of two cabins, from which a foot-trail has been made to connect with the mine-workings, situated about a quarter of a mile distant and at about 200 feet higher elevation.

Ore-body.—An intrusive, andesitic dyke, some 120 feet in width, occurs as a bold, precipitous bluff reaching a height of more than 50 feet above a wide bench on the southerly slope of the mountain. The surface of this dyke shows many fissures which apparently maintain continuity both vertically and along their strikes. These fissures all contain such copper minerials as chalcocite, bornite, a little native copper, and a good deal of stain from copper carbonates. All the indications point to the existence of a large amount of low-grade copper ore.

The fractures vary in width from a few inches to about 2 feet, and there are several of them within a width of 70 feet. The spaces on the surface of the dyke between the fractures show considerable mineralization across the entire width of 70 feet, but across 16 feet 6 inches on the north-east side of the face of the dyke the mineralization is more pronounced than across

the adjoining 54 feet towards the south-west. No blasting has been done on the face of the bluff to the south-west, although the dyke is about 50 feet wider. The remainder of the width of the dyke, about 50 feet farther to the south-west, shows practically little effect from any mineralizing agency so far as appears from an examination of the surface.

The south-east face of the dyke has been blasted off and the mineral quarried for a width of 70 feet to a height of about 30 feet. All of the material so broken down has accumulated at the foot of the bluff. This represents quite a large tonnage of low-grade ore from which could be sorted several tons of high grade, the remainder being of too low a grade to stand shipping, even if good transportation facilities existed.

It appeared doubtful whether sorting would pay, and, as it is practically impossible to mine the narrow stringers separately, an average sample was taken with a hammer and moil across a width of 16 feet 6 inches of the face of the dyke which assayed: Gold, trace; silver, 1 oz.; copper, 3.8 per cent.; showing it to represent ore of commercial grade.

The rest of the face of the quarry, 54 feet in width, was not sampled; although the mineralization there was not quite as strong as across the section sampled, yet it seemed sufficient to warrant mining if transportation and smelting facilities were favourable.

The outcroppings on the top of the bluff were followed for some considerable distance until the snow-line was reached; where the rocks were bare, the same conditions, with regard to structure and width, apparently prevailed. The dips of the fractures containing the copper minerals are vertical, while the dip at the contact between the andesitic dyke and a soft rock, resembling a black ferruginous sandstone, is at an angle of 75 degrees. The dyke cuts the strata of the slate almost at right angles, the strike of the slate being N. 70° E., with the dip of the strata at an angle of 75° towards N. 20° W.

No work was found on any other of the mineral claims belonging to the group; it was said afterwards, by one of the owners, that practically all of the work had been seen, but not all of the outcroppings.

The distance from the *North West* group northerly to the head of Kleanza creek across the range of mountains forming the divide between that creek and the Zymoetz river is only about three miles in a direct line. It is in this range of mountains that a great deal of prospecting has been done and about thirty mineral claims located. Had the examination been made about a month later, the divide could easily have been crossed, the summit being about 5,600 feet elevation, although some of the peaks reach nearly 8,000 feet, but the snowslides were so active at the time that any such attempt would have been foolhardy.

From the bridge across Salmon river to the bridge across the Zymoetz river at the big bend, a distance of about nine miles, there have been no mineral claims reported, except near the 25-mile post, where a group of claims was located some years back. Here a bluff on the river-bank was found to contain some particles of native copper, but no work had been done, which is to be regretted, since it is possible that thoroughly systematic prospecting might have been followed by gratifying results. The country-rock crossed for about a mile between the 25- and 26-mile posts is made up of volcanics, some having amygaloidal structure and showing considerable mineralization, but easterly from the 26-mile post to the bridge at the 30-mile post the rock formation, traversed by the trail, is chiefly made up of conglomerate and sedimentary rocks, with the conglomerate overlying red feldspathic sandstone and shale of a purplish tint.

TREASURE MOUNTAIN.

The mountain range, locally known as Treasure mountain, which rises between this portion of the Zymoetz river and Kleanza creek, presents many characteristics similar to those found on the *North West* group at the head of Salmon river. Kleanza, or Gold creek, as it is

locally called, has its source in Summit lake and the several tributaries which head in the northerly slopes of Treasure mountain. A good horse-trail connects this section with the Zymoetz river and also with Kitsalas village, about twenty miles west from Summit lake.

This range of mountains, of which one of the loftiest peaks is locally called Treasure mountain, is extremely rugged, with precipitous slopes, deep basins caused by erosion, and many small watercourses flowing from glaciers on the summits. Above an elevation of about 3,000 feet there is no timber whatever; on the lower slopes there is an ample supply of hemlock, cedar, and balsam for mining, building, and fuel.

The climatic conditions are those usually found in high mountain ranges; heavy snow-storms may be expected on the summits almost any month in the year, as well as rain and fog at lower levels. Two trips had to be made into this section, as in June the danger from snowslides rendered any attempt to reach the summits impracticable, but with proper camp accommodations and precautions taken to secure miners against danger from snowslides, work could be carried on during every month in the year.

The lack of transportation is the great drawback. When the Grand Trunk Pacific Railway Company had surveys made up the Zymoetz river and grading was commenced near Copper City some years ago, this section was the scene of much activity, since it would have been comparatively easy to construct a system of aerial tramways for transporting ores from Treasure mountain to the Zymoetz river. However, since the Grand Trunk Pacific Company abandoned the Zymoetz river route, the development of this mineral-bearing section has been practically at a standstill, and owners of mineral claims have been merely performing the necessary assessment-work.

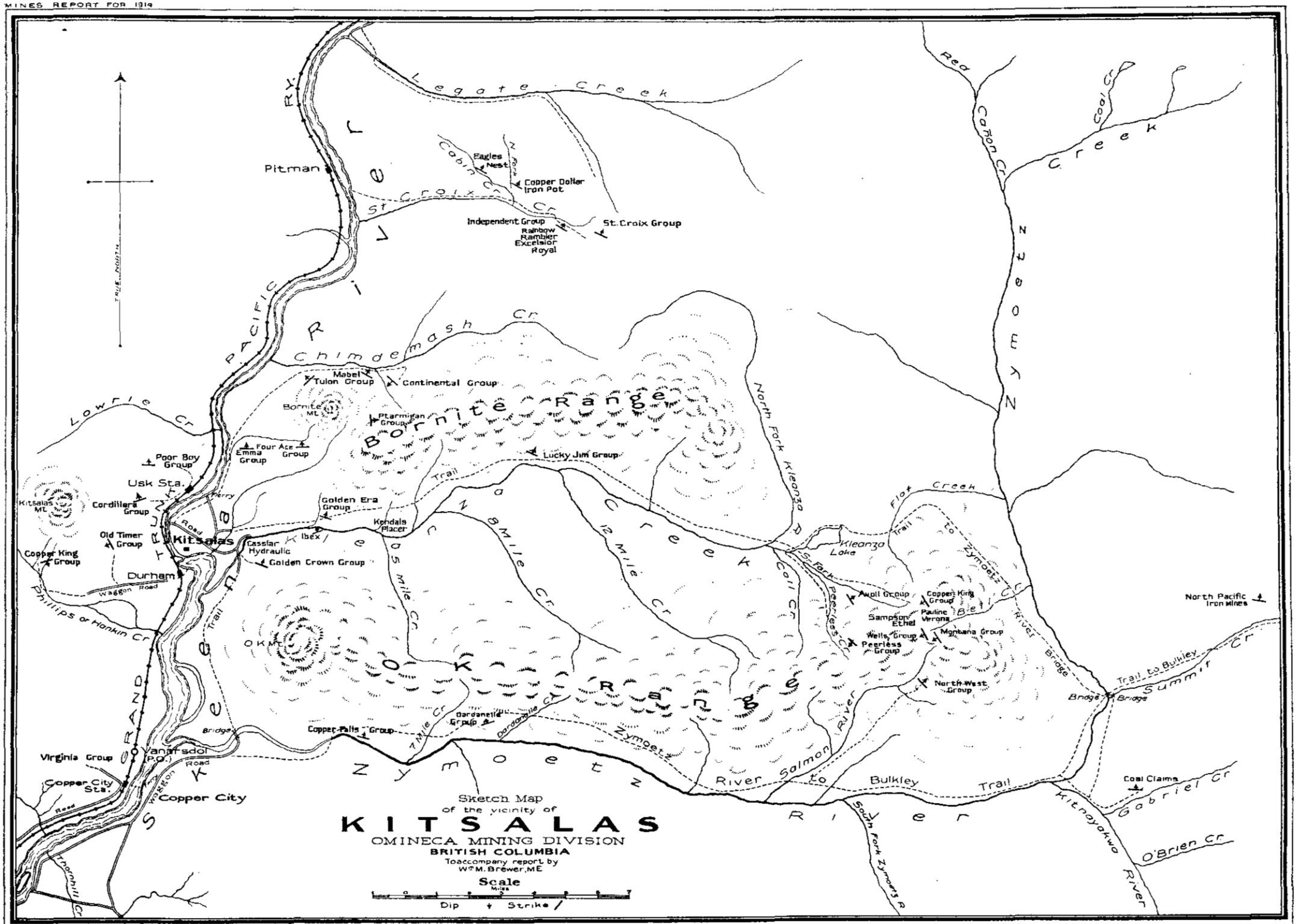
Wells Group.

This property is located on the north side of and also on the summit of Treasure mountain at elevations ranging from 4,300 to 5,600 feet above sea-level. There are seven mineral claims in the group, named as follows: The *Grizzly Circus*, *Wells*, *Simmer and Jack*, *Andesite*, *Mesozoic*, *Giant Powder*, and *Imogen*. These are owned by Lee Bethuren, J. D. Wells, and Eli T. H. Hamblet, of Kitsalas. In addition to the group, there are four claims in which the same owners are also interested—the *Ethel*, *Sampson*, *Pauline*, and *Verona* mineral claims. Some of the boundaries of these join the boundaries of the group, but these last-named claims had not been included in July, 1914.

The property is reached by a branch from the main Kleanza trail, the forks being at the west end of Summit lake. From this point the course of the South fork of the Kleanza is followed up to its head; there the trail crosses the north-east spur of Treasure mountain, in a pass, at an elevation of 4,600 feet above sea-level, descending 300 feet down the mountain-side overlooking the head of Bell creek, a tributary of the Zymoetz river, and follows around a bench in an easterly direction to the *Grizzly Circus* mineral claim, a distance of about two miles and a half.

The first mineral seen on the property was at this point, where an outcropping of quartz, heavily stained with copper carbonates, is exposed crossing a small watercourse, but until some prospecting-work has been done, no material data can be gleaned as to the extent, strike, or dip, since the outcropping, as exposed, did not show its full width nor sufficient length.

From this point the trail was followed on to the adjoining mineral claim, the *Wells;* on this claim, at an elevation of 4,600 feet and about 500 feet from the north-east side line and 200 feet from the south-east end line, near a big snowslide, attention was directed to an outcrop of copper ore at the contact between two igneous rocks, one slightly porphyritic, probably an andesite porphyrite; the other a well-defined intrusive dyke very similar to the dyke described as occurring on the *North West* group.



Drawn by Geographic Branch, Surveyor Generals Office.

The width of this dyke is 35 feet; a portion of it has been subjected to fissuring and shearing movements, and the fractures thus formed are filled with chalcocite and bornite ore. These fissures are exposed in a large open-cut 200 feet above where the outcroppings were first seen, and were five in number, occurring in a width of 4 feet 3 inches of dyke, and in which the aggregate width of ore is 1 foot. A sample taken from this width assayed: Gold, 0.06 oz.; silver, 6.0 oz.; copper, 13.7 per cent.

From this open-cut the line of strike of the vein followed the course of a gulch that was partially filled with a snowslide, but the owners of the property had employed men to shovel snow at several places up the gulch where open-cuts had been made in past seasons, so that it was thereby possible to form a fairly accurate opinion of the possibilities of the prospect. The difference in altitude between the open-cut where the sample referred to was taken and the summit of the dyke at the top of the gulch is 800 feet, and by horizontal distance between the two points is about 600 feet.

Sufficient outcroppings were seen to justify the conclusion that the fissured zone in the dyke maintained continuity up the gulch, but whether the ore-bodies in the fissures are persistently continuous or whether they are lenticular cannot be stated, as in so many places in the gulch the snow formed a deep covering, as it did also on the summit, except at one point where the dyke forms a bold bluff, in which outcroppings of copper minerals occur.

A long open-cut has been made across the face of the bluff referred to, which exposes mineralization in the dyke to the foot of the bluff, to a depth of 15 or 20 feet and for a width of 34 feet; this represents a diagonal, rather than a right-angle, crosscut across the face of the dyke. The fissuring in this face was pronounced, but, as the fractures were quite narrow and numerous, it seemed to be impossible to attempt to mine profitably unless the whole width that carried mineral was included.

In order to ascertain the average values represented by the mineralization, two samples were taken across the face of the open-cut; one represented a fair average across 23 feet 6 inches on the north-east end of the open-cut. This assayed: Gold, trace; silver, 0.6 oz.; copper, 0.8 per cent. The other sample represented a fair average across 8 feet adjoining and south-west from the first sample. This assayed: Gold, trace; silver, 0.4 oz.; copper, 0.5 per cent.

Owing to the snow covering the surface between the exposures of the ore in the gulch and the outcroppings last described, it was impossible to trace the connection, if any exists, between them.

The owners af the *Wells* group have confined all the work to the showings described occurring on the *Wells* claim, and, although they reported outcroppings of ledges showing copper-bearing minerals on other claims in the group, the snow covered the surface of these claims to such a depth as to render any examination impossible.

Montana Group. This group of five mineral claims is located in a south-easterly direction from the *Wells* group, and about a mile and a half distant, but across the summit of another spur of Treasure mountain. Owing to the extremely bad weather during the visit to Treasure mountain, the writer was unable to examine this property, although he waited for some days, during which snow and rain storms with heavy fogs in the mountains prevailed continuously.

Copper King Group. This group, consisting of six claims, is owned by T. H. Large, J. Dyer, M. H. Large, and E. J. Large, of Prince Rupert. The property is located on the summit of the northern spur of Treasure mountain at an elevation of nearly 5,000 feet above sea-level, or about 400 feet higher than the pass

at the head of the South fork of Kleanza creek. It is reached by the same trail as the *Wells* group, except that to reach the *Copper King* the traveller branches off to the north from the summit of the pass up the mountain.

The absence of all of the owners and the fact that the guide employed had never been on the property made any examination of the property impossible. From information later received from the owners, it would appear that there were outcroppings of copper minerals very similar to those seen on the *North West* and *Wells* groups, but that there had been too little development-work done to determine any material facts.

Avon Group. This group contains three mineral claims—the *Lake View*, *Avon*, and *Maple Leaf*, owned by R. Lowrie, of Usk—and is situated on a small tributary of the South fork of Kleanza creek about half a mile above the forks. The country-rock is a green andesite lying nearly horizontal and in places much altered. To the east there is an intrusion of granitoid rock, and, apparently, a dyke from which occurs on the *Avon* claim, about 40 feet wide, in which is much garnetite, quartz, calcite in well-defined, large crystals, and some brecciation. These rocks form the gangue material in a mineralized zone in the dyke, in which occur the following minerals: Chalcocite, bornite, chalcopyrite, iron pyrites, and copper carbonates.

Some open-cuts had been made exposing the mineralization, but the work is insufficient to demonstrate the prospective value of the property from a mining standpoint; in fact, nothing more can be said than that on this group of claims there are such showings of mineralization as to commend the property as a prospect with possibilities.

Peerless Group. This group contains the following named mineral claims: *Princess*, *Windy Zone*, *Mountaineer*, *Peerless*, *Empress*, *Wolverine*, and *Ideal*. At the time the property was visited, on July 26th, it was held under bond by Dr. Reich, of New York, together with nine other mineral claims which adjoin the *Peerless* group. This property is situated on the northern slope and extends over the extreme summit of Treasure mountain at elevations from about 2,500 to 5,000 feet above sea-level. As most of the trails were either buried deep by snowslides or had been cut across snowslides and obliterated by heavy rains and summer snow, it was a most difficult proposition to examine, because of the precipitous slope of the mountains, the many deep gulches with practically vertical sides, and immense snow and rock slides. Two attempts were made, the first in June and the second at the latter end of July, to thoroughly examine the occurrence of the ledges of mineral that have been exposed and the work done on this group, but on account of snow and fog it had to be given up after only a partial examination.

The country-rock is, for the most part, greenish- and reddish-coloured andesite. There has been very much disturbance, as evidenced by the large number of intrusive dykes, and these usually show effects from fissuring and shearing, similar to the conditions already referred to on the other groups of mineral claims in this same range of mountains. Usually the fissured zones have their lines of strike from north-west to south-east at varying angles, but some of them strike almost at right angles to this course and indicate the occurrence of a system of fissuring radiating from some common point. The dips are nearly vertical where any determination could be arrived at.

There have been several open-cuts made to expose the fissured zones in some of the dykes. All of these fissures contain bodies of such copper minerals as chalcocite, bornite, carbonates, and some chalcopyrite in a gangue of quartz usually associated with calcite, the latter being in well-defined and often quite large crystals measuring several inches across the faces.

It was not practicable to make a systematic sampling of these several showings, from many of which very high-grade specimens of chalcocite and bornite can be obtained, but these would not represent an average of the ore-body, as it would have to be mined, as usually this high-grade ore occurs as kidneys or lenses in the fissures more or less regularly deposited throughout the gangue material. Where so many mineral showings are exposed, as is the case on this group of claims, such a systematic sampling is necessary in order to avoid misleading results.

The ore from the *Peerless* group could be transported by aerial tramway to the Zymoetz river or Kleanza creek, but the distance to the latter would be much less than to the former. The probabilities of railroad-construction along either of these streams, whether to connect with the Grand Trunk Pacific or as an independent road with its ocean terminus at Kitimat, are problems for future consideration and will depend upon the tonnage available. Consequently, it is most advisable that the mineral claims, especially where the indications for large tonnage are as pronounced as they are on the *North West*, *Wells*, *Peerless*, and other groups in this range of mountains, should be systematically developed by such work as will show the available "ore in sight," together with the values such ore will average when mined.

The opinion of the writer is that a number of the mineralized dykes in this section will produce a large tonnage of low-grade ore, and that it will be found more advisable to develop with that end in view than to attempt to mine for the high grade, which will undoubtedly produce only a limited tonnage, such as would not be as attractive to railroad-builders as the larger tonnage, although of lower grade.

SUMMIT CREEK.

Returning to the main trail up the Zymoetz river, where that river is crossed by a substantial bridge at the confluence of Summit creek, about thirty miles from Copper City, this trail was followed up Summit creek in a north-easterly direction about eight miles to the iron-ore claims located some years back by Mansel Clarke, a prospector from Prince Rupert, and later sold by him to the North Pacific Iron Mines, Limited, of Prince Rupert.

The trail follows near and on the north side of Summit creek for five miles; there the creek is crossed on a good bridge; the trail then continues along the south side of the creek to the summit and headwaters of the Telkwa river.

The mountain ranges on both sides of Summit creek are rugged, with some extensive glaciers within sight, from which rapid mountain streams flow carrying large volumes of water.

The rocks at the mouth of the Summit creek are red to purplish sedimentaries, but, a short distance up the creek, granites and granitoid rocks occur with which are associated porphyrites and andesites.

The igneous rocks were found to continue to a point near the 37-mile post, where they form a contact with altered sedimentaries very much stained with iron oxide, and it is in this formation that extensive deposits of iron ore occur.

North Pacific Iron Mines, Ltd.

The property owned by this company is situated on the north side of Summit creek and contains nine claims covering a total area of approximately 375 acres, and extending from the creek up the south slope of the mountain from an elevation of 2,600 feet, the lowest point where the iron ore outcrops, to about 3,000 feet above sea-level. The claims comprising this property are: The *Limonite*, *Iron Mountain*, *Iron Valley*, *Iron Horse*, *Old Ironsides*, *Iron Stream*, *Iron Mask*, *Iron Slope*, and *Iron Ridge*. These claims are located in a solid block, the first three being located along the creek from west to east in the order named, with the second three joining on the north, then two adjoining farther north, and the ninth (the *Iron Ridge*) occupying a portion of the summit of the ridge still farther north, but adjoining the *Iron Mask* on that side.

The out-croppings of iron ore near the creek-bed on the *Iron Mountain* claim were traced diagonally across that claim on to the *Old Ironsides* to the north, and from there to the west on the *Iron Horse* claim. For the most part these out-croppings cover a very large acreage of swampy ground on a bench about 200 feet higher than the level of the creek-bed, and on the *Old Ironsides* claim the ore also covers the face of a prominent bluff which has a width of about 200 feet at the base and rises to a height of some 300 feet.

A number of open-cuts and trenches have been made at points around the boundaries of the deposit, but no drilling has been yet done to determine the depth on the swampy bench, so that there is not yet sufficient development to warrant an estimate as to the tonnage available. There is no question but that the quantity of iron ore is great, and from the examination made it is considered that the estimate of 7,500,000 tons made by John V. Rittenhouse, of Seattle, one of the owners, may not be excessive.

The analysis of the several samples indicate that this ore should be classed as a limonite rather than what is commonly known as bog-iron ore; according to Dana's classification where the phosphorus content of the ore is a negligible quantity, such distinction should be made for the reason that a better quality of iron can be made from limonite than from bog-ore. A sample taken, representing a fair average of the solid ore in the deposit at a depth of about 15 feet and about 30 feet in the surface outcropping, assayed: Iron, 51 per cent.; phosphorus, none; sulphur, 1.7 per cent.; silica, 2 per cent.

Another assay made from a sample submitted to the Provincial Mineralogist at Victoria by the owner gave the following returns: Iron, 50.6 per cent.; sulphur, 0.8 per cent.; phosphorus, none; silica, 1.7 per cent.

Other assays made from samples analysed by Falkenburg and Laucks, of Seattle, gave the following returns: Iron, 53.2, 53.2, and 54 per cent.; sulphur, 2.65, 1.89, and 1.15 per cent.; phosphorus, 0.0016, 0.014, and 0.002 per cent.; silica, 1.31, 1.62, and 1.04 per cent.

From the foregoing analyses it will be seen that this iron ore comes well within the "Bessemer limit" for the manufacture of steel or for car-wheel iron.

At the present time this property is handicapped by the lack of transportation, but the Grand Trunk Pacific Railway Company has had a preliminary survey made, and from that data the length of this railroad from the property to Copper City, on the main line of the Grand Trunk Pacific Railway, would be about sixty miles. The writer was informed by C. C. van Arsdol, chief engineer of the Grand Trunk Pacific Railway Company, that it was perfectly feasible to construct a railroad through this portion of the country via the Zymoetz River route for local freight-haulage, but that there were difficulties to be surmounted which made it inadvisable to incorporate that section in a transcontinental route.

The property is very favourably situated with regard to timber for mining, fuel, and a fair supply for lumber, the varieties being of hemlock and balsam, as well as some cedar. The water-supply furnished by Summit creek would be ample for all purposes, even to developing power for a plant of considerable magnitude.

Mansel Clarke, the discoverer and locator of this property, informed the writer that he had found other outcroppings of both magnetite and limonite iron ore for a distance of about nine miles in a N. 75° E. direction, or on the extreme summit at the headwaters of the Telkwa river, but could not find any deposits that would begin to approach in extent the body on the group of mineral claims examined.

Gabriel Creek Coalfield.

Kitnaiakwa creek flows into the Zymoetz river from the south about three miles below the mouth of Summit creek. At the 28-mile post on the main trail near the mouth of the

Kitnaiakwa river a cable has been stretched across the Zymoetz river with a cage attached. A trail has been built up the Kitnaiakwa to its junction with Gabriel creek, and up that creek to a group of claims staked for coal.

An alternative route to this coalfield is by a trail cut from the east side of the bridge across the Zymoetz river; thence in a south-easterly direction after crossing Summit creek near its mouth to the main trail up Gabriel creek. On the south side of Summit creek a wide belt of purple-coloured shale and red feldspathic sandstone occurs, with the line of strike of the strata N. 40° W. and dip at an angle of about 50 degrees towards the north-east.

At a point in the steep northern bank of the creek at an elevation of about 2,200 feet above sea level, and about two miles and a half above the mouth of Gabriel creek, there are the outcroppings of three seams of black shale with some coal, each about 12 inches thick, with clay-partings of about the same thickness. These coal-seams occur between the red feldspathic sandstone for the roof and a clay floor which overlies a black carbonaceous shale. The line of strike of the coal-seams is about N. 30° W. and the dip is at an angle of about 40 degrees towards N. 60° E.

Some serious attempts have been made to prospect the coal-seams by driving three adits at two levels. The upper is about 40 feet above the bed of the creek and the lower is just above high-water mark. Neither of these adits were in a condition to be examined thoroughly, being nearly full of clay from caving, but the lower one was entered for a distance of 63 feet; the face of the adit, however, was apparently a considerable distance farther. This adit was started to crosscut the formation for the purpose of exposing the coal-seams that outcropped at about 30 feet higher elevation, but, judging from the material on the dump, apparently the adit had not been driven far enough to accomplish this. The adit so far as could be seen along the 63 feet examined, was driven through a sand and gravel bank most of that distance. At about 63 feet in from the portal of the adit seams of clay and black shale were exposed, but beyond that point the adit could not be examined because the walls and roof had caved. A sample of the clay was taken for analysis to ascertain if it was a fireclay, but this test showed that it was not, and that it could only be used for making ordinary red brick.

The upper workings consisted of two short adits, both driven on the same level and parallel to each other, with only a few feet intervening between the portals. Both of these had been driven under an outcropping of coal, but neither of the adits could be entered, as they were filled up by material that had caved in from the walls and roof.

At the entrance of one of these adits the three seams of shale and coal with clay partings could be seen, and from these two samples were taken which were found by analysis to contain the following:—

Sample.	Moisture.	Volatile Combustible Matter.	Fixed Carbon.	Ash.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Coal	7.9	18.9	38.9	34.0
Shale and coal	10.0	8.5	0.1	81.4

As there had been no other prospecting-work done on any of the several claims staked, it was not possible to obtain any accurate data as to the extent of the coal-measures in this field, but apparently they occupy a narrow, isolated belt, and that their extent along the line of strike reaches to the neighbourhood of the bridge across the Zymoetz river. Outcroppings of

rock are scarce, but at one point on the trail a patch of grey sandstone was found with ammonite fossils. From the position of the coal-outcroppings on Gabriel creek, together with its strike and dip, it would appear that the grey sandstone underlaid the coal-seams, but at what depth is almost impossible to say until boreholes are made.

The varieties of timber present are principally hemlock and balsam, and the supply is sufficient for mining and fuel purposes for several years to come.

Gabriel creek carries a considerable volume of water, and at one point, near the coal-outcrops, at an elevation of 2,200 feet, has an abrupt fall of about 60 feet, and below the falls flows through a box canyon for a considerable distance. The difference in elevation between Gabriel creek at the falls and the Zymoetz river at the mouth of the Kitnaiakwa is 1,000 feet, the distance being about three miles.

TWELVE-MILE CREEK—KLEANZA CREEK.

Twelve-mile creek flows into Kleanza creek from the south near the 12-mile post on the main trail between the village of Kitsalas and the bridge across the Zymoetz river on the Copper City-Bulkley Valley main trail.

Lucky Jim Group.

The *Lucky Jim* group of mineral claims consists of the *Josie*, *Lucky Jim*, *Grey Wolf*, *Silver Hill*, and *Blue Bird* claims, owned by Fred Forrest and J. Gagne. The *Lucky Jim* claim, the earliest location, was staked in 1908; the *Grey Wolf*, adjoining the *Lucky Jim* on the south, was staked in 1909, and the other claims later. The discovery post on the *Lucky Jim* claim is on an outcropping of three narrow stringers containing iron, chalcocite, bornite, epidote, and chlorite.

The country-rock is a fine-grained, dark-coloured igneous rock, probably a porphyrite; apparently this is a very wide dyke, a portion of which has been sheared and fissured; there are many slickensided cleavage-planes, indicating considerable movement after the formation of the dyke. The line of fissuring can be traced for some distance in a northerly direction, but to the south is hidden by slide-rock. The lines of strike of the three main fissures vary from N. 40° W. to N. 5° E. The dips are at angles of from 55 to 78 degrees towards the north-east, N. 65° E., and N. 85° W.

Near the discovery post, where two open-cuts have been made, the fissures carrying mineral spread out in the shape of a fan. The distance between the two outside stringers is 22 feet, with the rock in the intervening space very much crushed, altered, and almost schistose, but in the floor of one open-cut, 15 feet long by 18 feet deep, the fissuring appears to have narrowed to a width of 5 feet, with the mineralization disseminated through that width. At an elevation of 1,900 feet above sea-level and 60 feet below the outcropping, an adit has been driven nearly 60 feet in a N. 5° E. course, following the strike of the middle stringer as it shows on the surface, and apparently exposing that stringer of mineral at the adit level. Towards the face of the adit the mineralization has the same appearance, as far as being disseminated through the dyke is concerned, as in the floor of the open-cut, with the fissured portion of the dyke decreased to a width of 4 feet 6 inches. An average sample taken at the face of the adit across that width showed it to contain only traces of gold, silver, and copper. Although at that particular point the mineralization is of too low grade to give the property any commercial value, it does not necessarily follow that all of the mineralized material in the drift adit is of equally low grade, but it is shown how very advisable it would be to sample the material systematically in order to ascertain what values are contained before doing further work.

There is no question but that the mineral in the narrow stringers will carry values, but it is doubted if mining operations could be profitably carried on by mining the stringers separately, or whether it would pay to hand-sort the ore as much as would be necessary.

On the *Grey Wolf* mineral claim an incline shaft has been sunk to a depth of about 16 feet below the floor of an open-cut made in the face of a bluff in such a way that the face of the open-cut is about 25 feet high, so that, with the depth of the shaft added, there is exposed a vertical section of an igneous dyke about 40 feet high.

This dyke is wide and appears to be very similar in composition, as well as in appearance, to the dyke occurring on the *Lucky Jim* claim, but the fissuring is not as pronounced, for on the *Grey Wolf* there is only one fracture, 12 inches wide, filled with quartz stained by iron and copper minerals. Occasionally particles of chalcocite and bornite are found in this so-called vein, but judging from an average sample taken across it, the mineralization is not sufficient to make it of any value; where sampled, an assay showed only traces of gold, silver, and copper.

FIVE-MILE CREEK.

Between the *Lucky Jim* group and Five-mile creek, which flows into Kleanza creek near the 5-mile post from Kitsalas, no mineral claims had been staked, but there was a camp near the 9-mile post from which a party of prospectors was endeavouring to locate the leads that carried the ore from which pieces of well-mineralized float had broken off and been washed down the mountain streams, but at the time visited the prospectors had not reported any success.

Five-mile Creek Hydraulic Leases.

The 5-mile post on the main trail is at an elevation of 1,600 feet and 700 feet above the level of the bed of Kleanza creek. On the creek almost directly below the 5-mile post I found some placer-miners at work on a hydraulic lease owned by M. C. Kendal, J. D. Wells, J. Gagne, and Glenn Searle. This ground has been worked successfully, in a small way, by Kendal for the past three or four years, but during the season of 1914 it was the intention of the owners to prepare the ground ready to be worked on a larger scale by piping with water under pressure.

The work being done when the property was visited was cutting a drain-ditch through an old creek-channel, and ground-sluicing the gravel from this through sluice-boxes in which some fairly coarse gold-dust was being saved. The drain-ditch is to be used to divert the water from the present main channel in order to leave the bed dry. Then a large bed-rock flume will be installed and the gravel in the present bed of the creek washed through it. As this portion of the creek-bed has been sufficiently prospected to establish the probable value of a cubic yard of gravel, the owners anticipate profitable results. The rim-rock on the north side of the creek, where it has been exposed by placer-mining operations, was covered by about 5 feet of gravel; this it is expected will be about the average depth to bed-rock in the channel, which is about 100 feet wide. The bed-rock is a green chloritic, feldspathic rock slightly schistose, probably an andesite, with its line of strike north and south. The grade of the creek-bed is sufficient to furnish good dumpage for tailings.

The water to be used for hydraulicking will be taken from Five-mile creek, at 700 feet higher elevation than the bed of the river, and about half a mile distant.

Golden Era Group.

This group of claims is situated three miles east of Kitsalas, on the southern spur of Bornite mountain, and consists of the *Golden Era* and *Chloride*, adjoining claims. The property is owned by J. D. Wells, Dyer and Chrystal, of Kitsalas, A vein, containing arsenical and iron pyrites, in a quartz gangue outcrops on the *Golden Era* claim at an elevation of 1,700 feet and about 500 feet north from the southern boundary and close to the dividing line between the two claims. This vein is a well-defined fissure in a diorite country-rock, with good walls and about an inch of talcose gouge separating the vein-matter from each wall. The foot-wall near the vein is slightly gneissic in structure but the hanging-wall is massive.

The line of strike of the vein is N. 40° W. and the dip is at an angle of 40 degrees towards N. 50° E. or into the mountain-side. An open-cut has been made in which the vein, 18 inches wide, is exposed in the face for 10 feet high and 12 feet long. By the outcroppings the extension of this vein can be traced towards the south-east for a distance of about 200 feet on to the *Chloride* mineral claim adjoining. A sample, typical of the ore-body, but not to be considered as an average, assayed: Gold, 0.26 oz.; silver, 1.4 oz.

An open-cut has been made on the *Chloride* claim about 200 feet south-east from that on the *Golden Era*, in which the vein is exposed, and also a dyke of mica lamprophyre which cuts across both the country-rock and vein at right angles to the line of strike. The width of this dyke has never been determined, nor has any prospecting been done to find the vein on the south-easterly side of the dyke, where the overburden of slide-rock and debris is quite deep.

A second vein has been exposed in a shallow open-cut on the *Chloride* claim about 20 feet higher than the one already mentioned, but so little work had been done on this, and as there were no natural exposures of outcroppings, it was hardly possible to form any reliable opinion about it. Apparently the hanging-wall of the *Golden Era* vein is the foot-wall of the second vein, the filling of which is chiefly iron pyrites with a little azurite and malachite in a quartz gangue. The line of strike and dip of this vein conform with those of the *Golden Era* vein.

The examination of this group of mineral claims left the impression of the advisability of doing more thorough and systematic prospecting in this section, as the geological formation is favourable and the transportation facilities are good.

Ibex.

The *Ibex* mineral claim is situated on the south side of Kleanza creek, almost due south from the *Golden Era* group, and about three miles easterly from Kitsalas. The claim extends from the creek-bed up the mountain-side to the south; the owners are Moody, Richardson, and Scott, of Kitsalas, and R. H. Jennings, of Prince Rupert.

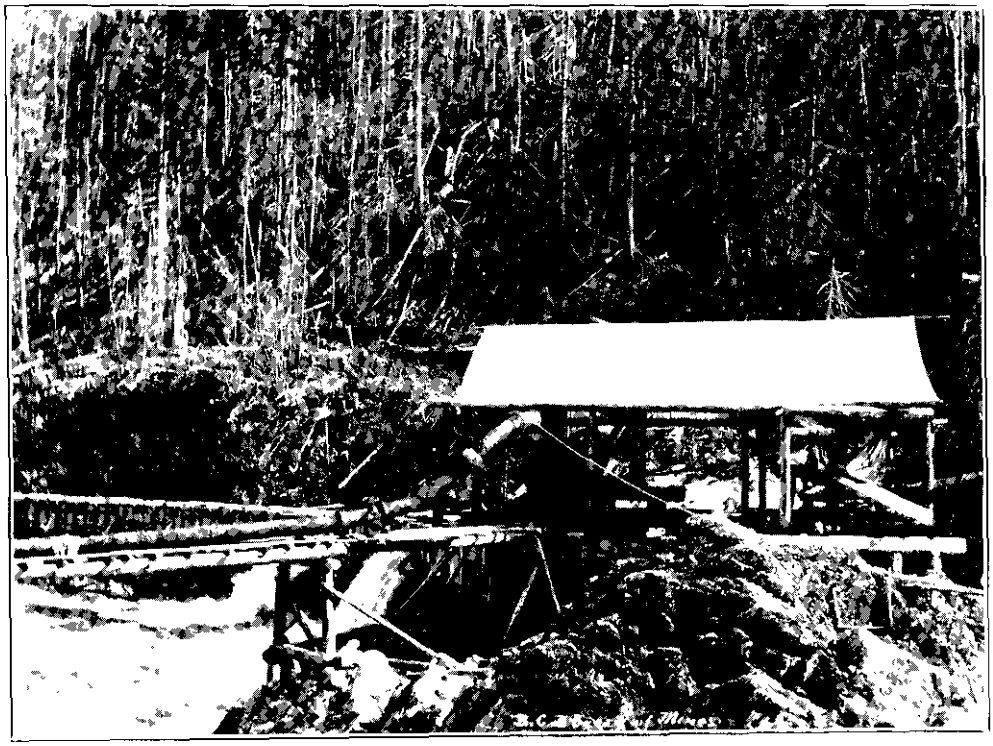
An outcropping of mineral, consisting of iron pyrites associated with copper minerals and galena in an andesite dyke, occurs at the foot of a steep bluff close to the bed of the creek on the south side. The minerals appear as replacements in the dyke rather than as vein-matter in a fissure. There are no well-defined walls, and although outcroppings are found for a distance of some 20 feet along a line of strike, the extent cannot be determined until more work has been done. This has been attempted at a point some 50 or 60 feet up the steep bluff where a short adit has been driven, but so far with only partially satisfactory results. An open-cut has also been made near the level of the creek-bed. A sample, representing sorted ore from the dump at the open-cut, assayed: Gold, 0.12 oz.; silver, 3.5 oz.; copper, 3.8 per cent.

Cassiar Hydraulic Mining Co.

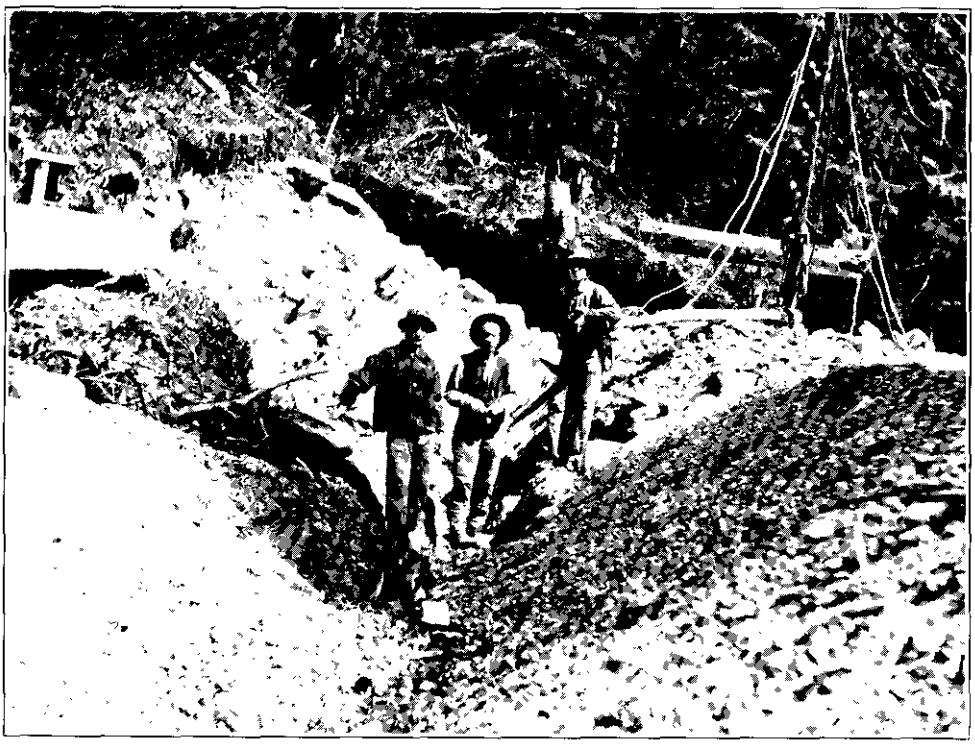
This company, which was organized in 1911, has acquired an hydraulic lease extending for half a mile in length along Kleanza creek, where the bed and bars on each limit average about a quarter of a mile wide. This lease commences at the falls situated about two miles above its confluence with the Skeena river at an elevation of 100 feet higher than the mouth. The officers of the company are Angus St. Marie, general manager; Thos. Falcon, secretary; and Lee Bethuren, superintendent.

Kleanza creek was the scene of placer-mining operations about forty years ago, when the work was carried on with ordinary sluice-boxes by men shovelling in the gravel from the bars on each limit, but there was too much water in the creek and bed-rock proved too deep for hand-work.

Since the Cassiar Hydraulic Company began operations by the installation of machinery in 1912, various causes, such as high water in 1913 which washed away a considerable length of the flume, have delayed the company from doing actual mining until this past summer,



Cassiar M. Co.'s Hydraulic Plant—Kleanza Creek—Omineca M.D.



Five-mile Creek Hydraulic Mine—Kleanza Creek—Omineca M.D.

when it was expected, in June, that the results would prove satisfactory. During July, however, the heavy, continuous rains and consequent high water prevented mining. Preparations had been made to bed-rock flume the bed of the stream by the construction of a log dam across it to divert the water from the main channel into a drain-ditch 400 feet long, of an average depth of 10 feet, and width of about 10 feet, but the stream rose so high that the water flowed over the dam, and the construction of the bed-rock flume could not be begun until late in the season.

Instead of constructing a flume from far enough up the creek to bring water with sufficient pressure to hydraulic direct, the company installed a pumping plant, driven by water-power, and the stream used for hydraulicking is pumped through the pipe-line under a pressure of 85 lb. through a 3-inch nozzle.

The pumping plant consists of a 36-inch Worthington centrifugal four-stage pump run by a 42-inch turbine wheel. This pumps the water into a pipe 14 inches in diameter, which is reduced down to 10 inches at the giant, tipped with either a 3-inch, 3½-inch, or 4-inch nozzle; there is also a 10-inch hydraulic elevator. The water to drive the turbine-wheel is brought through a flume 700 feet long by 8 feet wide by 4 feet high, with a grade of ½ inch to 12 feet. The pumping plant is built in the creek-bed at the head of a box canyon, where a fall of 24 feet in the creek affords most excellent dumpage facilities.

The bed-rock is heavy clay overlying a granitoid rock, but, as it has only been exposed in three places in the drain-ditch, no estimate can be made as to its average depth. In one place, on the bar on the north side of the creek near the falls, this clay bed-rock was reached at a depth of about 5 feet. A shaft was then sunk in the clay a depth of 15 feet, when granitoid rock in-place was exposed, and, as no placer gold could be found in the clay or on the rock, it was taken for granted that the clay was the permanent bed-rock along that portion of the stream.

The rock formation changes about a quarter of a mile above the canyon to a metamorphosed argillite, and above this point the gravel-bar on the right limit of the stream is about 30 feet high, but above bed-rock carries small values. The gravel-bar is much shallower from there down the stream.

The placer gold found in the river is quite coarse; boulders are found in considerable quantity, but not very large, and are easily handled with derricks.

O.K. MOUNTAIN.

This is the local name given to a lofty peak on the south side of Kleanza creek, because, when the snow partially covers the northern spur, the two letters "O.K." are distinctly outlined. Outcroppings of free-milling, gold-bearing quartz were discovered near the base of this mountain some years ago, and the *Golden Crown* group of mineral claims was located.

Golden Crown Group.

This group is situated on the opposite side of the Skeena river from the Grand Trunk Pacific Railway about two miles from Kitsalas, and consists of the following-named mineral claims: The *Ruby*, *Golden Crown*, *Granite*, *Lucky Jim Frac.*, and *Noble Five*, owned by J. D. Wells and associates, of Kitsalas. There are apparently three distinct veins on the *Golden Crown* claim, with their lines of strike and dips nearly parallel. These veins are in a sheared zone in the Coast granite which has been much disturbed and faulted by intrusive dykes of mica lamphrophyre, as classified by the Canadian Geological Survey. These dykes are found crosscutting the veins as well as paralleling their lines of strike, and usually dipping at nearly the same angle and in the same direction as the veins. The No. 3 vein is the highest in the series. Its line of strike is N. 40° W. and its dip is at an angle of 40 degrees towards N. 50° E.

At an elevation of 575 feet this vein has been exposed in the No. 4 adit, driven 12 feet along the vein, which is fairly well defined and filled with iron pyrites in a quartz gangue. There is an average width of 2 feet of this quartz exposed in the roof and face of the drift, of which an average sample across the face assayed only traces in gold and silver.

About 150 feet south-west from, and on about the same level as No. 4 adit, the Nos. 1 and 2 veins are exposed in the No. 3 adit. This is driven for a distance of 75 feet in a general southerly course along the veins, both of which are exposed for the length of the adit, and form a junction near the face where the width of quartz is 2 feet, with granite for the hanging-wall and an igneous dyke for the foot-wall, dipping at an angle of 40 degrees towards the east. The igneous dyke parallels the strike of the vein and forms the hanging-wall for about 30 feet from the portal, when the veins appear to cut through it, and it is the foot-wall from that point to the face, appearing to continue as such beyond. The country-rock through which this adit is driven is very much disturbed and broken up, and each of the veins in the drift is only a few inches wide until they unite at the face.

The No. 2 adit is driven at a somewhat higher elevation than No. 3, and apparently exposes both Nos. 1 and 2 veins; also an igneous dyke, similar to the one seen in No. 3 adit, paralleling the strike of the veins for about 15 feet, beyond which the dyke appears to cut out, leaving the country-rock very much less disturbed, and, in the face, a short distance farther, the two veins have formed a junction with the line of strike N. 40° W. and dipping at an angle of 29 degrees towards N. 50° E.

There is, at the face of the adit, quartz of a width of 4 feet between well-defined granite walls, with a few inches of gouge on each wall. An average sample taken across 4 feet of quartz at the face of the No. 2 adit assayed: Gold, 0.12 oz.; silver, 1.1 oz.

The following is a list of assays said to have been made by Allan McCullough, B.A., of Tacoma, Wash, U.S.A., from samples that J. D. Wells, the owner of the *Golden Crown* group, informed me he had taken from various points in the workings on the Nos. 1 and 2 veins:—

Sample No.	Gold.	Silver.	Copper.
	Oz.	Oz.	Per Cent.
24	0.35	5.10	Trace.
25	0.49	1.00	Trace.
26	0.16	Trace	*Nil.*
27	0.18	*Nil.*	0.40
28	Trace.	*Nil.*	*Nil.*
29	0.17	0.20	0.20
30	0.38	0.20	0.50

At an elevation of 775 feet the No. 1 adit has been driven in for 115 feet; at the portal there is a quartz-outcrop 5 feet wide, between well-defined granite walls; the quartz carries small particles of free gold and iron pyrites.

The course of the adit for 20 feet is S. 50° E., and from that point to the face, 95 feet beyond, it is S. 35° E. These courses correspond with the line of strike of the fissure, assumed to be the No. 1 vein. At a point 10 feet under cover from the portal of the adit the vein splits, and two veins are exposed in the drift for a short distance. As the lower or No. 1 vein appeared to be the stronger, the course of the adit was slightly changed to conform with its line of strike, and at the point where the turn was made an incline winze has been sunk on the vein 14 feet, following the foot-wall at an angle of 21 degrees, which is 20 degrees flatter than at the portal.

The width of quartz gradually becomes narrower from the portal to the split in the vein, where the No. 1 vein is 18 inches wide, and continues to hold that width in the winze as well as along the strike for 30 feet beyond the turn in the adit, when, 6 feet farther, it decreases to 6 inches wide, where an igneous dyke intrudes. The adit has been driven through this dyke, which is 18 feet wide, and beyond it, for a distance of about 40 feet. The fissure, corresponding with the No. 1 vein, continues through the dyke to the face of the adit, but the vein-matter appears lean and is only about 6 inches wide. Near the face the quartz carries iron pyrites and the walls of the vein are 12 inches apart. A sample taken across 18 inches at a point 50 feet under cover from the portal, where the width of the vein commences to decrease, assayed: Gold, 3.32 oz.; silver, 4.5 oz.

The extreme apex of this vein, so far as the open-cuts show, outcrops at a point about 300 feet easterly from the No. 1 adit, and about 150 feet higher elevation. From the variable values of the samples as shown by the assay returns, it is evident that a very systematic and careful sampling is necessary in order to demonstrate the commercial value of the property, as well as to determine the best method of treatment for the ore. There is an ample supply of water in Kleanza creek that can be economically developed to furnish all the power necessary to run a fairly large plant. The timber-supply, consisting principally of hemlock and cedar, is quite plentiful and accessible.

An aerial tramway about two miles in length could easily be constructed to transport ore to the railway-track on the opposite side of the Skeena river below Kitsalas canyon, if such policy was deemed advisable.

BORNITE MOUNTAIN RANGE.

The area, bounded on the west by the Skeena river from Kitsalas canyon to the mouth of Chimdemash creek, on the north by Chimdemash creek, and on the south by the lower portion of Kleanza creek, is covered by a range of high mountains locally called Bornite range. This name was given to these mountains because, about 1890, pieces of float of bornite were found by hunters and trappers in some of the watercourses and slides at high altitudes These discoveries encouraged prospectors to search for the source of the float, and, later, to the location of several groups of mineral claims on the western and northern spurs of the mountain range. Amongst the earlier of these locations were the *Emma*, *Four Ace*, *Ptarmigan*, and *Toulon*. On all of them a considerable amount of development-work was done previous to 1900, but, because of lack of transportation facilities, work was discontinued after Crown grants were obtained, and the properties have remained idle until the present day.

The construction of the Grand Trunk Pacific Railroad revived prospecting since 1910, resulting in the location of the *Continental* group and several other claims on the Chimdemash.

Ptarmigan Group. This group of claims consists of the *Ptarmigan*, *Ptarmigan No. 2*, *Arden*, *Blue Grouse*, *Fedora*, *Emerald*, *La Tosca*, *Missouri*, *Tandem Frac.*, and *Transit*. Crown grants were obtained several years ago after a large amount had been spent, but no work has been done since 1902. The property is at present owned by Mrs. S. A. Singlehurst, of New York, who, it is reported, visited it during the summer of 1913 in company with a mining engineer, and, after an examination had been made, expressed the intention of resuming operations when the railroad company had established a regular freight service.

In the Report by the Minister of Mines for 1901 there is a description of this property by Herbert Carmichael, then Provincial Assayer.

The *Ptarmigan* group is situated near the summit of Bornite mountain at an altitude of 5,000 feet and about four miles from Kitsalas in a north-easterly direction. There was a wagon-road constructed about 1902 to connect the claims with the village, and, later, a small shipment of ore was hauled over this road, and transported for treatment, by the Hudson's Bay Company's sternwheel steamer to Port Essington; thence by the S.S. "Boscowitz" to Vancouver, where it was transhipped to the Tacoma smelter. So far as can be learned, there is no record of the values contained in this shipment, but such would have had to be exceptionally high to stand the expense of transportation alone, without considering the costs of mining and smelting.

Outcroppings of galena, bornite, and chalcopyrite in a quartz gangue fill a vein in an igneous rock resembling diorite. The strike of this vein is north and the dip 75 degrees towards the east. The width of the vein varies approximately from 2 to 4 feet.

A shaft has been sunk to a depth of 130 feet, with crosscuts and drifts from tho 30-, 60-, and 100-foot levels. At the 30-foot level the drift to the north is 20 feet long and to the south 25 feet; at the 60-foot level the drift to the south is 16 feet long; at the 100-foot level drifts to the north and south total 60 feet in length. In addition to this work there are a number of open-cuts on the surface.

Emma Group. This property consists of the *Emma*, *I.X.L.*, and *Boot Jack* mineral claims, owned by the Skeena River Mining Company, and is situated on the east bank of the Skeena river in the foot-hills of the Bornite Mountain range, about half a mile north from the Government ferry across the river to Usk Station, on the Grand Trunk Pacific Railroad, and at the end of the wagon-road connecting Usk with the village of Kitsalas.

At a point 500 feet above sea-level, or 200 feet above the Skeena river, and 1,300 feet east from the river-bank, where the side of the mountain is quite steep, there is outcropping a fissure-vein filled with quartz mineralized with bornite, iron pyrites, and chalcopyrite, lying between well-defined walls, with a few inches of gouge between each wall and the vein-matter. The rock forming both walls is a slightly schistose, close-grained porphyrite.

A few feet below this outcrop a drift adit was driven in 1897 for about 170 feet along the strike of the vein, which is to the east, the angle of the dip being 47 degrees towards the north. In this the vein is not well exposed from the portal to a point 65 feet in because of the timbering; however, sufficient of this ore-body was visible to indicate its continuity. From there to the face of the adit is not timbered, so a close examination could be made. For the first 25 feet beyond the timbering a dyke appears as an intrusion, but beyond the east contact between the dyke and the country-rock the vein-structure is very regular and well defined. The ore-body as here exposed is more than 6 feet wide; at the face of the adit the quartz is narrower and, instead of one body, is divided into several narrow stringers, the widest being about 15 inches, with brecciated country-rock between, but the fissure with well-defined walls remains persistent, and indicated that the quartz in the vein probably had a lenticular structure, with the lenses lying *en eschelon* in the fissure.

As it was not feasible to systematically sample the vein because of the timbering, a fairly average sample was taken from a dump of about 200 tons at the portal of the adit; this sample assayed: Gold, 0.3 oz.; silver, 1.9 oz.; copper, 3.3 per cent.

Three other samples, assayed by Allan McCullough, of Tacoma, the samples having been furnished by the owners, I was reliably informed showed the following values :—

Sample No.	Gold.	Silver.	Copper.
	Oz.	Oz.	Per Cent.
1	0.44	*Nil.*	8.70
2	1.04	0.40	Trace.
3	1.08	Trace.	5.90

The vein as exposed in the *Emma* mineral claim is concealed by underbrush until the eastern boundary of that claim is reached at the No. 1 post of the *I.X.L.* claim, at an elevation of 1,000 feet. Near this post there is an extensive outcropping of quartz mineralized with bornite, iron pyrites, and copper carbonates.

An open-cut had been made on this outcropping, exposing a vein from 6 to 10 feet wide, with its line of strike S. 80° E. and apparently dipping at an angle of 58 degrees towards S. 10° W.; but, as there were evidences of local disturbance in the country-rock formation, these directions may prove to be inaccurate when further work is done. A sample representative of the vein-matter, but not taken as an average, assayed: Gold, 0.02 oz.; silver, 8.04 oz.; copper, 6 per cent.

Four Aces Group.

This group contains four Crown-granted mineral claims and a fractional claim, owned by P. Hickey, of Victoria; John Flewin and George Rudge, of Port Simpson. The property is adjoining the eastern boundary-line of the *Emma* group, at a much higher altitude, on the western spur of Bornite mountain, the westerly portion of the property being at an elevation of 1,900 feet above sea-level.

I found a series of quartz-outcroppings along a general south-easterly course, the widest being 15 feet, which development-work may prove to represent a vein with unbroken continuity. The country-rock is a green andesite and has schistose structure; this structure is quite pronounced near the fissure, which is fairly well defined at the point where development-work has been done near the western boundary of the property.

Several open-cuts were made previous to the issuing of Crown grants about 1902; many of these were found to be more or less filled from caving, but sufficient could be seen to justify the opinion that the property is well worth systematic development, now that transportation facilities are available.

A systematic sampling of all the showings was not possible because of the caved condition of many of the cuts, but a representative sample of the quartz vein-filler where it was 15 feet wide assayed: Gold, 0.03 oz.; silver, 3. oz.

CHIMDEMASH CREEK.

Toulon Group.

This group of Crown-granted mineral claims comprises the *Portland, Toulon, Mona, Bull Dog,* and *Montezuma,* owned by the Bornite Mining Company of Portland, Ore., and situated on Chimdemash creek, about 7,000 feet east from the Skeena river. The property is reached by a good horse-trail connecting with the Usk-Kitsalas wagon-road; the nearest station on the Grand Trunk Pacific railroad is Usk, about three miles distant. Several years ago a right-of-way 7,000 feet long was cleared for an aerial tramway to connect the mine-workings with the Skeena river, but construction was not commenced.

A vein, hereinafter referred to as No. 1, outcrops at 1,200 feet elevation, in which bornite, chalcocite, and copper carbonates occur in a quartz gangue. The line of strike of this vein is S. 30° W. and the angle of its dip 40 degrees towards N. 60° W. Both walls are schistose for a short distance from the vein.

There are also some outcroppings which indicate the occurrence of a second vein about 4 feet wide in close proximity to that just referred to, but the second one, if continuous, would appear to have its line of strike S. 15° E. and its dip vertical.

An adit 80 feet in length has been driven along the strike of the No. 1 vein, in which two distinct faults occur, one 45 feet in from the portal, the second 73 feet in, both of which cut the vein. The first appears to have been a down-throw and has thrust the vein down about 6 feet, as it was found below the floor of the adit beyond the fault by sinking a winze 12 feet deep. Beyond the second fault the vein has not been exposed, although, as a winze was only sunk 7 feet, it is quite possible that by sinking deeper the results might prove satisfactory.

After losing the ore-body beyond the second fault a crosscut was driven into the diorite country-rock 60 feet towards S. 60° E. Apparently this crosscut was made in the expectation of exposing the No. 2 vein, but, if so, the work was abandoned before any definite results were obtained. A sample typical of the ore-body, but not to be considered as an average, assayed: Gold, 0.84 oz.; silver, 11.0 oz.; copper, 8.0 per cent.

About 75 feet below the No. 1 adit a second adit had been driven, but could not be entered as the portal had caved in. M. C. Kendal, who had superintended the work, said that this opening had been driven 130 feet in length in a S. 15° E. direction in diorite country-rock, and that the location of this adit had been selected on the assumption that it would expose the so-called No. 2 vein, on which a winze had been sunk 15 feet deep, all in ore, near the portal of No. 1 adit, but as this was filled up at this time no examination could be made.

A third adit is located 25 feet below No. 2 and a little to the west, in which is exposed a vein 18 inches wide filled with the same character of ore as is in the No. 1 adit. This vein has been drifted on for a distance of 50 feet; its line of strike is S. 15° E. and its dip is at an angle of 45 degrees towards S. 75° W. The country-rock forming the walls of this vein has the same schistose structure as the walls of the No. 1 vein, but, taking into consideration the angle of the dip of the No. 1 vein, it appeared to be more likely that the ore-body exposed in in No. 3 adit is a third vein occurring independent of the other two, and is an indication of lenticular structure in the vein formation. In either case a survey, as well as further work, is necessary in order to solve the problem. Considering that the general grade of the ore is so good, and that the indications of an extensive ore-body are promising, this property has possibilities.

Continental Group.

This group consists of the following mineral claims: The *Sunset*, *Continental*, *Sunrise*, *Morning*, and *Black Jack*, owned by the Hamblett Bros. and J. D. Wells, of Kitsalas, and J. S. Cowper, of Vancouver. This property is situated on the northern slope of Bornite mountain on the south side of Chindemash creek, about one mile by trail from the creek. The *Black Jack* and *Morning* claims cover the southerly portion of the area occupied by the group, and their boundaries extend up the mountain-side nearly to the summit, or to an elevation of nearly 5,000 feet. The mineral outcroppings exposed are located on the *Continental* mineral claim at an elevation of 3,900 feet.

Two fairly deep open-cuts, one 47 feet long, the other 20 feet long, have been made, with about 100 feet intervening between the southerly end of the longer or No. 1 cut and the northerly end of the No. 2 cut. In each of these a clean-cut fissure-vein, filled with quartz carrying bornite, chalcopyrite, and iron pyrites has been exposed, although it is concealed by a rock-

slide along the 100 feet intervening between the ends of the open-cuts Both the hanging and foot walls are well defined; the country-rock, belonging to the Kitsalas formation, is diorite and is slightly schistose near the ore-body.

The maximum width of the vein-filler is at the northerly end of the No. 1 open-cut, where it reaches 3 feet, but towards the southerly end of the cut, as well as in the No. 2 cut, the vein is narrower, with a maximum width of about 1 foot. Samples taken, which represented about a fair average from each of the open-cuts, assayed as follows: No. 1 open-cut: Gold, 0.08 oz.; silver, 1.6 oz.; copper, 1.9 per cent. No. 2 open-cut: Gold, 0.04 oz.; silver, 1.4 oz; copper, 4.1 per cent.

A water-power of considerable capacity can be developed on Chimdemash creek, and while there is no timber above the outcroppings, the supply of hemlock at lower levels is quite abundant.

Mabel Claim. This claim is one of the earliest locations in the foot-hills of the Bornite range, and is situated on the south side of Chimdemash creek about two miles above its mouth, and is at present owned by J. D. Wells, of Kitsalas. In 1894 Captain Madden, one of the pioneer placer-miners, drove a short adit into the bank of the creek on a quartz ledge, which is 18 inches wide where it outcrops, at a slightly higher elevation; this adit had caved in, so that an examination was not practicable. A sample taken across the outcrop of 18 inches wide assayed only traces in gold and silver.

ST. CROIX AND LEGATE CREEKS.

The mouth of St. Croix creek is situated on the east side of the Skeena river about five miles above the mouth of Chimdemash creek; Legate creek is another tributary of the Skeena, which empties in about five miles above St. Croix creek.

St. Croix creek is quite large, and falls about 3,000 feet in the distance of eight miles between the headwaters and its mouth. The source of the creek is an extensive glacier formed on the summit of a rugged, precipitous range of mountains, some of the peaks of which reach an elevation of about 7,000 feet. This range is the watershed between St. Croix and Legate creeks, the last named being much the longer, but with less fall.

The Grand Trunk Pacific Railway has a station called Pittman on the opposite side of the Skeena from the mouth of St. Croix creek, but there is no ferry, the crossing being made by small boat or canoe; there is no trail on the east side of the Skeena above the mouth of Chimdemash creek.

The properties on Legate creek are reached from Pacific Station, via Grand Trunk Pacific, crossing near there in a canoe, and following a poor trail up the creek some fourteen miles. Another route is from the *St. Croix* group across the summit of a high mountain range and a glacier, a distance of about six miles. Although there is no trail here, the trip can be made without any great difficulty, except at certain stages of the year, when the conditions on the glacier are such as to endanger life. When the writer visited St. Croix creek it was not advisable to attempt to travel by that route.

From the most reliable information obtainable, it was ascertained that, while there were some good surface showings of such copper minerals as chalcopyrite and bornite, and some outcroppings containing galena and iron pyrites, so very little work had been done it was not sufficiently important to warrant spending the time required to make the trip around by the long route, which would have occupied at least six days, but it is probable that the section is well worth systematic prospecting.

Independent Group.

This group of claims is situated about seven miles up St. Croix creek on the south side, and reached by travelling over a good foot-trail built along the north bank of the creek. The *North Star*, *Copper King*, *Southern Cross*, and *Copper Queen* mineral claims comprise the group, which is owned by J. D. Ross, Stanley Ross, and Carmen Ross, of Vancouver, and Harry Jones, of Pittman. The discovery post on the *North Star* is located at an elevation of 3,600 feet, about a mile and a quarter below the head of St. Croix creek. About 100 feet south-easterly from this post mineral outcroppings occur in what appears to be an andesite. The mineralization is, for the most part, iron pyrites with some galena, occurring apparently as replacements in the dyke, and as exposed covers a width of about 5 feet.

Some open-cuts have been made along the apparent line of strike in a N. 20° W. direction, but this work had not been carried sufficiently deep to determine the dip or the extent. A sample, typical of the mineralized body, assayed: Gold, trace; silver, 0.8 oz.; copper, 4 per cent.

Other work done on the ground consisted of two adits, one of which was driven on the *Copper Queen* and the other on the *Copper King* claim, but in neither of these was any mineralized body exposed; both were driven as crosscuts in the country-rock.

St. Croix Group.

This group of mineral claims contain the *Ruth*, *Jessie*, *St. Croix*, and *Speedwell* claims, owned by J. D. Ross, of Vancouver, and James Brown, of Pittman, and is situated at the head of St. Croix creek. The mineral outcroppings, so far found, occur on the *St. Croix* claim, very near the summit of the range of mountains that forms the divide between St. Croix, Chimdemash, and the headwaters of a tributary of Legate creek, at an elevation of 4,650 feet.

Surrounded by glaciers, but with its summit bare of snow, an igneous dyke stands out as a prominent, precipitous bluff at an elevation of about 2,000 feet above the bed of St. Croix creek. The face of this dyke has been blasted off for a width of 40 feet and to a depth of about 8 feet to prospect a series of fissures exposed on the surface. The face of the open-cut shows that the fissures in the dyke have resulted from shearing movements; they are five in number, each about 12 inches wide, having their lines of strike nearly parallel, but varying from N. 10° E. to N. 15° W., and with their dips at varying angles from 20 degrees towards S. 10° E. to 40 degrees towards N. 75° E.

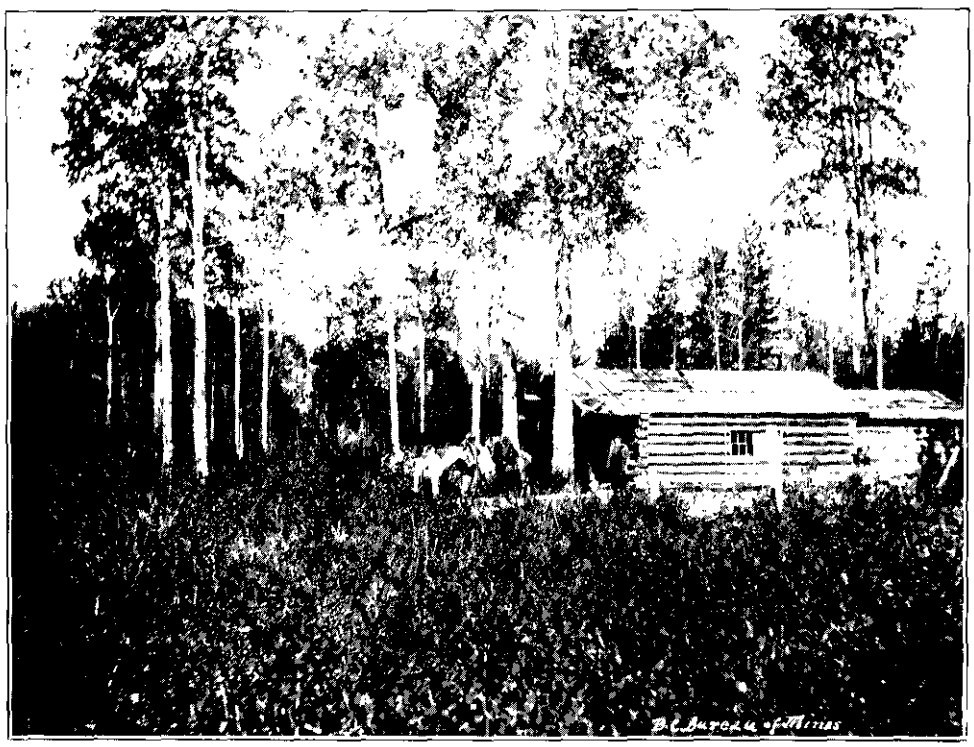
In three of the fissures bornite with some chalcocite represents the mineralization, while, in the other two, iron pyrites with occasionally crystals of galena in a quartz gangue fills the fissures. The mineralization appears to be by replacement. A sample taken across 12 inches in one vein assayed: Gold, trace; silver, 16.6. oz.; copper, 8.4 per cent. Another sample taken across 12 inches in another vein assayed: Gold, trace; silver, 0.7 oz.; copper, *nil*. In the floor of the open-cut there were indications that the vein from which the first-mentioned sample was taken was widening.

There are some indications of mineralization of the dyke rock between the fissures, but whether this is sufficient to enrich the entire width of the face of the open-cut across 40 feet to a commercial value depends on so many conditions that no opinion can be expressed until a systematic course of experiments has been conducted.

Rainbow Claim.

This mineral claim is the most easterly of four claims, not grouped, the others being named the *Rambler*, *Excelsior*, and *Royal*. These were staked during the summer of 1914 and are located south-westerly from the *St. Croix* group and south from and adjoining the *Independent* group. The owners are Harry Jones, James Bell, and James Brown, of Pittman, and J. D. Ross, of Vancouver. The *Rain-*

Fiddler Creek—Omineca M.D.



Chesley's Ranch—Kitsumgallum—Skeena M.D.

bow claim, adjoining the *Jessie*, one of the *St. Croix* group on the south-west, is the only one of the four on which any work has been done or on which any discovery of copper-mineral outcroppings had been made up to the time of the examination, on August 26th, 1914, although there are outcroppings of gossan or iron oxides on others which may lead to the discovery of minerals of commercial value.

The outcroppings on the *Rainbow* claim are situated at an elevation of 4,600 feet, or about on the same level as the work on the *St. Croix* mineral claim. These are composed of narrow stringers of iron- and copper-stained rock, with some bornite and chalcopyrite in the cleavage-planes of the igneous country-rock. Thorough prospecting and systematic work may lead to the discovery of an ore-body of commercial value.

Eagle's Nest Claim.

This mineral claim is situated about two miles westerly from the *Independent* group, and on the west side of Cabin creek, a tributary of St. Croix creek, at an elevation of 3,100 feet, and is owned by Peter Lauzon, of Pittman. A wide open-cut has been made in a volcanic dyke rock at a point where the dyke is very quartzose and considerably stained from iron and copper minerals. An average sample across 3 feet of the face of the open-cut, where apparently the strongest mineralization had occurred, after being assayed, proved to carry only traces of gold and silver.

Iron Pot and Copper Dollar Claims.

These mineral claims are situated on the North fork of Cabin creek and are owned by James Brown, of Pittman, and J. D. Ross, of Vancouver. At an elevation of about 2,400 feet and crossing the bed of the creek there occurs a ledge about 25 feet wide of quartzose rock with banded structure. Its line of strike is N. 30° W. and dip vertical. The hanging-wall is a greenstone-schist and foot-wall an igneous dyke. A wide open-cut has been made to crosscut the ledge, and portions of it are said by the owners to yield $4 a ton in gold, the writer did not take any samples, because such might be misleading unless systematically taken, which was hardly practicable during the examination.

LORNE CREEK.

This creek flows into the Skeena river from the west near the 130-mile post on the Grand Trunk Pacific Railway, and has a history, as narrated by Samuel Booth, an old-time miner, dating back to 1884, when placer gold was first discovered in the creek by Harry McDame (after whom McDame creek, Dease river is named). Since that time placer- and hydraulic-mining operations have been carried on spasmodically. During the past summer four placer leases have been represented, as follows: Two by the Dry Hill Mining Company, one by Penrose, and one by the Hardscrabble Mining Company.

Dry Hill Mining Co.

The majority of the stock in this company is owned by Wm. Tuttle, resident manager, and Charles E. Burgess, of Prince Rupert. The leases owned by the company extend along the north-east side of the creek, one mile up the ancient channel, situated about a mile and a quarter from the present channel, and extending from near the railroad crossing to the point of intersection between the present and ancient channels. The bed-rock is a black, fine-grained, carbonaceous, banded tuff.

Work done previous to this year is represented by a pit about 500 feet in length up the old channel by about 30 feet wide at the lower end, and increasing to about 150 feet wide at the face where the gravel-bank is about 180 feet high. This portion has all been worked out to the bed-rock, except a small area in the south-east corner.

The extent of virgin ground is about 3,700 feet in length up the channel from the present face of the pit by about 200 feet wide at the widest portion between the rim-rock on each side. The "pay" on bed-rock is enough to produce satisfactory results from hydraulic operations on a large scale, so far as could be judged from an experimental run. In the past operations were handicapped by an insufficent water-supply; this is being improved by constructing a new flume two miles and a quarter long, 5 feet wide by 3 feet high, to convey 1,800 miners' inches of water from Lorne creek with a 350-foot head. About 1,200 feet of this flume had been completed in August, 1914. The lumber being used was cut on the ground by a sawmill installed last year, and Mr. Tuttle, the manager, expects to have the flume completed ready for next season's operations.

The Penrose Lease. This lease adjoins the *Dry Hill* on its western boundary, at the point of intersection of the present and ancient channels, and extends for half a mile up the ancient channel on the south-west side of the present one. This had been worked by Mr. Penrose during the past summer, but work had been suspended a few days before the writer's visit, and, as no one was then on the ground, data as to results could not be obtained.

Hardscrabble Mining Co. This company owns the ground adjoining the *Penrose* lease on the west. No work was being done at the time the property was visited, but some prospecting had been carried on earlier in the season.

FIDDLER CREEK.

Fiddler creek is a tributary of the Skeena river, flowing in from the south-west at a point about two miles and a half southerly from the mouth of Lorne creek.

The Brentford Group. There are seven mineral claims and a fraction contained in this group, which is owned by John Burns, John Williams, and Richard Doyle, of Doreen, the nearest station to the property on the Grand Trunk Pacific Railway. The names of the claims are as follows: The *Brentford*, *Hedley*, *Fiddler*, *Josie*, *Nelson*, *Albana*, *Royal Soverign*, and *Drumbo Fraction*. The property is located on the south side of Fiddler creek about three miles from the Grand Trunk Pacific track. During the past season a good trail has been constructed from the railroad-bridge across Fiddler creek to the *Hedley* claim, where all the work has been done, at an elevation of about 950 feet.

There appears to have been quite an extensive intrusion of diorite, possibly of sufficient extent to occupy the area covered by at least two, if not more, of the claims contained in the *Brentford* group. The country-rock in which this intrusion occurs belongs to the Hazelton formation, and is for the most part made up of tuffs, with dark argillaceous beds and bands alternating. These are considerably altered near the contact of the intrusive mass in which the ore-bearing veins on this property occur.

There are at least two distinct ore-bodies in the *Brentford* group; both are fissure-veins in diorite, having their lines of strike parallel to each other towards S. 50° W., with dips almost vertical.

Development work has been all performed on the *Hedley* claim, and consists of an adit driven on the No. 1 or main vein a distance of 75 feet, the open-cut to the portal of the adit being about 25 feet long. There are also several open-cuts in S. 50° W. direction from the adit on the outcropping of the same vein; these cuts have been made on the steep mountain-side above the adit level, and have sufficiently exposed the vein in several places to warrant the assumption of its persistence for at least a distance of 600 feet, and to an elevation of 25

feet above the adit level. There is, in addition to the above-described work, a shallow shaft sunk at a point 50 feet lower than the adit level, but this has not reached rock in place. The adit is closely timbered, and it was not possible to see the roof to measure the width of the ore-body; in the face the ore was 3 feet wide. In the open-cuts the width of the vein of ore was from ½ foot to 4 feet. The outcropping is 60 feet above the adit level at the face of the drift, and at the farthest point on the surface examined the elevation was 125 feet higher than the adit level.

Mr. Burns, one of the owners, stated that outcroppings could be seen at intervals for a farther distance of about 2,000 feet when the snow was off the surface, but no work had been done, and the exposures were long distances apart.

The following list of assays shows the values obtained from samples taken by the writer, which represent the average of the vein-matter for the widths sampled at the points designated:—

Location sampled.	Assay Values.		
	Gold.	Silver.	Copper.
	Oz.	Oz.	Per Cent.
From foot-wall side, face of adit, 2 feet wide	0.07	4.4	0.4
From hanging-wall side, face of adit, 1 foot wide	0.05	7.6	1.1
From outcrop 40 feet above adit level, 18 inches wide	0.04	4.2	*Nil.*
From outcrop 60 feet above adit level, hanging-wall side, 3 feet wide	0.02	1.0	*Nil.*
From outcrop 60 feet above adit level, foot-wall side, 1 foot wide	Trace.	0.4	*Nil.*
From outcrop 125 feet above adit level, 6 inches wide	0.02	95.0	Trace.
From dump at portal adit, No. 10 vein, grab sample	0.02	35.8	0.3

The No. 2 vein, which occurs about 50 feet east from the No. 1 or main vein, has been exposed in a narrow watercourse by a series of prospect-holes, but the ore in this vein, so far as proven, is very narrow, varying in width from a streak of rusty decomposed material to a width of 10 inches of ore. The fissure appears to be very persistent as far as followed, a distance of about 200 feet up a very steep mountain-side. An average sample taken across the outcrop where it is 10 inches wide assayed: Gold, 0.08 oz., silver, 7.2 oz.; copper, 0.8 per cent.

The Fiddler Group.

This group contains three mineral claims—the *Boulder*, *Indicator*, and *Intrusive*, owned by L. C. Knauss. The claims are staked in a line from north-east to south-west, the *Boulder* being the north-east claim of the group, with the other two claims staked in the order referred to, towards the south-west. The north-east end line of the *Boulder* claim is about 2,000 feet south-westerly from the north-west end line of the *Josie* claim of the *Brentford* group, at about the same elevation, but on the opposite side of a tributary of Fiddler creek.

The ore-body is exposed only on the *Boulder* claim near the discovery post, at an elevation of 2,250 feet, and occurs as a bedded deposit, with its dip conformable to that of bedding-planes of the argillaceous country-rock. The line of strike of the vein is approximately S. 60° E. and the dip is at an angle of 30 degrees towards N. 30° E.

The ore is galena, iron pyrites, chalcopyrite, and some tetrahedrite in a quartz gangue. The widths of the outcroppings vary from 22 to 36 inches, and the vein is exposed in several open-cuts for a distance of about 800 feet, starting from a point about 200 feet vertically above the creek.

Five samples were taken of these outcroppings, each one representing an average of the ore-body for the width sampled and at the point designated. The following list shows the values carried by these :—

Location sampled.	Assay Values.		
	Gold.	Silver.	Copper.
	Oz.	Oz.	Per Cent.
Taken across 12 inches at a point 200 feet from discovery post on *Boulder* claim	0.4	2.3	Trace.
Taken across 3 feet at a point about 70 feet from same discovery post	0.25	1.4	Trace.
Taken across 1 foot 10 inches wide at a point 62 feet from same discovery post	2.48	7.6	3.4
Taken across 2 feet wide at a point 49 feet from same discovery post	1.96	8.9	0.8
Taken across 1 foot 10 inches wide at a point 9 feet from discovery post	1.43	5.2	0.6

Just north from the discovery post on the *Boulder* claim there occurs a wide, intrusive granite dyke which apparently had cut off the ore-body on the dip, but prospecting late in the summer at a point about 400 feet northerly from the discovery post and about 150 feet lower exposed a vein carrying minerals having the same characteristics as those in the vein on the opposite side of the dyke, and also with its line of strike and dip conformable with the strike and dip of that vein, so that it would appear that this last named is the extension of the vein.

In July last, Martin Welsh, of Spokane, bonded this group of claims and commenced development-work by driving an adit that in October was 140 feet in length. The portal of this adit is located near the discovery post of the *Boulder* claim, immediately south from the granite dyke. The ore-body, which had been left in the roof of the adit, apparently has a width varying from 2 to 4 feet for 60 feet in from the portal, where it becomes narrower, the pinch appearing to have been caused by an intrusive granite dyke, through which, however, the vein appears to maintain continuity for 20 feet to where the granite dyke disappears; there this vein widens to 18 inches, which width it apparently maintains for 30 feet to a well-defined fault which cuts across the adit. Beyond this fault and to the face of the adit, a distance of 30 feet, another fissure is exposed which, while continuous, is only about 4 inches wide. At a few points along the adit for the first 60 feet the ore-body has been broken into above the roof to prove its continuity.

Samples taken representing averages of the widths sampled at the points designated assayed as follows :—

Location sampled.	Assay Values.	
	Gold.	Silver.
	Oz.	Oz.
Taken across 4 inches at the face of the adit	0.03	0.3
Taken across 10 inches immediately east from fault 110 feet from portal of adit	0.02	0.2
Taken across 18 inches at a point 25 feet east from fault 85 feet from portal of adit	0.32	2.5

A rough compass survey showed that the adit, beyond a point about 60 feet in from the portal, was not being driven in a course conformable with the line of strike of the vein. From this point the course is slightly changed, so that the roof of the adit is placed so much below the original ore-body as to conceal it completely and make it appear as though cut off. The fissure followed from that point appears to have no connection with the main fissure which outcrops at the surface. The supply of both timber and water for all purposes is plentiful.

KITSALAS MOUNTAIN.

So far as at present reported, no mineral claims have been staked on the west side of the Skeena river south from Knauss mountain, situated a few miles south from Fiddler creek, until Lowrie creek, near the northern spur of Kitsalas mountain, is reached, some seventeen miles south from Fiddler creek.

Poor Boy Group.

This group of mineral claims consists of the *Triune, Gold Standard, Ella, and Poor Boy* claims, owned by L. A. Moody, Richard Lowrie, James Gall, and James Darby, of Usk, and is situated in the foot-hills of the northern spur of Kitsalas mountain. On the *Triune* claim an open-cut has been made in a sheared zone in diorite country-rock at an elevation of 500 feet. In this occasionally could be noticed kidneys of quartz containing particles of visible free gold, also quartz containing a little bornite and stained with copper carbonates, but no evidences of the existence of an ore-body of commercial value could be found.

On the *Gold Standard* claim, adjoining the *Triune* on the east, an open-cut in a sheared zone in diorite country-rock 15 feet long, with the face of the cut 12 feet deep, was examined; this was made into the side of the mountain at an elevation of about 800 feet, and showed a vein 18 inches wide filled with quartz, striking east and west and dipping to the north, a sample from which assayed: Gold, 0.06 oz.; silver, 1.6 oz.; copper, 0.3 per cent.

Another open-cut, also in a sheared zone in diorite, about 200 feet west from the one just referred to, showed a vein filled with quartz; this vein was 30 inches wide on the surface, but only a few inches wide in the floor of the cut 8 feet below. Judging from all the surrounding conditions, it is considered doubtful if any commercial value could be attached to the discoveries so far made on this group of claims, but further prospecting may reveal better showings.

Cordillera Group.

This group of mineral claims includes the *Queen Ann, Cordillera, Yellow Pearl, Gold Dust, Camille,* and *Gold Sentinel,* owned by James Darby, of Usk, and J. D. Wells, of Kitsalas. The property was staked during the spring of 1914, when the finding of rich float led to its discovery; it is situated about two miles and a half southerly from Usk Station, on the east slope of Kitsalas mountain. At an elevation of 700 feet a fissure-vein outcrops in a diorite country-rock. This had been exposed by a series of open-cuts for a distance of about 500 feet along its line of strike towards S. 30° W., with the dip apparently nearly vertical. The width of vein-filling varies from 1 to 8 feet, but whether the outcroppings are those of a continuous vein or of separate lenses along a general line of strike had not been determined.

The minerals in this vein are chiefly chalcocite and bornite in a quartz gangue, in which can be seen many particles of free gold, visible to the naked eye. The most northerly exposure of mineral is in fairly heavy timber on the *Queen Ann* mineral claim, close to the dividing line between that claim and the *Cordillera*, which adjoins it to the south-west. At this point an open-cut 27 feet long by about 8 feet wide has been made. The No. 2 open-cut is 25 feet distant towards S. 30° W.; this is 10 feet long by about 8 feet wide. The No. 3 open-cut is 75 feet distant in the same direction, which is also 10 feet long by about 8 feet wide. The No. 4

open-cut is 200 feet distant in the same direction; this is 15 feet long by about 8 feet wide. No. 5 open-cut is 25 feet distant in the same direction; this is 21 feet long by about 10 feet wide. No. 6 open-cut is 100 feet distant in the same direction; this is 21 feet long by 10 feet wide. The elevation between the No. 1 and No. 6 open-cuts rises gradually, the difference between the two points being about 100 feet.

The following list of assays shows the values carried by the samples taken:—

Location sampled.	Assay Values.		
	Gold.	Silver.	Copper.
	Oz.	Oz.	Per Cent.
Selected sample from No. 1 open-cut	0.38	9.3	23.4
Average sample across 3 feet from No. 3 open-cut	0.4	3.8	7.1
Shipping-ore from No. 2 open-cut, representing about 10 per cent. of vein-matter	0.7	8.9	10.6
Shipping-ore from No. 1 open-cut, representing about 5 per cent. of vein-matter	0.36	9.5	21.1

In addition to the outcroppings and work referred to, other mineralized outcroppings had been discovered on the mountain at a considerably greater elevation, which indicated a series of veins lying nearly parallel to the line of open-cuts, but no work had been done. From all the indications this group of mineral claims is very promising, and it should be systematically prospected.

Old Timer Group.

This group consists of the *Old Timer*, *Fannie*, *Walker*, and *Digby* mineral claims, owned by C. W. D. Clifford, J. W. Patterson, and J. D. Wells, of Kitsalas. It is situated on the south-eastern slope of Kitsalas mountain about one mile west from the Canyon, and is reached by a foot-trail which branches off from the wagon-road connecting the old village at the Canyon with Phillips creek.

At an elevation of about 1,800 feet an open-cut has been made across an igneous dyke on the *Walker* claim. This cut is 24 feet long by about 8 feet wide and 12 feet high at the face.

This dyke is very much fractured; there is considerable epidote and some chalcopyrite in a quartz gangue filling the fissures, which strike nearly north and dip vertically. These fissures are narrow, the widest being 2 feet; an average sample taken near the face of the open-cut, assayed: Gold, 0.03 oz.; silver, 0.8 oz.; copper, 3.4 per cent. The surface is so heavily covered with underbrush as to conceal all traces of any possible extension of the fissure along the strike.

Copper King Group.

This group consists of the *Poor Mine*, *Copper King*, *North Star*, and *Big Copper* mineral claims, owned by Peter Brusk and associates. The property is situated on the south slope of Kitsalas mountain near the head of Phillips creek, on the north side, and about five miles west from Kitsalas canyon. It is reached by an excellent trail up Phillips creek, which branches off from the wagon-road from the Canyon at Brusk's ranch.

At an elevation of about 1,900 feet, on the *Copper King* claim, in the bed of a branch of Phillips creek, there is a strong outcropping of quartz carrying bornite, chalcopyrite, and iron pyrites. In an open-cut made in the south-east bank of the branch creek, the walls on each side of this outcropping are so well defined as to indicate a clean-cut fissure in an igneous rock. The line of strike is 75° E. and the angle of dip is 60 degrees towards the south-east.

This vein is exposed along the strike for a distance of 80 feet, and has an average width between the walls, including a few inches of gouge between each wall and the ore-body, of about 3 feet. A sample taken representing about an average of the vein assayed: Gold, 0.1 oz.; silver, 3.3 oz.; copper, 12.8 per cent. A selected sample assayed: Gold, 0.03 oz.; silver, 3.8 oz.; copper, 17.9 per cent.

A vein, very similar to the one just referred to, is exposed in another tributary of Phillips creek, situated about 1,000 feet distant towards the east, on the *Big Copper* claim, but at a somewhat higher elevation. On this outcropping no work has been done, and, as there are no rock exposures between the two creeks, it was not possible to trace any relationship between the two outcroppings.

On the *Copper King* claim, near the southern boundary-line and on the north bank of Phillips creek, an adit (No. 1) has been driven in the sheared portion of an igneous rock, where some bornite occurs in the fracture-planes. This adit is 42 feet long, 20 feet of which is in a N. 20° E. direction, and the balance is N. 30° W.; a winze has been sunk at the face 14 feet deep. A little mineral occurs scattered through the country-rock in the cleavage-planes of the fractures as well as in the solid rock, but with no defined walls.

At a point about 50 feet higher elevation than the No. 1 adit and about 200 feet in a northerly direction on the east bank of a tributary of Phillips creek, another adit (No. 2) has been driven 50 feet long in a N. 70° E. direction; also a winze has been sunk 15 feet deep, but was full of water. This adit crosscuts an igneous dyke showing lean mineralization as specks of chalcopyrite and bornite very similar to the mineralization showing in the No. 1 adit. Near the face of the No. 2 adit a granite dyke is exposed that apparently cuts off the diorite, and further work was abandoned. An average sample of the mineralized diorite assayed: Gold, trace; silver, trace; copper, 0.3 per cent.

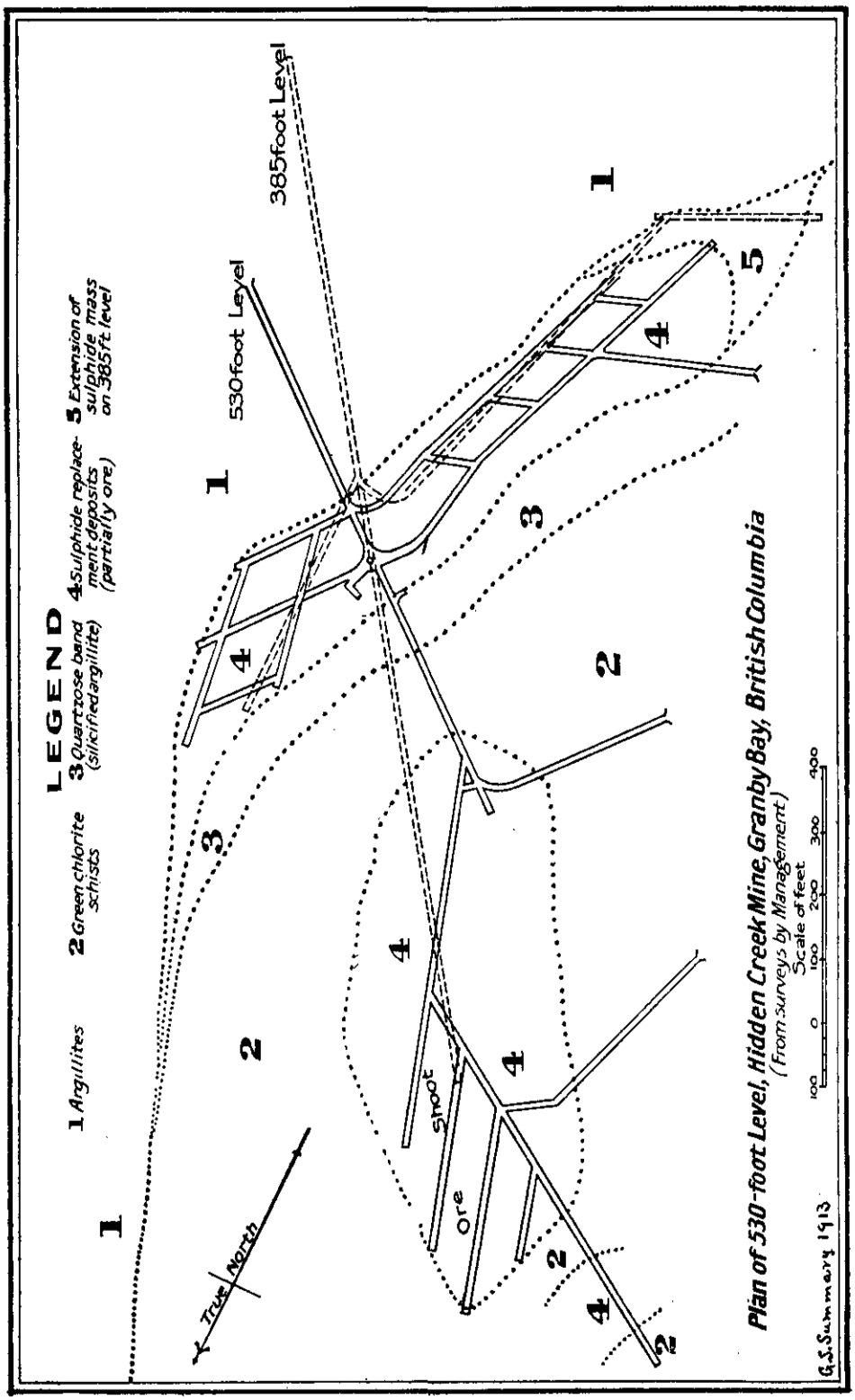
The supply of timber is ample for all purposes; the supply of water in Phillips creek is sufficient to furnish power to run machinery for a plant of considerable capacity.

Virginia Group. This group is located one mile north from the Copper City ferry on the west side of the Skeena river, and contains the *Virginia*, *Highland*, and *Erin* mineral claims, owned by A. G. Walker, of Copper City. On the *Virginia* claim an adit has been driven 15 feet under cover beyond an open-cut 15 feet long, into a body of iron-stained, calcareous quartz carrying some epidote, but, so far as at present exposed, no other minerals. A sample across 3 feet assayed only traces of gold and silver and no copper.

GRANBY BAY, OBSERVATORY INLET.

By far the most important event that happened in the history of the mining industry in northern British Columbia during 1914 was the "blowing-in" of the new smelting plant of the Granby Consolidated Mining, Smelting, and Power Co., Limited, at Anyox, on Granby bay, Observatory inlet, about 120 miles north from Prince Rupert. The investment for the construction of the smelter, power plant, machinery at the mines, development, electric railway, and buildings at the smelter and mining camps aggregated $3,680,000 up to the time the smelter was blown in, during March, 1914.

The Minister of Mines' Reports for the years 1911 and 1913 contained articles descriptive of the occurrence of the ore-bodies and of the partial construction of the plants, written by Donald G. Forbes, M.E., but the history of the property, which is somewhat unusual, has not been mentioned, so a brief summary will be given in this report.



Plan of 530-foot Level, Hidden Creek Mine, Granby Bay, British Columbia

(From Surveys by Management)

The original mineral claims were located in 1901 as the *Hidden Creek* group by McMillan, George Rudge, and H. B. Flewin, of Port Simpson, and were described as being situated on Ekswan (Goose) bay, this name being changed to Granby bay in 1914. In 1902 the property was bonded for $40,000 to M. K. Rodgers, of Seattle, as agent for the late Marcus Daly, of Butte, and some serious development-work performed, but, after Mr. Daly's death, it was examined by Horace V. Winchell on behalf of the Daly heirs and allowed to revert to the original locators.

In 1905 a syndicate, formed in Vancouver, B.C., by some of the original Britannia Copper Syndicate, bonded the *Hidden Creek* group from McMillan, Rudge, and Flewin, and expended about $25,000 in development-work.

In 1908 M. K Rodgers again became interested in the property, which he purchased for Thos. Hudgins, a banker of Butte, and himself for $135,000, and continued development-work on a larger scale until 1910, when it was sold to the Granby Company, the purchase price being reported at $500,000.

The following description of the geology is taken from the report of Donald G. Forbes, M.E., of Victoria, B.C., on page 67 in the Minister of Mines' Report for 1911: "The rock formation in which the ore-bodies occur may be best described as an argillaceous schist; it has been subjected to very considerable alteration, and in some places the fissile structure of the argillaceous bands has disappeared and the rock appears to be massive. This rock formation can be traced for several miles along the shore of the inlet to the adjacent islands, and extends nearly to the summits of the mountains to the west of the property, where the Coast granites are found. The ore-bodies are at some points cut by intrusive dykes, but these dykes have no influence on the nature of the ore, nor on its commercial value."

In the mines previous to July, 1913, there had been done over 16,000 feet of underground development-work, exclusive of diamond-drill holes. Since then and up to July 1st, 1914, the underground development-work has been increased by an additional 5,400 feet of drifts and raises, as well as 6,400 feet of diamond-drill boring. As a result of this later work, the boundaries of the two main ore-bodies have been well defined above the 385-foot level to the surface, at 475 feet higher elevation, on the ore-body known as the Cabin Bluff or No. 1, and 515 feet higher elevation on the Mammoth Bluff or No. 2 ore-body. Levels have been opened at 150 feet, 230 feet, 385 feet, 530 feet, 630 feet, 700 feet, and 800 feet above tide-water. This is the reverse from the usual conditions, because generally the levels are measured from the surface downwards.

Both the Nos. 1 and 2 ore-bodies are elliptical in plan. The No. 1 has the greatest length, being about 1,300 feet along the strike, which is slightly east of north, the dip being 65 degrees to the west. The No. 2 ore-body has been proven to be nearly as long, with a maximum width of about 200 feet. The strike of this ore-body is north-west and dip at an angle of 45 degrees towards north-east. The distance of barren ground between the two ore-bodies on the surface is about 150 feet, but on the 385-foot level the distance has increased to 800 feet.

The tonnage of "ore in sight" is estimated at 9,563,000 tons, carrying 2.2 per cent. copper and about 30 cents in gold and silver to the ton. This is surrounded by a body of low-grade ore running 0.6 per cent. copper. In this body the tonnage in sight is estimated at 8,589,500 tons. When the high and low grade are considered together, it gives an estimate of 18,152,500 tons of 1.4 per cent. copper ore.

Since the middle of March last, when the smelter was first blown in, until July 1st there had been shipped from the mines 77,377 tons of ore, carrying 2.4 per cent. of copper to the ton. Most of this ore was mined from the No. 1 ore-body from the stopes above the 530-foot level, only 8,476 tons from the No. 2 ore-body having been shipped.

On July 1st, 1914, there was 15,000 tons of broken ore in the mine. During the past season two entirely new ore-bodies, No. 3 and No. 4 were discovered and explored. They are of the same general type as the No. 2 ore-body and in the same mineralized area. The total ore developed in the two bodies is 1,407,500 tons, carrying 1.8 per cent. of copper.

Mining operations are being carried on by three systems, as follows: First, glory-hole from the surface on the 630-foot level on No. 2 ore-body where that level comes to the surface on the south-westerly slope of the Mammoth Bluff; second, Treadwell or shrinkage system of driving drifts along the strike of the ore, making raises about 20 feet high for ore-chutes, with 60 feet between centres, through which only about one-third of the ore broken down is drawn, the balance being left for footage for drills and men; then stoping upwards on an incline in all directions from the tops of the raises the entire width of the ore-body, but leaving pillars across the ore-body from 60 to 120 feet apart and about 30 feet wide at the top, according to the standing qualities of the ground, with intermediate drifts cut through the pillars connecting the stopes along the strike; third, the system followed in the Granby mines at Phoenix, locally termed "benching."

The arrangement for handling ore is by a gravity system throughout, by chutes, specially designed, from the stopes to the 230-foot level, where the crushers are located, and from the crushers into the ore-cars, each of 25 tons capacity on the 150-foot level, whence it is transported to the ore-bins at the smelter on Granby bay, one mile distant over a 3-foot gauge electric railway laid with 56-lb. rails.

The total length of the electric railroad main line is 3.22 miles, distributed as follows: "A" line on nearly level grade with switchback, connecting the mine with the smelter-yard, 7,913 feet in length; "B" line with 2 per cent. grade, connecting the wharf with "A" line, 7,490 feet in length; copper track with 2½ per cent. grade, connecting "B" line with the smelter, 1,516 feet in length. Spur sidings and yard-tracks total 2.36 miles, consisting of smelter-yard tracks, 2,626 feet; ore and coke tracks on high line, 2,753 feet; charge tracks, 3,167 feet; wharf track, 1,710 feet; sawmill spur, 1,770 feet, storage sidings, 458 feet. There are on the line of this railroad 1.95 miles of trestle-work.

The equipment consists of two 42-ton Baldwin-Westinghouse locomotives, twenty-five hopper-bottom steel ore-cars, each of 25 tons capacity, as well as the necessary flat cars for hauling freight from the docks to the smelter and mine.

The works are on Granby bay, an indenture in the western shore of Hastings arm, which, with Alice arm, merges into Observatory Inlet. The Burniston range of mountains, rising to an elevation of 5,700 feet, separates Observatory inlet from Portland canal; the mines and reduction-works are on the eastern foot-hills of this range. The settlement is called Anyox, and, being on deep water, is directly accessible to ocean-going steamers. There are usually two steamers that arrive weekly from Vancouver.

The ore from the mines is weighed in the 25-ton cars on a 40-foot, 80-ton-capacity track-scale; thence is dumped into the ore-bins of 8,000 tons capacity, over the tops of which the tracks from the mine are laid. From the bottoms of these bins the ore is drawn into charge cars running on a track at a level 35 feet below the mine-track.

The furnaces, of which there are three, are 50 inches wide by 30 feet long, and are the regular type of rectangular, water-jacketed matting-furnace made by the Traylor Engineering and Manufacturing Company. The furnaces are provided with 4½-inch tuyeres at 10-inch centres. The slag-tap is at the side. The converter-room is in one end of the main smelter building, in which are three converter-stands. The converters, of the Great Falls type, are 12 feet in diameter.

The downtakes from the furnaces and the flue from the converter-hoods lead into a large dust-chamber at the side of the main smelter building. From the centre of the chamber the main flue leads up the hill to the reinforced-concrete stack, 22 feet in diameter by 153 feet high, the top of which is about 300 feet above the furnaces.

The Granby Company has secured from the British Columbia Government the right to reclaim a large area of ground by filling in with slag a shallow-water area in Granby bay directly in front of the smelter-site. Thus is a convenient dumping-ground for the slag obtained, and as the dump grows the area of the company's new made land will gradually increase.

Power is generated at a hydro-electric plant on Granby bay just below the smelter-site. The water of Falls creek has been impounded by a crib and rock-filled dam one mile back of the smelter; a 6-foot wooden-stave pipe conveys the water from the reservoir to the Pelton wheels in the power-house at an available head of 400 feet. The power-house equipment includes two electric generators of 938 k.v.a., with exciters; two motor-generator sets of 300 k.w. each; three Connersville blowers, with Pelton buckets on fly-wheel of blowers, with a capacity of 48,000 cubic feet of free air a minute, supplied at 3 lb. pressure; and a Nordberg blowing-engine, with a capacity of 21,500 cubic feet of free air a minute at a pressure of 16 lb. A Nordberg compressor is also installed in the building, which has a capacity of 4,000 cubic feet a minute at 100 lb. pressure. The blowing-engine and compressor are provided with buckets on the fly-wheel, the same as the blowers.

The docks on Granby bay are 500 feet long by 50 feet wide, equipped with three travelling ore-bunkers for coke and ore. A concrete fire-proof store building 117 feet long by 60 feet wide, three stories high is located near the dock and is run as a complete department store. One steamer, the "Amur," and six barges, are used in the blister-copper, coke, and lime-rock service.

The smelter town of Anyox, owned by the Granby Company, is built near the dock, and comprises a modern hotel, large recreation-hall, hospital, seventy-five cottages, each containing either three, five, or seven rooms, with bath-room, and furnished with electric lights, water and sewer connections. There are three trunk-line sewers, and waterworks system having 60 lb. pressure to the inch, with the necessary mains, fire-hydrants, and connections with all the buildings. The streets are laid out systematically, walks and roadways planked, and the streets well lighted by electric arc-lights. There is also a sawmill and a brickyard located on the outskirts of the town; the former having a daily cutting capacity of 25,000 feet board measure, and the latter a daily producing capacity of 25,000 bricks.

Near the mine the Granby Company has built large bunk-houses and mess-houses, as well as a number of residences similar to those at Anyox, and equipped with the same modern conveniences; also a recreation-hall, superintendent's office, and storage building for supplies. The bunk-house is two stories with basement, the last mentioned being furnished with shower-baths, drying-room, and with lockers for the men's clothes arranged along the walls. The first or ground floor is divided into separate rooms, but the upper floor is undivided and designated as the "bull-pen," and is furnished with cots.

NOTES BY PROVINCIAL MINERALOGIST.—The Granby Consolidated Mining, Smelting and Power Company is now operating a number of mines and two smelters in British Columbia, and, in addition, mines in southern Alaska. The main office of the company is in Vancouver and is the headquarters of the general manager, F. M. Sylvester; the general superintendent of mines, C. B. Smith; the general superintendent of smelters, W. A. Williams; and the treasurer, G. W. Woostor.

The territory in which the company is actively operating has been divided into four sections, namely :—

(1.) *South-eastern British Columbia*—including mines at Phoenix—under the superintendency of C. M. Campbell.

(2.) *British Columbia Coast*—including mines at Anyox—under the superintendency of H. J. C. MacDonald.

(3.) *South-west Alaska*—including *Midas* mine, Valdez—under the superintendency of E. E. Campbell.

(4.) *Southern Alaska*—including *Mamie* and *It-Dean* mines—under the superintendency of N. W. Sweetser.

This company has carried on a vigorous campaign to acquire new properties in many districts, particularly in Alaska, where three new mines have been acquired and deals for others are pending. The ores from these Alaska mines will all be brought to the company's smelter at Anyox for treatment.

The capacity of the Anyox plant is to be considerably increased in the near future, and the company is making every preparation for copper-mining and smelting on a large scale.

The Anyox smelter was not closed at the outbreak of the European war, as was the Grand Forks plant, but has been operated continuously during the past year, after "blowing-in" in March; 260,809 tons of ore was smelted, yielding 2,853 oz. gold, 130,767 oz. silver, and 11,084,646 lb. copper.

Bonanza Creek.

Bonanza Group. This group of mineral claims is situated on Bonanza creek, which flows into Granby bay from the north-west about two miles southerly from Anyox. The Granby Company has been prospecting for several months prior to July last on this property, and in the autumn of 1914 was reported to have acquired it. These mineral claims were amongst the earlier locations in the district, having been staked in 1900, but until the Granby Company began systematic prospecting but little serious attempt had been made as regards development-work, owing to the low grade of the mineral contents of the wide body of schist, which contains numerous veinlets filled with quartz carrying some iron and chalcopyrite.

Glacier Creek.

Golconda Group. This group contains the *Golconda*, *Golconda No. 1*, *Copper Consolidated*, *Blue Bird*, *Blue Bird Extension*, and *Blue Bird Extension No. 1*, owned by Dr. A. C. Crookall, A. W. Graham, and Patsy Forrest, of Seattle. This property is situated along both sides of Glacier creek, a stream flowing nearly parallel with the course of Bonanza creek, and emptying into Granby bay about a mile southerly from the mouth of that creek. Except assessment-work, no serious attempt at development has been made; during the past summer the claims were surveyed.

The same belt of argillaceous schists, in which the ore in the *Hidden Creek* mines occurs, extends on to and across Glacier creek, as well as up that creek some two miles to the glacier in which the creek has its source.

Red Wing Group. This group contains the *Copper Crown*, *Red Jacket*, *Red Wing Frac.*, and *Red Wing* mineral claims, staked by Joseph McGrath in 1909, when he found a very large quantity of float consisting of lumps and boulders of chalcopyrite, often carrying 8 per cent. of copper mixed with slide-rock from the steep mountains on the northern side of the creek at the foot of the glacier. This property has been surveyed and Crown-granted, but the work done has been confined to the necessary annual assessments.

The same belt of argillaceous schist, common to the country surrounding Granby bay which in places is altered to mica-schist, extends through the *Red Wing* group, but the igneous dykes found in other portions of this zone are more numerous and extensive than elsewhere.

The mineralized areas in the schist on this group of claims are of less extent than is usually found in this zone, but the values are more concentrated, occurring apparently in well-defined ribs of varying widths across the schist rather than as a mineralized belt along the line of strike of the schist.

Sufficient work has not been done to demonstrate many material facts regarding the possible commercial value of the property, but, in any event, the mining and transportation costs must be much higher than on the Granby Company's property, because of the glaciers on the higher levels within the boundaries of the group; also because of the extreme danger from snow and rock slides, and the attendant difficulty of building a camp near the mine-workings unless a large outlay of capital was made to drive long adits at low levels, with portals beyond the routes of the slides.

GIBSON ISLAND.

This is a small island situated in the northern entrance of Grenville channel, about thirty miles south from Prince Rupert, and on the regular route travelled by the Coast steamers which ply between Victoria or Vancouver and Prince Rupert. The area contained in the island is about 640 acres.

The rock formations occurring on Gibson island are crystalline limestone, hornblende-schists, and diorite, classified by R. G. McConnell, of the Canadian Geological Survey, as belonging to the Prince Rupert formation. At the contact of the hornblende-schist and limestone, outcroppings of copper minerals in a quartz gangue were discovered some years ago and a group of mineral claims was located.

The island is well supplied with timber, chiefly hemlock; the supply of water is fairly good for domestic and mining purposes, but not for power, as the highest points on the island only reach an elevation of about 100 feet above sea-level; consequently the watershed is inconsiderable, and pumping would have to be adopted for concentration purposes.

Wild Goose Group.

This group contains the *Copper King*, *Wild Goose*, *Ophelia*, *Standard*, and *Nellie* mineral claims, owned by Roy Chrisman, Otis J. Benson, J. McDonald, George Keyes, and F. B. St. Amour, of Prince Rupert, B.C. Along a ridge that traverses the *Wild Goose* and *Ophelia* mineral claims at an elevation of about 100 feet above sea-level, there occur several outcroppings made up of such minerals as iron pyrites, chalcopyrite, bornite, a little galena and zinc-blende in quartz gangue. These showings have a general N. 15° W. line of strike, with vertical dip. The country-rock on the north-east boundary of this mineral belt is hornblende-schist and on the south-west crystalline limestone.

From the work done at the No. 1 open-cut on the *Wild Goose* claim, about 200 feet south-east from the dividing line between that claim and the *Ophelia* claim, it appears as though the mineralization had the structure of a large lens and that this work exposes the maximum width of the mineralized zone.

The No. 1 open-cut is about 8 feet deep for a length of 20 feet, then about 3 feet deep for a further length of 48 feet. This crosscuts the zone, and a cross-section, commencing at the hornblende-schist wall on the foot-wall side, is as follows: 8 feet ore in quartz gangue; 4 feet ore mixed with limestone; 1 foot limestone; 1 foot ore in quartz gangue; 1 foot limestone; 1 foot ore in quartz gangue; 1 foot limestone; 5 feet ore in quartz gangue; 38 feet covered with gravel containing some nodules of ore; 10 feet ore in quartz gangue; followed

by crystalline limestone on the south-west boundary, which is apparently the permanent hanging-wall. A sample taken from the open-cut by the writer across the 8-foot ore-body assayed: Gold, 0.02 oz.; silver, 3 oz.; copper 6.3 per cent.

In a S. 15° E. direction from the No. 1 open-cut, and also on the *Wild Goose* claim, there are four more open-cuts, and an adit in a distance of about 300 feet. In all of these the mineralization is very similar to that in the No. 1 open-cut, but the width and values appear to gradually decrease.

In a N. 15° W. direction from the No. 1 open-cut, and on the *Ophelia* claim, there are five open-cuts; in these the width of the mineralized zone appears to be about the same as in the No. 1 open-cut, and judging from appearances, the values are about the same, but no samples were taken for assay, as it was hardly practicable to systematically sample the entire ore-body unless considerable work was done clearing out each open-cut.

Three diamond-drill holes had been bored in 1913, but these were all located several feet from the ore-body on the foot-wall side, and apparently pointed away from the ore-body rather than at an angle which would intersect it, unless the dip changes, of which there does not appear to be any indication.

On the *Copper King* mineral claim, adjoining the *Wild Goose* on the south-east, there is an outcrop of bornite and chalcopyrite mixed with limestone on which no work had been done. From this a sample taken as representing a fair average assayed: Gold, trace; silver, 2 oz.; copper, 1.6 per cent.

PITT ISLAND.

This island is situated about five miles south-east from Gibson island, and it was visited because of information that it contained an extensive deposit of magnetic iron ore. This was found on a point on the north end of the island near Stuart's anchorage, where there is a bluff 50 feet high by about 50 feet wide, made up of practically solid iron ore, occurring in a hornblende-schist country-rock. The apparent line of strike was followed towards the south-east for about 300 feet, and the same character of ore found exposed in a series of several trenches, some of which crosscut the ore-body for about 30 feet. A sample taken assayed: Iron, 59.1 per cent.; sulphur, *nil*; phosphorus, trace.

SKEENA MINING DIVISION.

NOTES BY PROVINCIAL MINERALOGIST.

The Provincial Mineralogist has been favoured with the following information regarding the mine at Surf inlet, Princess Royal island, by the kindness of C. E. Verrill, M.E.:—

"During January and February the property was examined by the Tonopah-Belmont Development Company of Philadelphia. The above company took a working bond on the property in April, and immediately thereafter began the installation of a compressor plant and mining equipment with which to carry on development-work.

"A 10-drill compressor plant was installed, entire new camp buildings built, and actual underground work started about August 1st.

"A new tunnel was started about 300 feet below the workings developed by the Surf Inlet Company, and about 500 feet above the level of the lake, which is at the base of the mountain on which the mine is situated. This lower or No. 3 tunnel was driven as a crosscut for about 400 feet until the fissured zone, which follows a general fault-plane through the country for about eight miles, was encountered. The tunnel was then continued as a drift along this fissured zone, in which the ore-bodies occur in the upper workings. At the present time (December 17th, 1914) this tunnel has been driven a total distance of about 1,200 feet, or about 800 feet along the fissured zone. Present progress in driving this tunnel is at the rate of about 400 feet a month. It is estimated that the total distance from the portal of this tunnel to a point under the developed ore in the workings above is about 1,700 feet, so that by the end of the present year this tunnel should be approaching the vicinity where ore-bodies can be reasonably expected to exist, and by March 1st, 1915 it should be demonstrated whether or not the ore-bodies developed above continue down to this level.

"Further development-work has also been carried on the upper workings by drifting on the ore-bodies to the north, and this work has demonstrated ore for a distance of some 250 feet beyond the point where the Surf Inlet Company stopped work. Drifting is still going on here, and crosscuts are being driven across the ore at 50-foot intervals.

"The total distance along the strike throughout which ore has been developed by underground work is now about 1,000 feet. The average depth on this ore is about 400 feet, and the maximum depth at face of drift is about 750 feet. This is all in the upper workings; the new lower tunnel not yet having encountered the ore-bodies.

"The width of the ore-bodies is very variable, the ore occurring as lenses in the fissured zone, but the average width is probably about 10 feet. The maximum width of clean ore is about 25 feet. The average value, based upon the sampling by some dozen engineers who have examined the property, including myself, is $6.50 in gold to the ton.

"There are three distinct systems of lenses of ore all occurring in the fissured zone, known locally as the East, Middle, and West veins. These lenses, while roughly parallel, have a general tendency to form a junction north of the present workings. At least, they are nearer together at the north end than at the south, and if they maintain their present strike will come together within the next 100 feet to the north.

"The terms of the bond are as follows: The Tonopah Company agrees to do at least 1,500 feet of work on the lower tunnel-level before July 1st, 1915, and to expend not less than $75,000 on development-work before that date. At that time they agree to pay the owners $150,000, to begin the construction of a 500-ton mill and have it in operation within eighteen months, and to give the owners a one-fifth or 20 per cent. interest in the organization. Otherwise they quit the property and relinquish all rights, equipment, etc.

"The Tonopah-Belmont Development Company has organized a Canadian company through which they will carry on all its mining operations in connection with this property. This is the Belmont Canadian Mines, Limited. The president of this company is Clyde A. Heller, also president of the Tonopah Company. The secretary and treasurer is K. Kitto, also holding the same office in the parent company. Thus far there are only three directors of the Belmont Canadian Company—Mr. Heller, Mr. Kitto, and myself; the idea being to increase the size and scope of this organization only in proportion to the magnitude of its operations. The superintendent at the mine is F. W. Holler, for some years connected with the Tonopah Company's operations in Nevada and Mexico. He has about forty-five to fifty men at the mine, and has built a first-class camp which offers very comfortable accommodations not only for the employees, but for any visitors who are interested in looking over the operations."

WESTERN CANADA PORTLAND CEMENT COMPANY'S PROPERTY.

The following notes in regard to the property of the Western Canada Portland Cement Company are taken from a report by W. E. Losee, which was forwarded to the Provincial Mineralogist, with permission to use for publication.

The property is situated on the Skeena river at Mile 79 to 83 on the Grand Trunk Pacific Railway. The lime-deposit is a band of marble 400 feet wide, lying above the railway-track, and having a height above the tracks of from 100 to 2,000 feet. These levels were taken by aneroid, but the weather being fine, are considered approximately correct. There are two unimportant intrusions of trap-rock into this band of marble.

The following analyses of the limestone were made by J. O'Sullivan, Vancouver, B.C. :—

	White Limestone.	Grey Limestone.
	Per Cent.	Per Cent.
Silica	2.0	9.0
Oxide of iron and alumina	1.0	2.0
Carbonate of calcium	97.0	88.9
Magnesia	Trace.	0.1
Sulphuric acid	None.	None.

On the western end of the property, near where the limestone occurs in the largest body, there are several beds of fine clay and shale which has been analysed and found to be of a good quality for cement-manufacture. There is also an immense gravel-bank close to the Shames river on the western lease which is very suitable for concrete purposes.

An analysis of a sample from the clay-deposit by J. O'Sullivan is as follows :—

Silica	62.40	per cent.
Alumina	20.51	"
Oxide af iron	8.20	"
Lime	1.00	"
Magnesia	1.50	"
Sulphuric acid	0.60	"
Ignition loss (combined water, carbonic acid, and organic matter)	6.50	"
Total	100.71	"

The property is held by a number of leases, all of which have been surveyed. There are several mountain streams crossing the property which give water in the dryest season. The whole of the leases from Mile 80 to Mile 83 are covered with a fairly good growth of timber, some of it running as large as 3 feet in diameter. Hemlock is most abundant, with some spruce and cedar.

From measurements made, Mr. Losee estimates that the Shames river has a drop of 375 feet in two miles, and that it could be hydro-electrically developed to give about 7,000 horse-power at extreme low water.

In conclusion, Mr. Losee, who for eight years was superintendent of the Vancouver Portland Cement Company at Tod Inlet, says: "Further comment by me would be superfluous, as your property will bear the closest examination."

PORTLAND CANAL MINING DIVISION.

REPORT BY JOHN CONWAY, MINING RECORDER.

I have the honour to submit herewith my annual report for the Portland Canal Mining Division for the year ending December 31st, 1914.

Mining generally throughout this Division shows an improvement as compared with 1913. Several of the prominent properties are under bond to reliable parties, and prospects are looking bright for the coming year.

MAPLE BAY.

The several groups of claims owned by Collison & Noble, and the *Comstock* group, owned by the Messrs. Flewin, have been bonded to the Granby Consolidated Mining, Smelting, and Power Company, Limited. The work done by this company consisted of diamond-drilling, and I am informed that results were satisfactory.

GEORGIA RIVER.

The *Guggenheim* group consists of eight claims situated on the eastern slope of a mountain which lies between the North fork of Georgia river and Portland canal, approximately ten miles from Stewart.

The property at present is reached by a trail which zigzags up to the crest and down the other side of the mountain referred to. The natural site for a trail from the south is up the Georgia river, which empties into Portland canal some eight miles farther down, or over a low divide which separates the mountain on which the property is located from the adjoining one on the north. The formation in this vicinity, which is schistose in character, is uniform and appears to be in place.

There are several veins on the property carrying more or less mineralization. Chief amongst these is a large quartz ledge from 10 to 30 feet in width, exposed and traceable across the entire property. No great surface values have been obtained; in several places, however, where open-cuts have been made good gold values have been secured.

Intersecting the large vein a smaller vein occurs, which also gives promise of developing ore. Here, as well, gold values predominate. At two points on the small ledge referred to, where it intersects the larger, some ore is in evidence on the surface; this ore is said to have assayed from 6 to 8 oz. in gold and 15 to 25 oz. in silver; the quartz on the surface gave little or no values where mineralization was absent. As sinking on the small ledge could not be done owing to a small stream flowing over it at the point desired, a shaft was sunk in the hanging wall, in 1912, to a depth of 17 feet. A quartz-seam which was of no consequence at the surface widened out to 18 inches at the bottom, where some excellent high-grade ore was encountered. While the values were not uniform, considerable of the quartz which showed little mineralization gave good assays in gold.

A small crosscut was run to cut the small ledge, this being the original object in view, and at this point the quartz showed very little mineralization. An average across the ledge about 12 inches in width gave 2.4 oz. in gold and 4 oz. in silver.

In 1913 a tunnel was started some distance down the hill which would give considerable backs by the time it reached a point vertical under the shaft. This also had to be driven at the outset in the hanging-wall. In 1914 the tunnel was advanced to a distance of 55 feet from the portal, and had just encountered the ledge when work was discontinued for the season.

About 200 feet above the point of intersection on the first-mentioned or larger vein considerable work in the way of open-cuts was performed, assays of the ore ranging from 0.2 to 3.7 oz. in gold being obtained.

While the property is a promising one, still enough work has not been done to determine or indicate in any measure what can be expected.

The co-owners of the property, C. H. Dickie, Beaton & Hemsworth, are making arrangements to commence active development-work in the spring as soon as weather conditions permit.

MARMOT RIVER.

The *Emma Gordon* group, consisting of three claims, is situated on the shore-line of Portland canal just south of the mouth of Marmot river, and is owned by S. G. O. Chalmers and G. W. Bruggy. Twenty-five feet of tunnel has been driven and considerable amount of surface work has been done. A small trial shipment made to the Trail smelter gave the following assay values: Gold, 0.08 oz.; silver, 66.4 oz.; copper, 0.56 per cent.

Montana Group.—A leasing bond has been taken on this property by Angus McLeod and G. W. Bruggy. It was the intention of the lessees to make a shipment of high-grade ore in the fall, but smelting conditions would not warrant them in doing so.

SALMON RIVER.

The group of eight claims owned by the Salmon-Bear River Mining Company, Limited, was bonded in November to H. Robinson Plate, of New York. Mining operations commenced early in December with a force of ten men under the superintendency of N. L. Wimmler, M.E.

It is the intention of the management to use diamond-drills for prospecting the ground, and drills will be taken to the property over the snow-crust in March.

Big Missouri Group.—On the *Big Missouri* claim the crosscut tunnel started some time ago was extended 20 feet, but it will require at least another 25 feet to get under the ore-body showing on the surface. On the *Province* claim a tunnel was driven 15 feet, all in ore. On the *Golden Crown* claim the tunnel was extended a considerable distance, and on the *Union* claim an open-cut about 10 feet shows some ore.

This property is under bond to the Gastineau Mining Company, which is operating on a large scale in the vicinity of Juneau, Alaska. Diamond-drills will be used for proving up the ground and operations will commence early in the spring.

Yellowstone Group.—This group was under option to the Canadian Mining and Exploration Company, Limited. The work done by the company under the superintendency of W. J. Rolfe, M.E., consisted entirely of surface work, such as small shafts and trenches. The owners were notified three months after the expiration of the option that the company had decided not to continue development on the property.

The *Martha Ellen* group, owned by the Hercules Mines, Limited, was also under examination by Mr. Rolfe for the Canadian Mining and Exploration Company, Limited. The same character of work was done as on the *Yellowstone* group. It is the intention of the Hercules Mines, Limited, to install an oil-driven compressor on the property early in the spring.

The Indian Mines, Limited, reports 65 feet of drifting along the hanging-wall in No. 1 tunnel, and 25 feet of crosscutting in No. 1 tunnel.

Annual assessment only was done on the Cascade Falls Mining Company's property during the year.

BEAR RIVER.

The *Prince John* group, consisting of three claims, *Prince John, Nos. 1, 2,* and *3,* situated on the west side of Bear river about four and a half miles from the town of Stewart, is owned by J. H. Nesbitt and Andrew Archie. The mountain-sides along this side of the Bear River valley are very steep, rising from the valley-level at about 45 degrees, and the outcrop where the work has been done is about 2,000 feet up the mountain-side. The ore-deposit runs north-west and south-east, following along the mountain-side, with a slight upward trend towards the west.

The lower part of the mountain-side is a diorite, which forms the foot-wall of the ore-deposit. The heaviest mineralization appears at about 800 feet upward from the diorite, and at this point the work has been done. The entire mineralized ore-bearing zone is from 40 to 60 feet in width, having for the hanging-wall solid Coast granite. Between the diorite and granite occurs a siliceous schist and greenstone belt which appears to be quite heavily mineralized throughout, but most heavily in the central part. The work done at this point consists of 45 feet of tunnel; the first 20 feet is in slide or broken surface rock, and the remaining 25 feet in solid formation. The last 25 feet shows copper minerals freely distributed through the rock; shipping-ore can be sorted from this rock. The tunnel crosscuts the formation, and about 40 feet beyond the end of the tunnel, but on the surface, is an open-cut about 60 feet in length which shows good copper values the entire distance. Running parallel with the diorite and granite through the schist and greenstone are several narrow porphyry dykes.

There are no slides at this point of the mountain-side to interfere with work winter or summer. There is good timber from the base of the mountain up to the claims and a good and safe camp-site where the work is done. The veins dip into the mountain at an angle of about 45 degrees.

The *Royal* group consists of seven claims and two fractions, and is owned by W. B. George and associates. It is situated on the south side of Bear river about six miles above the junction of Bear river with American creek and about eighteen miles from the town of Stewart. A 30-foot tunnel has been driven to crosscut a ledge which is from 50 to 60 feet in width and dips into the mountain at an angle of about 38 degrees. Some good ore was struck in this tunnel; assays from samples taken at the face of the tunnel gave copper values, with fair gold and silver values. The vein has been traced for over 2,000 feet on the surface. About 600 to 1,000 feet higher up the mountain lies another brecciated mineralized zone; several open-cuts have been made on it, and a shoot of ore opened up 5 feet in width and 1,000 feet in length, this being perpendicular, with a slight dip to the lower vein. Average assay values are said to give about $35 in gold, silver, and copper.

GLACIER CREEK.

The work done by the Portland Canal Tunnels, Limited, during the year is as follows: Main crosscut tunnel, 816 feet (total length 3,629 feet); drifts (four veins), 1,542 feet; crosscuts (two), 84 feet; raises (two), 165 feet; surface drifting, 40 feet; total, 2,647 feet.

The Green vein, which probably forms the foot-wall of the "fissure-zone," was crossed near the face of the main tunnel. The vein showed streaks of ore varying in width from $\frac{1}{2}$ inch to 2 feet for a distance of 60 feet. The vein itself is nearly 100 feet in width. The best streak of ore has been drifted on for a distance of 313 feet and considerable milling-ore has been developed; just how much it is impossible to say, as no raising has been done. The ore differs from any previously mined in the fissure-zone in that it contains sufficient zinc to justify the saving of this metal. Other metals present are gold, silver, and lead, also bunches of ore carrying up to 2 per cent. copper. Drifting on other veins, while encouraging, did not find ore in sufficient quantities to mine. (Report furnished by C. B. White, Superintendent.)

Lakeview Group.—Development-work was continued on the property during the season and some ore was sacked for shipment. A shipment of 2 tons was made to the Tacoma smelter, which gave assay values of 0.41 oz. gold and 404 oz. silver to the ton. Owing to existing conditions at the smelters the owners did not feel justified in making further shipments.

Ruth & Francis group consists of five claims situated on the North fork of Glacier creek, owned by J. H. Nesbitt and A. Archie. The claims are three miles and a half from the railroad and a good trail leads from the railroad up to the claims. There are two leads crossing the claims on which work has been done. One, the *Ruth & Francis* ledge, runs parallel with the creek on the west side, and the *Copper King* ledge runs easterly and westerly, crossing the *Ruth & Francis* ledge nearly at right angles.

There is about 70 feet of tunnel on the *Ruth & Francis* lead which, following the lead, is in ore all the way. Thirty-one feet in from the tunnel entrance there is 4½ feet of ore. As the ore-body widened out from this point, the tunnel swings to the left along what is supposed to be the foot-wall, and the remaining work has all been in ore. With the intention of prospecting this lead from a better location, a working-tunnel has been started 200 feet lower down on the lead; it is in 16 feet. The *Ruth & Francis* vein carries antimony, lead, and silver as its principal values.

The *Copper King* vein is farther up the creek and crosses it; the ore contains copper with some gold. There are several open-cuts showing an approximate width of 20 feet, and a crosscut tunnel has been driven 50 feet, with possibly 50 feet more to go, which should tap the vein at about 75 feet in depth.

American Creek.

The *Kansas* group, owned by the Vancouver Portland Canal Mines, Limited, has been leased to George H. Collins. Three men in seven weeks took out 5 tons of silver-lead ore which it is said will average about $150 to the ton, and 4 tons of surface ore which is also expected to assay well. Owing to present conditions no shipment was made.

Office Statistics—Portland Canal Mining Division.

Free miners' certificates (individual)	104
" " (company)	4
Mineral claims recorded	137
Certificates of work issued	344
Bills of sale, etc., recorded	39
Filings	13
Certificates of improvements recorded	29

Revenue.

Free miner's certificates	$ 853.75
Mining receipts, general	2,661.35
Other sources	115.00
	$3,630.10

PORTLAND CANAL MINING DIVISION.

NOTES BY WM. FLEET ROBERTSON, PROVINCIAL MINERALOGIST.

BEAR RIVER CAMP.

I beg to report that I visited Stewart, on the Portland Canal, on September 23rd to 26th, 1914.

In the Bear River camp I found that during the past summer quite a number of prospectors had been at work in the hills, employed chiefly in doing assessment-work on claims previously staked, but a number of new locations had been recorded.

At the time of my visit all but three or four of the prospectors had left the camp, as the weather had become too bad for work in the hills.

The only mining-development work going on in the camp was being carried out by the Portland Canal Tunnels, Limited, which company has been, for some time past, driving a long crosscut tunnel to cut the leads, which had been encountered, outcropping—at much higher elevations—for a considerable distance, both to the north and to the south.

As this tunnel will do much to prove and develop the various other properties in this part of the camp, all other development-work has been postponed until the results to be obtained in the tunnel have been shown.

Before describing what has been accomplished in these tunnel-workings, and in order that the significance of such accomplishment may be fully appreciated, it may be advisable to briefly review the general conditions and mode of occurrence of the ore-bodies in this portion of the camp, as they appear to the writer.

The geology of the camp has been fully described by R. G. McConnell in the Summery Reports of the Geological Survey of Canada for the years 1910 and 1911, while the camp and its various mineral claims were reported on by the writer in the Report of this Department for 1910.

Summarizing from these reports, it may be said:—

The rock formation in the locality affected by the workings of the *Portland Canal* is described by McConnell as "the Bitter Creek argillites." In these argillites there is a great fracture or shear-zone which runs in a general north-and-south direction, conforming as to dip and strike with the bedding of the argillites, and on this zone are located practically all the important claims of this immediate vicinity. The "Portland Canal fissure-zone" is described by McConnell as "clearly traceable from the *Jumbo* and *Ben Bolt* claims, situated near the head of the South fork of Glacier creek, north-westerly to the *Portland Canal* mine, a distance of over two miles. Beyond this point the surface drops down into the valley of Glacier creek and exposures for some distance are infrequent. Occasional quartz-outcrops, however, occur at intervals in the same strike, and there is little doubt that the zone continues across the valley (of Glacier creek). North of the valley the outcrops increase in number and the zone is easily traceable through a number of properties to the *Sunbeam* claim, a total distance from the *Jumbo* of over four miles."

The zone varies in character and width along its course; to the south, on the *Jumbo* claim, it is about 100 feet in width, and consists of a mass of crushed and brecciated slates, enclosing small quartz stringers and kidneys, but no large persistent quartz vein. Farther north the quartz occurs mostly in a central band, usually from 6 to 20 feet in width.

Farther north, in the deep valley of Glacier creek, quartz-outcrops occur over a width of fully 800 feet.

At the *Stewart* mine, half a mile north of Glacier creek, the zone has a width of 400 feet and contains four main quartz veins, the largest of which is 27 feet wide.

On the *Sunbeam* claim, near the northern termination of the zone, only one large vein is exposed.

This great shear-zone would therefore appear to be at least four miles long, with a maximum width in its centre, near Glacier creek, of about 1,000 feet, diminishing both to the north and south.

In this zone there are a number of diorite dykes, not of very great thickness, which appear, generally, to follow the dip and strike of the zone.

In proximity to these dykes and parallel to them there are found planes of more than ordinarily crushed material, along which silicification has taken pace to such an extent as to form brecciated-silica-cemented "veins," as they are called, and these veins in places are mineralized with sulphides of iron, copper, zinc, and lead, carrying values in gold and silver.

McConnell seems to be of the opinion that these dykes, of which he describes several, were injected after the formation of the shear-zone, but prior to the mineralization and silicification of the breccia, and that they were not genetically responsible for the mineralization.

"The dykes of this series occur at several points in the district either adjoining or close to the ore-zones, but their genetic connection, if any, is probably limited to shattering the slates and so forming a channel for the ore solution."

These silicified breccias adjacent to the dykes form the so-called veins of the district, and are best exemplified, as such, on the *Stewart* property, where four "veins" are found in the fracture-zone, which here has a width of some 350 feet.

These veins have been known as the No. 4 or most westerly vein; then, towards the east, the Nos. 1, 2, and 3, the last being the most easterly and known as the "Green vein."

On the Portland Canal Company's property, a mile and a half to the south of the *Stewart* property, and at an elevation of 2,500 feet, the vein there worked, and fully described in the 1910 Report of this Department, has been supposed to correspond to the No. 4 vein of the *Stewart*, in which, at the *Stewart*, the only ore-shoot, of considerable size, was found.

This supposed correlation was based upon the similarity in character of the mineralization and possibly also of the dip, but this supposition was impossible of any definite confirmation and remained a matter of conjecture, as the nature of the ground prevented the tracing of the leads on the surface.

Little, if any, doubt existed as to the identity or continuance, both horizontally and vertically, of the fissure-zone.

As to the continuance of the veins in the zone, whatever the hopes may have been, there was no evidence at all satisfactory, and it was a matter requiring demonstration.

Such was the condition of affairs when the Portland Canal Tunnels, Ltd., started to drive in its long crosscut tunnel at an elevation of 319 feet above sea-level, in the hope and personal conviction of the promoters that the veins were continuous. Outsiders naturally considered it a "long shot."

The tunnel has now been driven in for a total distance from the portal of 3,671 feet and has cut across the fissured zone, as was expected, and, furthermore, it was found to have retained, at this depth, of approximately 2,200 feet vertically lower than the *Portland* workings, most of the features it showed in the higher workings on the surface.

In the zone, where struck by the tunnel, there were found to be at least four fairly defined silicified and brecciated zones, with accompanying diorite dykes, which tally sufficiently well with the four "veins" observed on the *Stewart* to justify the presumption that they are correlated and probably the same.

This fact must be admitted as a distinct confirmation of the hopes of the tunnel engineers and a very decided encouragement, and may be said to have demonstrated that the veins persevere in the fissure-zone to a depth at least greater than the tunnel-workings.

As is quite apparent in the older working properties and as has been pointed out by McConnell, these veins are not mineralized commercially throughout, but the valuable minerals were confined to concentrations, in ore-shoots, lenses, etc., of greater or less size, which formed but a fraction of the gross extent of the vein.

It would therefore not be a matter for particular discouragement if, where the tunnel happened to crosscut these veins, they should at these points be devoid of ore in commercial quantities.

On the other hand, should ore be encountered in any vein, it would be a matter of considerable encouragement in proving that the ore did continue to that depth, but no great commercial significance would attach to the fact until, by lateral and vertical development on the vein, the extent of the ore-shoot had been demonstrated.

As to what has been done by the tunnel-workings, the following has been taken from the mine-plans after an approximate verification on the ground by the writer:—

The Portland Canal tunnel was started in on the *Riverside* claim a couple of hundred feet from the concentrator of the Portland Canal Mining Company, at an elevation of 319 feet above sea-level; this location and elevation suiting admirably for the delivery of ore directly into the bunkers of the concentrator.

As already stated, the tunnel has been run in for a total distance of 3,671 feet in a general S. 70° E. direction. The first 3,000 feet (approximately) of the tunnel is perfectly straight (S. 69° E. from plans), passing through the *Jennie*, *Lucky Boy*, and *Melba* claims and into the *Richard II.* claim, where a slight deflection was made to the right, so that the continuation of the tunnel cuts the southern corner of the *O.K.* claim, the face of the tunnel being in the *Mosquito* claim.

At a distance of 600 feet in from the portal a drift was run to the north from the tunnel for a distance of 80 feet, when it came out in the canyon of Glacier creek, and this adit now serves for ventilation and as a dump for waste rock.

At 2,450 feet in from the portal a distinctly brecciated and silicified zone or vein was cut by the tunnel, called by the management the *Lucky Boy* lead. This lead has been drifted on to the north for a distance of 500 feet, when an inclined raise was put up, at an angle of about 60 degrees, for a distance of 140 feet, when it "holed out" in the canyon of Glacier creek and serves now as a ventilating-tunnel.

The *Lucky Boy* lead is supposed by the management to correspond with a lead exposed in a surface cut on the *Richard* claim, where it was fairly well mineralized.

The *Lucky Boy* lead as exposed in the tunnel and drift, although very fairly well defined, did not contain any appreciable amount of sulphides.

At 2,642 feet in the *Melba* lead was cut—another fairly well-marked brecciated zone some 40 feet wide, cemented by siliceous infiltration and with some narrow bands of sulphides.

This is supposed by the Tunnels management to correspond to the leads worked in the *Portland Canal* mines and developed as the No. 4 or most western vein in the *Stewart* property.

Whether the leads encountered in the tunnel may be correlated with those found elsewhere seems unimportant; the main fact that the fissure-zone continues to this great depth with the same characteristics as on the highest workings, and contains a series of veins that are mineralized, seems proven, which is quite sufficient for the present.

On the *Melba* lead, by the last of September, a drift had been run to the south for a distance of from 300 to 350 feet, which shows the lead to contain some mineralization by sulphides, not sufficient to be considered ore, but enough to give encouragement that ore may be obtained by drifting.

At about 2,760 feet in, a lead about 10 feet wide, similar and parallel to the others, was cut through. Where cut by the tunnel it did not show mineralization and it has not been drifted upon.

At 2,916 feet a lead, known as the *Richard* lead, and which is accompanied by a dyke, was cut through. On this a drift had been run to the south for 140 feet, with, near the face, a raise of about 30 feet.

This lead, where cut by the tunnel, contains a small but encouraging band of sulphide ore which followed along in the drift, and on the best part of this the raise had been put up.

In the face of the drift and at the top of the raise the ore-streak had become very small and further work had been stopped for the time being.

At 3,610 feet in from the portal and almost on the dividing line between the *O.K.* claim on the north and the *Mosquito* claim on the south, the largest and possibly the most promising lead of all was cut. The lead itself—by which is meant the brecciated zone—was found to be from 50 to 60 feet wide, its limitations being rather indefinite.

The lead has been supposed to correspond with the No. 3 or Green vein of the *Stewart*, the most easterly of the veins in the fracture-zone, and, certainly, the face of the main tunnel, about 60 feet farther in, to the east, appears to have entered into the unfractured slates.

In this lead there are visible four or five stringers of ore ranging from 2 to 12 inches in width, with a larger stringer of about 24 inches. On this larger ore stringer a drift had been run to the south for some 50 to 60 feet, and at the end of September the work was still progressing. Accompanying this band of ore are several smaller stringers appearing in the face of the drift.

The writer took a sample from the face across what might be called the ore-band, some 2 or 3 feet wide; this gave upon assay: Gold, $2; silver, 3.8 oz.

This assay confirms the samplings and assays made by Mr. Elmendorf, taken where the tunnel crosscut the lead, which showed, on two samplings of the first or outer 10 feet of the lead, $2.30 and $1.60 in gold and 4.9 oz. and 6 oz. in silver.

The term "ore" as it has been here used is intended to mean such portion of the vein as gives visible evidence of containing enough sulphides to form a reasonable mill-feed for the concentrator, and would produce about 1 ton concentrates from 5 tons of ore.

The work in and from the tunnel has not progressed far enough to enable any definite opinion being expressed as to the ultimate success of the undertaking—even on the *Mosquito* lead, the present showing in which is far the best in the tunnel. As already pointed out, the enterprise has so far been successful, in proving the veins with depth and the fact that at least some of these veins are there mineralized, both as to constituents and values, very similarly as on the surface workings. This would appear to justify the further prospecting of the various leads with a fair chance of finding ore-bodies quite equal to, if not better than, those found on the surface.

Emma Gordon Mineral Claim.—While in Stewart a trip was made by launch to the *Emma Gordon* mineral claim, owned by G. W. Bruggy and S. Chalmers, of Stewart, and situated some six miles down the canal from Stewart and on the east side.

The property is of especial interest as it is totally dissimilar from any property previously reported upon in the district, and is in another class of rock-formation—in the Coast granite. By drawing attention to what has been here found, it may lead to a more thorough prospecting of this formation, which has not been looked upon with favour by the prospector.

The workings were found to be on the water's edge, the mountains rising therefrom at a steep angle, the formation being entirely the Coast granite, which here is full of fractures and faults, with innumerable cross-slips dividing the granite into, more or less, cubical masses.

Some of the main fractures show the granite on either side to be more highly silicified than is the general mass, but not necessarily showing any other mineralization. The minor fissures and slips seem recent breaks and show no alterations along their sides.

The work was started on the water's edge, where a small diorite dyke was visibly outcropping and cutting the granite at a flat angle for a few feet, when it became nearly vertical and seemingly cut into the hillside.

Along the contact of this dyke with the granite there is a small amount of iron sulphides, from which assays as high as 200 oz. of silver to the ton have been obtained.

This was the showing upon which the work was started, and the mineralization was followed in by a tunnel, which is now in some 20 feet.

The dyke—already mentioned—when it took on a vertical angle seemed to disappear, its course being continued by a small and irregular fissure in the granite, which did not appear to the eye to have been altered or to contain any particular mineralization, but a sample taken by the writer, as an average over 2 feet of this apparently unmineralized granite, gave upon assay $1.60 in gold and 28.8 oz. in silver to the ton, indicating values not apparent to the eye.

A sample of the rock as broken as ore in the inner part of the tunnel, but not showing any sulphides, assayed $1.60 in gold and 43.2 oz. silver to the ton.

Another sample taken as representing the first-class ore lying sorted on the dump, taken partly from the proximity of the dyke and containing some iron sulphides, gave upon assay $2 in gold and 109.6 oz. in silver to the ton.

QUEEN CHARLOTTE MINING DIVISION.

REPORT OF E. M. SANDILANDS, GOLD COMMISSIONER.

I have the honour to submit the annual report on mining operations in the Queen Charlotte Mining Division for the year 1914.

Mining in general has not been very lively owing to the unsettled state of the country and the inability to obtain capital for development. Several working bonds were in operation, but owing to the depressed state of affairs work was temporarily abandoned. One of the most notable features of the year was the issuance of some forty-two certificates of improvement.

Mr. Beresford, for five years Deputy Mining Recorder at Lockeport, has resigned, and Mr. Wm. Morgan, has been appointed in his place.

COLLINSON BAY.

In the early part of 1914 considerable work was done on the *Thunder*, *Sadie*, and *Spade Flush* groups, owned by Thompson, McMillan, *et al.*, and under bond to C. E. Mahon, of Vancouver. A crosscut tunnel some 275 feet has been run, and a drift 50 feet to the east on the vein, also a raise 25 feet high. Both the drift and upraise are in ore. Some twelve men were employed; Crown grants were issued the passed year for the above-mentioned claims.

IKEDA BAY.

At the *Ikeda* mines no work has been done, except the annual assessments on the un-Crown-granted claims. However, in November last, Mr. Ikeda opened up the mine again in a small way with some eight or ten men. He is shipping 40 tons of ore a month to the Granby smelter at Anyox. The work being done is on the *Lily* claim; a shaft is being sunk in the No. 3 tunnel, about 260 feet in from the portal; there is a good showing of chalcopyrite in the shaft. This vein runs parallel to the main vein. In the spring more men will be employed and work vigorously prosecuted.

JEDWAY.

At the *Copper Queen* no work has been done, with the exception of the usual assessments. This year again quite a number of the claims have been Crown-granted. A watchman is in charge of the property.

On the *Togo* mineral claim, owned by Daykin & Metcalfe, a shaft has been sunk to a depth of some 16 feet, encountering some good ore, assaying 3 per cent. in copper. This vein is 7 feet wide and its proximity to the water should enable it to become an early shipper.

HUSTON INLET.

On the *Hercules* group, situated on the divide between Huston and Collison bay and owned by McMillin & McEachern, an open surface cut was run this summer, uncovering the vein for a distance of 75 feet; the vein is 4 feet wide and assayed well in copper. More work will be done the coming summer.

The *Hope* claim, situated near tide-water in Huston inlet, has a vein uncovered for some distance with a width of 30 feet. Some good values have been obtained.

At the *Ivan* group, owned by Thompson, McKinnon & Sivart, four men have been employed and 65 feet of tunnel driven, besides considerable surface work, exposing the vein in three places. Work has been stopped for the present on this property.

On the *Rio Tinto* group, situated on Banner mountain in Huston inlet and owned by L. Abriel, surface cuts have exposed ore to a width of 40 feet for over 400 feet in length. The capping is garnetite and magnetite, with some high-grade bunches of copper ore.

LOCKEPORT.

On the *Swede* and *Last Chance* groups the usual assessment-work has been done. The ore showing in the main tunnel of the *Swede* group at the face has materially improved, besides some new showings being uncovered on the surface. The *Bird* group is being Crown-granted.

TASU HARBOUR.

At the *Warwick* group, in Tasu harbour, owned by J. E. Corlett and this past summer under bond to R. R. Hedley *et al.*, fifteen men were employed from January to June and some $10,000 expended. Eleven hundred tons of ore was shipped to Tacoma smelter, carrying 1.50 per cent. copper, 0.02 oz. gold, 0.42 oz. silver, and 62 per cent. iron. The mine is equipped with new (Crawford) aerial tramway, running to the beach, where a 1,200-ton bunker is erected. Good mine buildings were erected. The property is now closed. All the claims, some twenty-four in number, were Crown-granted this year.

Opposite this property, across the bay, is the *Marion Fraction* on which considerable work was done this year and with fairly gratifying results.

CUMSHEWA.

The Cumshewa Iron Mines, Limited, owns some six claims on Louise island, in Cumshewa inlet. Some fine showings of high-grade iron are exposed. No work of any great extent has been done this year, with the exception of a preliminary survey for a tramway to the beach, and harbour soundings, also some surface work.

SKIDEGATE INLET.

On the *South Easter* and *Beaconsfield*, situate near the Skidegate Indian Reserve and owned by McLellan & Gordon, Mr. Hickey has taken a bond and is sinking a shaft on the property. Assays of ore taken from this property are said to run well, as it has some high-grade galena carrying good values in gold.

GOLD HARBOUR (WEST COAST).

On McLellan's free-milling gold property in Gold harbour last spring Davey & Chapman did considerable work, and ran the stamp-mill with very gratifying results. Again in the fall Davey & Person worked the property for three months and made a very nice clean-up.

MASSET INLET.

In Justkatla inlet, at the head of Masset inlet, some quartz was discovered carrying free gold. Several claims were staked by Robertson & Stacks. No further developments have been reported.

OTARD BAY.

McPhail & Stewart are still operating their oil-drill in this vicinity, and they expect to put on another drill in the spring. They are now down to a considerable depth.

ROBERTSON-WILSON CAMP.

At the Robertson-Wilson camp on the Yakoun river quite a considerable force of men were employed doing development-work on the surface under the management of Professor Milnor Roberts and his assistant, Mr. McDonald. Good buildings were erected and some coal mined.

In this vicinity two diamond-drills were also in operation under the management of Mr. Barton, who had charge for the Graham Island Collieries. Considerable drilling was done during the summer. The drills were taken up the Yakoun river on scows when the water was high enough.

On the east coast of Graham island and about seven miles west of Lawn Hill F. C. Wright operated a coal-drill for an English syndicate. The drilling was closed down in the fall, but will be resumed in the spring.

J. D. MacKenzie from the Canadian Geological Survey, Ottawa, in company with his assistant, Mr. Dolmage, spent a good deal of the summer studying the geological formations around Camp Wilson and the islands in general.

OFFICE STATISTICS—QUEEN CHARLOTTE MINING DIVISION.

Claims recorded (quartz)	32
Certificates of work issued	152
Certificate of improvements	42
Bills of sale, etc., recorded	11
Free miners' certificates issued	95

Revenue.

Free miners' certificates	$ 507 50
Mining receipts	695 10
Other sources	1,112 50
	$2,315 10

QUEEN CHARLOTTE MINING DIVISION.

REPORT BY W. M. BREWER, M.E.

GRAHAM ISLAND.

During a portion of the month of August, 1914, the writer was engaged in making an examination of that portion of Graham island known as the Yakoun coalfields. The earliest report of these coalfields was published in the Annual Report of Canadian Geological Survey, 1873, by James Richardson. The next report was made by the late Dr. George M. Dawson, and published in the Canadian Geological Survey Report for 1878. In the British Columbia Minister of Mines' Report for 1902 there is a description of an examination made by Dr. T. P. Marshall, F.C.S. In the Annual Report of Canadian Geological Survey 1904, Dr. W. Ells describes this district, and the summary Report of Canadian Geological Survey for 1912 contains a description by Chas. A. Clapp, a member of the Geological Survey.*

During the examination made last summer, the writer met Professor Milnor Roberts, Dean of the School of Mines of the University of the State of Washington, and Livingstone Woernecke, his assistant, who were conducting drilling operations, doing other exploratory work, and making a topographical and geological survey of the coalfields in the interests of the Imperial Trust Company of New York, the present owners of the Wilson and Robertson tracts, containing some 20,000 acres, located nearly fifty years ago as coal lands. The writer is very much indebted to these gentlemen, not only for very efficient assistance in his examination, but also for generous hospitality during his visit.

There are two routes by which the traveller can reach the Yakoun coalfields; one is from Port Clements, situated near the mouth of Yakoun river, at the south-east end of Masset inlet; the other route is from Skidegate inlet, the channel which divides Graham from Moresby island, situated to the south.

By the first-mentioned route the trip can be made by either poling a canoe up the Yakoun river, a distance of about thirty miles, to the mouth of Wilson creek near the northern boundary of the coalfields and about a mile from Camp Wilson, or by walking along the Government trail, which connects Port Clements with Camp Wilson, the main camp in the coalfields; the distance by the trail is about the same as by the river.

By the alternative route the trip is made by boat from Skidegate village to the mouth of Honna river, which empties into Bearskin bay, Skidegate inlet; thence by Government trail to Camps Robertson and Wilson, the distance being about twenty miles.

Considered from a transportation standpoint, there has already been a railroad charter obtained by W. H. Armstrong, of Vancouver, providing for the construction of a road from a safe harbour near Lena island, on Skidegate inlet, northerly to Yakoun lake, at the head of the Yakoun river; thence down the river to Masset, where there is a good harbour. By this route few engineering difficulties would be encountered; an easy grade could be secured most of the distance, and a section of country would be opened for development, a portion of which has already been taken up by pre-emptors, many of whom are doing good work in improving their land.

Another and shorter route by which a railroad could be constructed without much difficulty would be to start from Yakoun bay, at the head of Rennel sound, on the west coast of Graham island; thence across a summit at an elevation of about 600 feet between the bay

*NOTE.—Since this report was written the Summary Report, 1913, of Canadian Geological Survey has been published containing a report on these coalfields by J. D. MacKenzie.

and Yakoun lake, a distance of about four miles; thence skirt around the west and north side of Yakoun lake, and from there follow along the west bank of the Yakoun river to the north end of the coalfields near the mouth of Wilson creek and about one mile west from Camp Wilson. This route, although much shorter, would fail to open up as great an area of agricultural land unless construction was continued to Masset village, as the west coast of Graham island is generally mountainous.

Camp Wilson.

Camp Wilson is situated on Wilson creek, which flows from the southeast into the Yakoun river about ten miles below Yakoun lake, the source of the river. So far as is at present known, the northern boundary of the Cretaceous coal-measures is only a comparatively short distance from Camp Wilson; in fact, drill-holes that have been bored about five miles north from the camp have exposed only igneous rocks.

The seam on which development-work has been done is known as the Wilson seam, which is underlain by 6 inches of good fireclay, from which Milnor Roberts reports that he has made in the laboratory, a good quality of firebrick.

The coal-measures are found occupying a synclinal trough, the line of strike of the axis of which is about S. 10-20° E. The boundaries of this syncline had not been determined at the time of the writer's visit, neither had the extent of the areas underlain by coal been fully demonstrated, but drilling operations with two diamond-drills were being energetically carried on. Two series of holes are being bored, one series on the dip, the other on the strike of the seam.

In his report, C. H. Clapp refers to this coalfield as follows: "At Camp Wilson the most promising of the coal-seams of Graham island has been opened up by a small amount of development-work. The measures associated with the coal-seam, which has a maximum thickness of nearly 17 feet, are a roof of greenish-grey pebbly sandstone and conglomerate, and a floor of coarse bluish-green sandstone 30 feet thick overlying carbonaceous sandy shale."

During the past summer there has been some prospecting—open-cuts and trenches made on outcroppings of coal designated as the Skid Creek seam. Skid creek is a small tributary of the Yakoun river, emptying into it about one mile north from the mouth of Wilson creek and flowing parallel to the last-named creek. The line of strike of this seam is N. 30° W. and the dip is at an angle of 70 degrees towards S. 60° W. From nine open-cuts made along the line of strike, at intervals, for a distance of 750 feet, the continuity of the coal has been determined, but up to the time of the writer's visit in August no one seam had been found of commercial value, because, while the occurrence is made up of a series of four narrow seams of coal in a total thickness of 10 feet of coal-measures, the thickest seam is the lowest one, and this is only 15 inches of clean coal.

This series of coal-seams apparently represents a distinct occurrence, as the line of strike is several degrees more westerly than that of the Wilson seam, and the dip of the measures is towards the opposite direction from the dip of that seam. It would appear as though probably a narrow anticlinal fold occurred between the two seams, and that the Skid Creek seam occupied a synclinal trough nearly parallel to the one occupied by the Wilson seam.

The development-work on the Wilson seam consisted of Nos. 1, 2, and 3 working openings, two shallow pits, and five diamond-drill holes. On the Skid Creek seam the development-work consisted of a series of open-cuts and trenches, exposing coal along the line of strike.

The No. 1 working opening on the Wilson seam is situated on the east side of Wilson creek, and consists of an adit driven along the coal-seam 54 feet in length, a shaft sunk 26 feet to connect with a winze 14 feet deep, sunk near the portal, from the bottom of which a lower

level has been opened and drifts run, totalling 50 feet in length, wholly in coal, with the maximum thickness of 16 feet at the northern face of the drift, but pinching to about 5 feet at the southern face. There is a sandstone-parting in the seam a few inches in thickness, and on the lower level the seam is broken by a small obliquely transverse fault. From a commercial standpoint the thickness of clean workable coal is between 9 and 10 feet for about 20 feet along the north drift on the lower level, commencing at a point 10 feet north from the winze and continuing to the north face; towards the south the seam pinches, so that, in the drift, the workable clean coal only averages between 4 and 5 feet thick. The line of strike of the Wilson seam is N. 10° W.; the dip varies from 60 to 80 degrees towards N. 80° E.

During the writer's visit the lower level at the No. 1 opening on the Wilson seam was unwatered, and he had a good opportunity to examine the coal-seam *in situ*. The fuel used at the diamond-drill plants on the property is the product from the Wilson seam as mined from the upper and lower levels at the No. 1 opening, but, as the quantity of coal required is comparatively small, mining operations are carried on in proportion to the demand, hence the reason why the workings were full of water.

The coal from this seam is excellent for producing steam, a fact particularly noticed by the writer during his visit, which was practically demonstrated by the results shown in both the diamond-drill plants.

The coking qualities of the Wilson seam are good, so far as shown by the results from laboratory tests made by Milnor Roberts. The percentage of coke contained in the coal is reported from these tests to be 60 per cent. from unwashed coal, with a percentage of 18.07 of pink ash in the coke.

The No. 2 working opening, or Ferguson cut, as it is called, is situated 400 feet south-east from the No. 1 opening, but on the west side of Wilson creek. This opening consists of a long open-cut and a slope sunk on the coal-seam, which is apparently the extension of the Wilson seam, as the line of strike and dip correspond with those of the No. 1 opening. The underground portion of the slope could not be examined, as it was full of water, but the writer was informed by Roberts and Woernecke that the coal-seam had about the same characteristics as were found at the No. 1 opening, but that in the northern end of the drift, where the coal was 13 feet thick, it was somewhat crushed by the occurrence of a fault. On the opposite side of this fault the seam is only 4 feet thick, but in the No. 3 diamond-drill hole, about 300 feet southerly from the No. 2 opening, the seam was again cut at a depth of 156 feet, and showed a thickness of 13 feet.

The No. 3 working opening is an adit, with its portal situated about 75 feet in a north-west direction from the No. 1 opening. The course of the No. 3 adit is north-east, its length is 75 feet, and the Wilson coal-seam is reported to be exposed at the face, but this adit was in such bad condition from caving that an examination was impossible.

In Nos. 1 and 2 of the diamond-drill holes a seam of coal was bored through, and gas was encountered in both. This gas was struck at a depth of 600 feet in the No. 1 drill-hole, situated on Wilson creek about 900 feet south-easterly from the No. 1 working opening, and burned through one entire night. Gas was also struck at a depth of 300 feet in the No. 2 drill-hole, which is also situated on Wilson creek about 600 feet south-easterly from No. 1 drill-hole, and burned so strongly as to endanger the drill-house.

A seam of coal between 3 and 4 feet thick was bored through in the No. 1 drill-hole at a depth of 344 feet; and in the No. 2 drill-hole a seam 5 feet thick was bored through at a depth of 173 feet.

A cross-section of the Wilson coal-seam at the No. 1 working opening, taken across 18 feet near the face of the drift on the lower level, reading from the surface down, is as follows:—

Roof, hard grey conglomerate with pebbles well rounded, 40 per cent. of rock.

	Ft.	in.
Hard brown shale	0	1
Coal, bony	0	8
Useful coal	4	0
Clean coal	7	3
Brown and black coaly shale	0	3½
Bony coal	0	2
Hard brown shale	0	1½
Whitish-grey, coarse argillaceous sandstone with coaly specks	0	5
Coal, broken by faulting, slightly bony	0	10
Coal	0	4
Coal, slightly bony	0	4
Coal	0	2
Brown clay shale	0	0½
Coal	0	5
Green clay shale	0	0¼
Coal	0	8
Hard brown bone	0	2
Coal	0	1
Hard brown clay bone	0	1
Soft brown clay bone	0	2
Coal crushed and broken, with bone	1	2
Bedded calcite vein	0	0½
Coal, bony	0	1
Very hard brown bone	0	3
Bedded calcite vein	0	0⅛
Soft white plastic granular clay, lenticular, 0 in. to 6 in., no rootlets in it, and does not appear to be typical under clay	0	0⅛
Total	17	10½

No samples of the coal at Camp Wilson were taken by the writer, as the seam had been thoroughly sampled by Charles H. Clapp, and the following analyses published in the Summary Report of Canadian Geological Survey, 1912:—

	Per Cent.
"Proximate analysis—	
"Water	2.44
"Volatile combustible matter	35.96
"Fixed carbon	48.64
"Ash	12.96
	100.00
"Coke	61.60
"Its character, firm, coherent.	
"Fuel ratio	1.35
"Split valatile ratio	3.26
"Ultimate analysis—	
"Carbon	70.6
"Hydrogen	4.8
"Nitrogen "Oxygen	9.5
"Sulphur	0.8
"Moisture	2.0
"Ash	14.3
"Carbon hydrogen ratio	14·0

"The other available analyses of the Camp Wilson coal are as follows:—

	Per Cent.	Per Cent.	Per Cent.	Per Cent.
"Water	2.65	1.06	2.47	1.91
"Volatile combustible matter	38.19	43.48	35.25	35.24
"Fixed carbon	53.73	46.01	59.36	59.39
"Ash	5.43	9.45	2.92	3.46
	100.00	100.00	100.00	100.00
		(Firm, Coherent Coke.)		(Non-friable Coke.)
"Fuel ratio	1.41	1.06	1.68	1.68"

Camp Robertson.

As the writer was informed by Milnor Roberts that the camp at Camp Robertson was closed for the season, the openings full of water, and nothing could be learned without the aid of a guide, as well as a force of men to unwater the workings, the writer did not visit that camp, which is about eight miles in a southerly direction from Camp Wilson.

The Robertson coalfield forms a portion of the holdings acquired by the Imperial Trust Company of New York. The field had been thoroughly examined for that company by Professor Milnor Roberts during 1913, and had also been reported on by Chas. H. Clapp, of the Canadian Geological Survey, in the Summary report for 1912. From these sources the writer, who has also been furnished with all the plans and sections by Milnor Roberts, has gleaned the following information:—

The coal-measures in the vicinity of Camp Robertson consist chiefly of green, very fine to coarse-grained sandstones, in places argillaceous, composed of the mechanically disintegrated detritus from the Vancouver volcanics and sandy conglomerates. Some of the beds are carbonaceous, and coaly lenses and tree-trunk impressions are common. The rocks are greatly deformed and cut by numerous dykes of dacite and andesite porphyrite. It appears that the general structure in the immediate vicinity is a narrow syncline, striking about N. 40° W., and pitching, amd perhaps widening, to the south-east. In the vicinity of Camp Robertson the width of the syncline underlain by the horizon of the coal-seams is probably less than 1,000 feet.

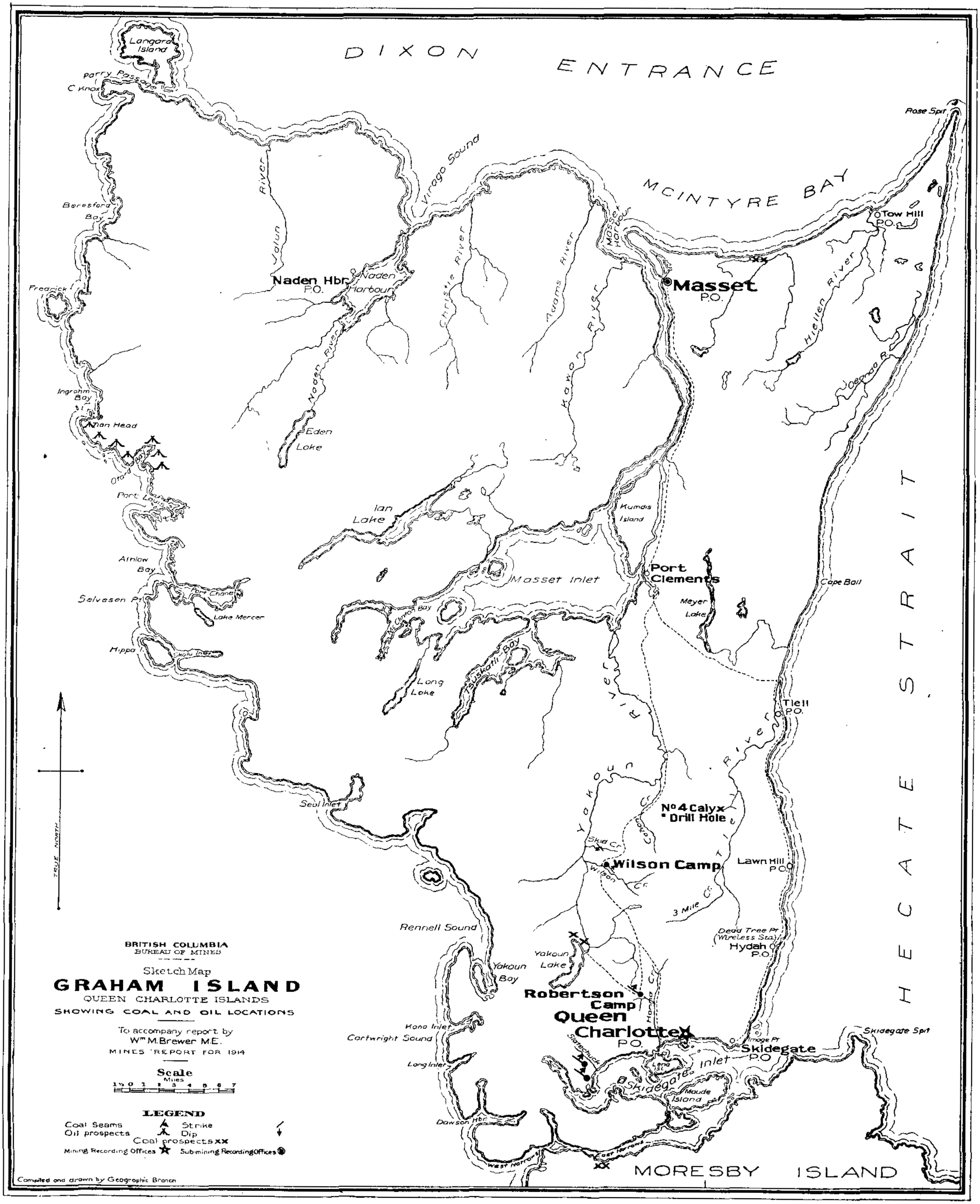
The following analyses of the coal from the Camp Robertson seams are taken from Clapp's report.

	Per Cent.	Per Cent.	Per Cent.
"Water	0.80	1.33	1.20
"Volatile combustible matter	23.27	35.25	29.13
"Fixed carbon	51.39	42.57	47.52
"Ash	24.54	20.85	22.15
	100.00	100.00	100.00
		(Firm, Coherent Coke.)	
"Fuel ratio	2.21	1.39	1.63"

The development-work done at Camp Robertson consists of an adit driven from the outcrop of a coal-seam, and following the seam under glacial drift until solid rock was reached, when a slope was sunk, in coal, on an incline of 13 degrees for a length of 68 feet; also an incline shaft sunk at another portion of the field to a depth of about 30 feet.

Five cross-sections taken from various points in the work referred to are as follows:—

No. 1.	Total thickness of coal,	3	ft.	10½	in.,	total thickness of section,	7	ft.	5	in.
No. 2.	"	"	2	"	9½	"	"	"	8	"	9¾	"
No. 3.	"	"	3	"	0¾	"	"	"	7	"	5¾	"
No. 4.	"	"	3	"	5	"	"	"	7	"	5	"
No. 5.	"	"	2	"	2	"	"	"	5	"	6	"



DIXON ENTRANCE
McINTYRE BAY
HECATE STRAIT
MORESBY ISLAND
Langara Island
Parry Passage
C. Knox
Rose Spit
Virago Sound
Beresford Bay
Jalun River
Naden Hbr. P.O.
Naden Harbour
Naden River
Christie River
Adams River
Kawon River
Masset Harbour
Masset P.O.
Tow Hill P.O.
Hiellen River
Oeanda R.
Frederick I.
Ingraham Bay
Eden Lake
Ian Lake
Port Louis
Kumdis Island
Port Clements
Masset Inlet
Meyer Lake
Cape Ball
Athlow Bay
Port Chanal
Selvesen Pt.
Lake Mercer
Hippa
Long Lake
Tlell P.O.
Tlell River
Yakoun River
Seal Inlet
No 4 Calyx Drill Hole
Skid Cr.
Wilson Camp
Wilson Cr.
Lawn Hill P.O.
3 Mile Cr.
Rennell Sound
Dead Tree Pt. (Wireless Sta.)
Hydah P.O.
Yakoun Lake
Yakoun Bay
Robertson Camp
Queen Charlotte P.O.
Kano Inlet
Cartwright Sound
Skidegate Spit
Skidegate P.O.
Skidegate Inlet
Long Inlet
Maude Island
Dawson Hbr.
West Narrows
East Narrows
TRUE NORTH
BRITISH COLUMBIA
BUREAU OF MINES
Sketch Map
GRAHAM ISLAND
QUEEN CHARLOTTE ISLANDS
SHOWING COAL AND OIL LOCATIONS
To accompany report by
Wm M. Brewer M.E.
MINES REPORT FOR 1914
Scale
Miles
LEGEND
Coal Seams
Oil prospects
Strike
Dip
Coal prospects xx
Mining Recording Offices
Submining Recording Offices
Compiled and drawn by Geographic Branch

Otard Bay Oil Prospects.

The writer had arranged to visit the section of the west coast of Graham island where some drilling has been done prospecting for oil, but on arrival at Masset he ascertained that the gasolene-launch "Polaris" was absent conveying J. D. MacKenzie, of the Canadian Geological Survey, to the same district, and that there was no other boat available to make the trip. After Mr. MacKenzie returned he informed the writer that at the drilling camp the only work in progress was reaming the drill-hole to insert a new casing, which would occupy considerable time; consequently, in the judgment of the writer, he did not feel warranted in incurring the expense of $33 a day for charter of boat and supplies for such an indefinite length of time as a trip around the west coast might consume at that season of the year, with the prospect of not being able to witness any operations from which conclusions relative to the existence of oil could be drawn.

QUEEN CHARLOTTE MINING DIVISION.

NOTES BY WM. FLEET ROBERTSON, PROVINCIAL MINERALOGIST.

GRAHAM ISLAND.

Graham island is the largest of the Queen Charlotte group, having an area of about 2,500 square miles. With the exception of Langara island, which is quite small, it is the most northerly of the group. During the field season of 1913, J. D. MacKenzie, of the Geological Survey at Ottawa, made a study of the south-central portion of Graham island, paying particular attention to the coal-bearing areas; a partial report of this work is included in the Summary Report of the Geological Survey of Canada for 1913. Mr. MacKenzie continued his geological work on Graham island during the summer of 1914, but his report on this is not yet published.

As considerable interest has been manifested about Graham island and its natural resources, the following extracts have been made from Mr. MacKenzie's report:—

"GENERAL GEOLOGY.

"The oldest formations exposed on Graham island are a series of metamorphic, volcanic, and sedimentary rocks, which have been considerably deformed in general, and are often extremely contorted in detail. These rocks, which are of Jurassic and perhaps Triassic age, have been intruded by stocks of diorite and granodiorite, in areas not investigated by the present writer. Fossils are abundant in the metamorphosed sediments, and the rocks are correlated with the Vancouver group. The intrusive rocks probably are satellites of the great Coast Range batholith, supposed to be of Upper Jurassic age.

"On the rough, denuded surface of these older metamorphic and igneous rocks, a series of conglomerates, sandstones, and shales were laid down unconformably. These sediments are called the Queen Charlotte series, and in their lower portion contain a coal-bearing horizon. The date of their deposition is placed in the Upper Cretaceous. The surface on which they were deposited was hilly, and often very uneven in detail. The general topographic conditions surrounding the basin probably resembled to some extent those found in the vicinity of Skidegate inlet to-day.

"After, and perhaps to some extent during, the deposition of the Queen Charlotte series, they were intruded by dykes and sills of volcanic rocks. These dykes and sills are up to 50 feet in thickness and occur abundantly in many localities. After the deformation and partial erosion of the Cretaceous rocks, extensive flows of volcanic rocks, probably coincident with the later phases of dyke and sill intrusion, covered part of the area now reported on. With these

volcanics, which are presumably of Tertiary age, are intercalated sediments, seen only at one locality, the south-east slope of Mount Kahgan. Tertiary sediments occur in the north-eastern part of Graham island, in places carrying lignite. The Tertiary volcanics have been removed from the larger portion of the area examined this year, and, in fact, it is uncertain as yet just how far they ever extended over it. Erosion and denudation have greatly affected the slightly resistant rocks of the Queen Charlotte series, which now lie in several basins separated by ridges of the pre-Cretaceous metamorphic and volcanic rocks.

"During the Glacial period, the Queen Charlotte range was occupied by an ice-cap, from which valley glaciers flowed, scouring out the present fiords which are so characteristic a feature of the Queen Charlotte group. The large amount of glacial till in south-central Graham island indicates that piedmont glaciers at one time occupied this area, while the occasional deposits, of well-stratified sands, gravels, and clays show that there was considerable deposition in lakes or estuaries of glacial origin.

"ECONOMIC GEOLOGY.

"*Coal.*—Coal is the principal mineral resource of the area examined, but deposits of gold, clay, building-stone, and, possibly, oil also occur. Coal occurs at one fairly well defined horizon in the lowest member of the Queen Charlotte series, of Cretaceous age. This Cretaceous coal is found in two separate and well-defined basins, which may be termed the Honna basin and the Yakoun basin, each named from rivers that drain the area underlain by them.

"The Honna basin, in the southern part of the area, contains the exposures at Cowgitz and Slate Chuck creek on Skidegate inlet; Camps Robertson and Anthracite in the interior; and Camp Trilby and another small opening near Yakoun lake. These are all different exposures of what is with little doubt the same horizon, repeated by folding. The exposures of the coal at Cowgitz, Slate Chuck, and Yakoun lake show it to have been locally metamorphosed into a substance in appearance like a high grade of anthracite. At Camps Robertson and Anthracite the seam is about 7 feet in thickness, but contains many shale and bone partings, so that the total coal does not exceed 4 feet. It is a bituminous coal, high in ash.

"The Yakoun basin fringes the north side of the highlands between Camps Robertson and Wilson, which consist of pre-Cretaceous rocks, with at least one small basin of Lower Cretaceous measures. The extent of the Yakoun basin northward toward Masset inlet is at present unknown. Camp Wilson in Section 25, Township 7, is the only locality where coal has been found in the Yakoun basin. At this place three openings show a seam ranging from 4 to 18 feet in thickness, and containing up to 16 feet of coal. This coal is of bituminous quality, and samples carefully taken by the writer show it to be higher in ash than has heretofore been supposed. It is free-burning, the ash is very light, and it makes excellent coke.

"*Gold.*—Gold is found on the *Southeasterly* claim, north-east of Skidegate Indian village. The deposit is a quartz vein averaging 9 feet thick, and is apparently a quartz replacement of a shear-zone in breccias of the Yakoun volcanics. The metallic minerals with which the gold is associated are sulphides, and are irregularly distributed in masses through the quartz gangue.

"*Oil.*—In some of the pre-Cretaceous rocks, oil-showings, consisting of coatings of black sticky tar on joint seams, are found, and some oil lands have been taken up on the strength of these appearances.

"COMMERCIAL POSSIBILITIES.

"Coal, at the present time, is the chief asset of Graham island. Timber is of value, but probably cannot yet enter the market except with the aid and development that an operating coal-mine would bring. Large quantities of clays exist suitable for the lower grades of clay products, such as bricks, drain-tile, and earthenware, and it is possible that clays of higher grade may be discovered. Oil is as yet an unproven resource.

"In regard to agriculture, much has been written, unfortunately not always of a responsible nature. Graham island, in common with much of the Canadian west, has suffered at the hands of unscrupulous real-estate boomers, whose misrepresentations have a tendency to bring the island into disrepute as a farming centre. There are, in the north-eastern portion of the island, large areas of level or gently sloping land which are underlain by partially consolidated sands and gravels of Pleistocene or Tertiary age. Parts of this area support a dense forest-growth, and the rest is covered with a surface deposit of decayed vegetation soaked with water, termed muskeg. There seems no good reason why, once this area is cleared and drained, it should not support agriculture on a considerable scale. It may be that local conditions will have to be carefully studied and crops suited to the environment selected, but the facts remain that the land and the climate are there ready to be utilized. It is not probable that agriculture will flourish in the plateau and mountain regions for some time to come."

OMINECA MINING DIVISION.*

REPORT BY STEPHEN HOSKINS, GOLD COMMISSIONER. (OFFICE AT HAZELTON.)

I have the honour, as Gold Commissioner, to submit the annual report for the Omineca Mining Division for the year ending December 31st, 1914.

Owing to conditions generally prevailing, there has been a marked falling-off of mining revenue as compared with the year 1913, but this must by no means be taken as an indication that interest in the mineral wealth of this district has in any way abated, as the subsequent notes will show.

GLEN MOUNTAIN.

Silver Standard Group.—For some months during the past year development-work was systematically prosecuted, but in the month of August all work was closed down. It is the present intention of the owners to continue operations next spring, and to ship the many tons of first-class ore now lying in the ore-sheds, which is said to assay 145 oz. silver, 24 per cent. lead, 0.23 oz. gold, and 21 per cent. zinc.

Canadian King Group.—This group has been continuously worked by McCrimmon & Stewart during the greater part of the year, who report that they have several tons of sorted ore ready to ship to the smelter, and many more tons of second-class ore on the dump, which they are unable to handle at the present time.

The usual assessment-work has been recorded on claims in this vicinity, but no further new locations appear to have been made.

NINE-MILE MOUNTAIN.

American Boy Group.—This group worked and owned by the Harris Mines, Limited, has been under development for the greater part of the year. Three car-loads of ore have been shipped from the property, for which the average returns are as follows: Gold, 0.08 oz.; silver, 112 oz.; lead, 29 per cent.; zinc, 12 per cent. In addition to this, the owners report having 600 tons of second-class ore on the dump, which will average $32 a ton.

It is the intention of this company to erect a mill in which to handle this ore when the mine has been sufficiently developed to allow them to determine the size of the plant which will be required.

**See also* Report by J. D. Galloway, Assistant Mineralogist, page 176.

Silver Bell Group.—After a period of inactivity the *Silver Bell* has been reopened, and development-work is now being prosecuted. It is hoped that this property will be in a position to ship ore during the coming summer.

There has been activity upon other properties in this vicinity, from which shipments of ore are looked for during the year 1915, concerning which no definite information has been obtained.

Twenty-three new locations were located on Nine-mile mountain during the past year.

ROCHER DÉBOULÉ MOUNTAIN.

As in former years this vicinity has claimed a great deal of attention.

Juniper Group. This group is commonly called Rocher Déboulé mine. J. D. Williams, manager of the Montana Continental Development Company, by whom this property is being worked, reports:—

"On Juniper creek, four miles and a half from Skeena crossing and five miles from Rocher Déboulé mine, a power plant of 200 horse-power has been installed. This hydro-electric plant contains a Pelton-Dobel water-wheel, operating under an effective head of 170 feet, which is belt-connected to a generator 187.5 k.v.a. at 2,300 volts. The power is transmitted over a three-conductor standard-construction transmission-line of five miles in length to a compressor plant at the mine. A compressor plant of 12-drill capacity has been installed at the mine. This compressor is of the Canadian Ingersoll type, two-stage duplex cross-compound. The compressed air is conveyed to the mine by an air-line of 2,000 feet in length. The mine is equipped with Water-Leyner drills and a No. 5 Leyner sharpener for sharpening the drill steel.

"During the summer and fall of 1914, 1,200 feet of development-work has been done on the western extension of No. 4 vein. A crosscut of 900 feet has been driven through the granodiorite to intercept the vein, and from the point of intersection with the vein a drift has been driven eastward upon the vein for a distance of approximately 300 feet. When the crosscut passed through the vein little ore was exposed, but drifting to the east the vein began to widen rapidly, and now has a width varying from 2 to 7 feet.

"Not all of this drift is in commercial ore, there being an ore-body, however, of approximately 80 feet in length which contains commercial ore for an average of about 21½ feet. This ore exposed in a new drift lies to the west of the former ore-shoots opened up by the Rocher Déboulé Copper Company, and the face of the present drift has not encountered ore-shoots which were exposed by the development-work of the Rocher Déboulé Copper Company. It is therefore problematic whether the ore to be encountered will be of the same grade as that formerly opened up. Considerable grey copper has been shown in the new ore-body opened up under the management of the Montana Continental Development Company. This ore is about 200 feet lower in depth than the ore opened up by the Rocher Déboulé Copper Company."

"One of the most difficult problems to be solved in the development of the Rocher Déboulé mine has been the transportation of the ore from the mine to the main line of the Grand Trunk Pacific Railway. This problem has been worked out by the use of three tramways, representing three distinct types. The first tramway is a surface narrow-gauge track following the contour of the mountain and negotiating the lowest pass, which has an elevation of approximately 4,300 feet above the main line of the tracks of the Grand Trunk Pacific Railway. This surface tramway delivers the ore from the portal of the tunnel to the ore-bins of the 2-bucket aerial tramway.

"The 2-bucket aerial tramway has a length of approximately 3,000 feet, and a fall in the distance of approximately 1,500 feet, where the ore is delivered into the ore-bins of the main aerial tramway. The main aerial tramway is approximately three miles and a half in length and has a vertical fall in this distance of approximately 3,000 feet, and is on the Bleichert system, heavy duty grip type. In addition to the above work, a sawmill of 3,000 feet capacity a day was installed at the mine to supply the dimension timber used in the construction-work.

"A telephone system has been installed, representing about twenty miles of telephone service.

"In order to build the aerial tramways, about six miles of wagon-road were constructed and about two miles of trails.

"At Prince Rupert, B.C., ore-bins of 400 tons capacity are about to be erected, which are designed to unload their contents within an hour. These ore-bins permit the entire handling of the ore from the mine to the steamer by gravity."

The work of development on this property is still in progress, and the ore is being gotten out ready for shipment as soon as the ore-bins are ready to receive it. It is now anticipated that regular shipments from this property will be made during the year 1915.

Great Ohio Group.—This property has been steadily developed during the year, with very encouraging results, concerning which no definite report has been received.

The *Wonder* and *Black Prince* groups have actively worked during the greater part of the year; in the early fall operations ceased. No report has been received from the bondholders as to the result of their season's operations, but it is understood that they will again resume work upon these properties in the near future.

There are many properties in this vicinity showing promise, but upon which the annual assessment-work only has been recorded.

Seventy-three new locations were recorded on the Rocher Déboulé mountain during the year 1914.

HUDSON BAY MOUNTAIN.

The annual assessment-work has been carried out on all the well-known properties in the vicinity, and upon the completion of the sleigh-road from Smithers to the mountain the owners of the *Coronado* group commenced hauling ore from the mine to the main line of the Grand Trunk Pacific Railway. No information has been received as to which smelter this ore will be shipped. It is learned that the owners of other properties are also preparing to make small shipments from their claims. Thirty-nine new locations were recorded from this vicinity.

HUNTER BASIN.

The annual assessment-work has been done and 39 new locations have been recorded in this vicinity.

Chas. Seeber, working under a lease, shipped to the Tacoma smelter 42 tons of ore from the *Colorado* mineral claim, which averaged about 100 oz. silver to the ton and 6.7 per cent. copper.

Wm. Hunter is reported to have mined two car-loads of ore from the *Hunter* group. This ore was packed to the railroad, where it now lies awaiting shipment to the smelter.

SIBOLLA CREEK.

In the fall of the year 1913 many placer locations were made on this creek, which is a tributary to Tahsta river.

During the summer of 1914 ledges of free-milling gold ore were discovered in the vicinity, which resulted in forty-two mineral claims being recorded. From reports it would appear that the country is difficult to get into; all travel so far has been from Houston, on the line of the Grand Trunk Pacific Railway, but it is suggested that an easier way may be found from Gardner canal by proceeding up the Kemano river.

BABINE MOUNTAIN.

Annual assessment has been recorded on all the claims in this vicinity.

Britzins & Morton, the owners of the *Debenture* group, report having exposed good ledges of ore upon their claims, one of which averages 5 feet wide. On this group a 35-foot tunnel was driven last summer, in which a great deal of concentrating-ore has been met with.

Forty-six new locations have been recorded from this district.

Some development-work was performed on the properties of the Babine Bonanza Mining and Milling Company, particulars of which have not been received.

BABINE LAKE.

Assessments were recorded on all the older claims in this vicinity and eleven new locations were recorded.

COPPER CITY. *

In the neighbourhood of Copper City thirty-five new locations have been recorded. During the past summer Crown grants were obtained for the mineral claims comprising the *Old Ironsides* group of limonite iron-ore claims, which subsequently changed hands, and it is understood an extensive programme for development next season has already been framed.

The *Cordillera* group, situated in the vicinity of Usk, recorded during the past year by J. D. Wells and associates, is said "to have passed the critical examination of some of the best expert opinions on the continent," and is now under option for the sum of $50,000; this property is reported to contain values in gold, silver, and copper. A shipment of ore from this property is now being prepared to be forwarded to the smelter.

FIDDLER CREEK.

Fourteen new locations have been recorded from this vicinity.

Burns, Gordon & Welch have obtained an option on the *Fiddler* group, upon which they have performed a considerable amount of development-work.

KITSALAS.

Assessment-work has been recorded on all the older claims in this vicinity, and from which fifty new claims have been recorded.

PLACER-MINING.

From a report received from Geo. Otterson, general manager of the Kildare Mines, Ltd., the owners of fourteen leases on Slate creek, it is gathered that "on the last day of August it was evident the pay-streak had been found, and on the following day it was located. The pay-streak consists of grey clay and gravel, lying in a bed of coarse yellow gravel and boulders, with an overburden of similar material, the separate strata being readily distinguished.

"The pay-streak has been exposed for a distance of 186 feet in a westerly direction, showing for this length, in the side of the creek wall, 6 feet, and should continue up the creek a long way. The pay-streak appears to be exceedingly rich, and the portion passed through the sluice-boxes gave a yield of about $30 to the cubic yard.

* *See also* Report by W. M. Brewer, M.E., in Skeena Mining Division.

"Owing to the shortness of water, work had to be shut down on September 8th, but during the eight days that intervened between this date and the time the pay-streak was first struck over 150 ounces of coarse gold was taken out."

The gold recovered is all coarse, with pieces varying in weight from a few grains to $\frac{7}{8}$ oz., and one nugget weighing $1\frac{3}{4}$ oz. was picked up and forwarded to Ottawa.

G. H. Knowlton and associates have spent a considerable sum of money on development-work upon their leases on Silver creek.

From a report received it is gathered that the value of all the ground drilled on these properties is better than 60 cents a cubic yard.

OMINECA RIVER.

The following report has been received from H. B. Perks :—

"Last year (1913) I was sent north by a local company to take charge of an alleged hydraulic mine. This work took me on to the Omineca river, where I found an enormous low-lying gravel-deposit. It covers some 800 acres, and from appearances, I judged it to be at least 30 feet deep. I had no equipment to properly sample such a deposit, but I put down in systematic order fifty-two shafts to water-level. When that was reached we could not proceed, as we had no pumping equipment and the seepage was very heavy.

"The result of this work convinced me that the deposit was a valuable one, and I so reported to the company.

"The deposit is enormous, filling the valley of the Omineca from rim to rim, and the width is generally over one mile.

"The Omineca river will average 300 feet in width, but it is shallow, simply winding its way along on the top of this great gravel-bed. There is very little soil anywhere, and vegetables cannot be grown with any success. The river is running at an elevatton of over 2,500 feet above sea-level. The timber of the country is jack-pine and spruce.

"This year a syndicate was formed with the idea of profiting by the knowledge I had gained last year.

"I went in with an assistant to a point called Hogem and built a raft there. We then made a careful exploration of the river to Germansen creek, a distance on the river of fifty-eight miles. I found the gravel-deposit even larger than I at first had thought, and continuous.

"We took up six leases, covering practically all the continuous run of the deposit. These leases give the syndicate the right to dredge in about 18,000 acres of gravel, with a depth of at least 30 feet, in a continuous string.

"The sampling of the fifty-two shafts last year showed much higher values than I expected. This first opinion has been strengthened as our explorations have proceeded.

"One of these shafts, 10 feet deep, in firm compact gravel, gave a result of $28\frac{1}{2}$ cents, and, of course, we were not within 20 feet of bed-rock. The gravel in this shaft was compact, and had not been subject to recent surface washings, as in some cases had happened."

The Cassiar Hydraulic Mining Company, with leases on Gold creek, carried on operations all the season, and during the last three weeks of favourable weather commenced sluicing. Work on the property was prosecuted for a period of seven months with a crew of from three to eight men.

The Dryhill Hydraulic Mining Company, operating on Lorne creek, has completed two miles of flume, and expects to be ready for sluicing by the month of July next.

OFFICE STATISTICS.—OMINECA MINING DIVISION.

Free miners' certificates (ordinary)	787
" " (special)	2
" " (company)	6
Mineral claims recorded	464
Certificates of work issued	744
Certificates of improvements issued	12
Bills of sale and other documents of title recorded	124
Powers of attorney recorded	49
Documents filed	50
Placer claims recorded and rerecorded	6
Applications for placer-mining leases	31
Placer-mining leases granted, hydraulic, creek, and bench	3
Placer-mining leases granted, dredging	6
Crown grants of mineral claims issued	12

Revenue.

Free miners' certificates	$4,270.25
Mining receipts	9,337.25
	$13,607.50

OMINECA MINING DIVISION.

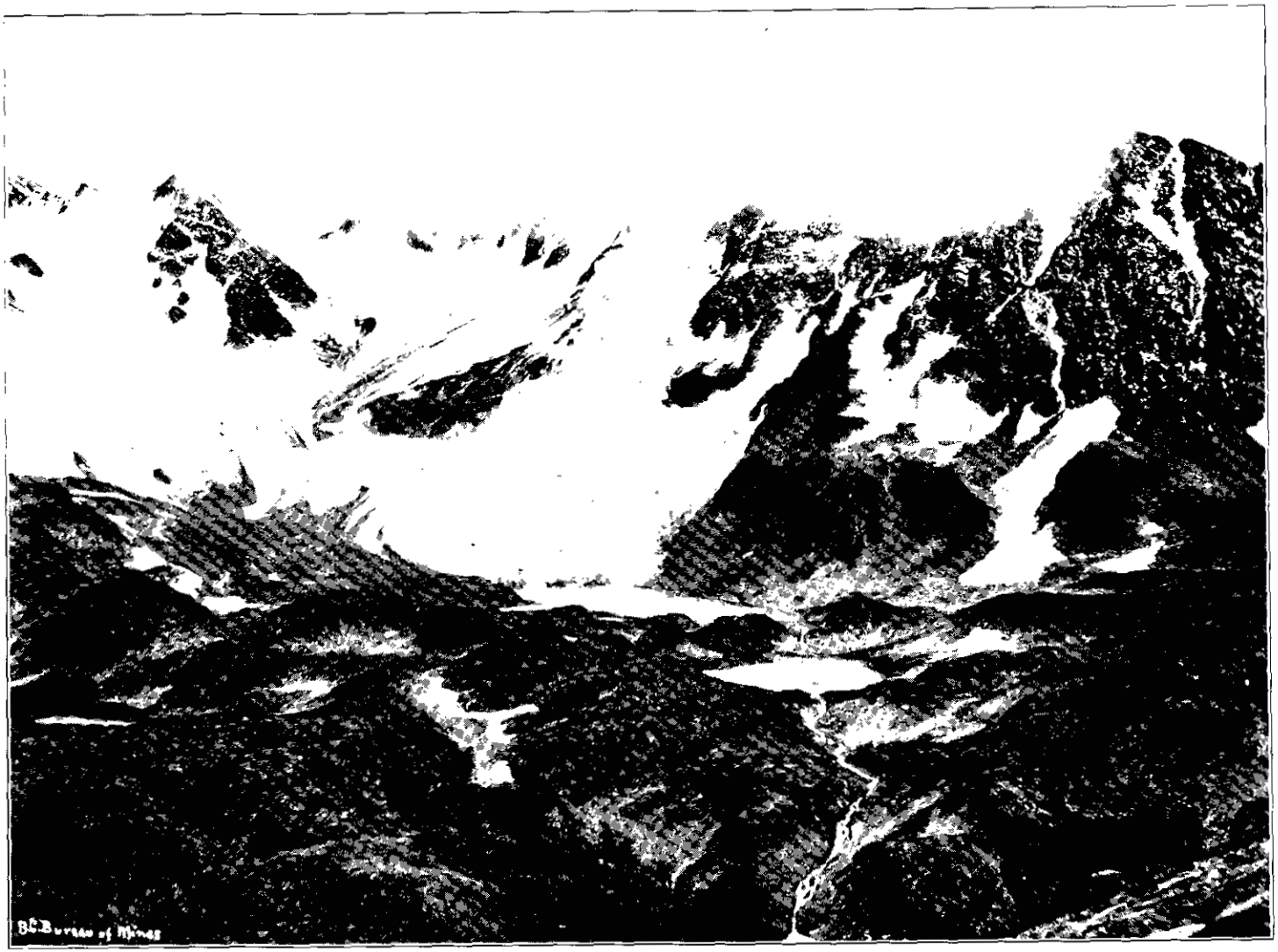
REPORT BY J. D. GALLOWAY, ASSISTANT MINERALOGIST.

INTRODUCTORY.

The writer's instructions for the field season of 1914 were to examine, and obtain information about, the mineral in the territory tributary to the line of the Grand Trunk Pacific Railway, commencing at Skeena Crossing and continuing easterly to Tete Jaune. W. M. Brewer, M.E., had been engaged by the Department to examine and report on the mineral properties along the Skeena river and tributaries, from Prince Rupert to Skeena Crossing, so that the writer simply carried the work easterly from the terminal point of Mr. Brewer's work.* It was, of course, impossible to examine all the tributary territory as herein indicated, but the more important points were visited, and from this, and other information obtained from various sources, a general summary will be attempted. The writer's work therefore lay entirely in the Omineca and Cariboo Mining Divisions, and the larger part of the season was spent in examining the metalliferous deposits along the Skeena and Bulkley rivers. The main body of the report is given in this place under the heading of "Omineca Mining Division," but the detail work at Fort George, Tete Jaune, and Barkerville will be found under the subdivision of the Annual Report entitled "Cariboo Mining Division."

In the Omineca Mining Division the mineral areas at present known along the line of the Grand Trunk Pacific Railway are found in the territory from Copper City to a short distance beyond Telkwa. Easterly from this point very few mineral locations have been made, but the railway traverses a considerable belt of good agricultural land. As yet, practically no important mineral locations have been made along the line of the Grand Trunk Pacific Railway in the Cariboo Mining Division, with the exception, possibly, of the mica claims at Tete Jaune. The Barkerville region, which is important for its placer-mining, lies considerably to the south of the railway-line and will be more directly benefited by the completion of the Pacific Great Eastern Railway than by the Northern Transcontinental.

*Mr. Brewer's notes on this portion of the Omineca Mining Division will be found included in the report on the Skeena Mining Division.



Driftwood Creek Divide—Babine Range.

LOCATION.

The Omineca Mining Division is situated in the northern interior part of British Columbia and embraces a territory of about 58,000 square miles. It is roughly of an oval shape, with the longer diameter in a north-and-south direction, and lies between the 53rd and 58th degrees of north latitude and the 122nd and 129th meridians of longitude. The Grand Trunk Pacific Railway traverses this section in a general easterly and westerly direction, but from Copper City to Hazelton it runs north-east, and from Hazelton to Houston it goes back again in a south-east direction; thus forming a large loop with Hazelton as the northerly apex. It will be well at this point to give the route of the new transcontinental railway across the northern part of the Province, which, although probably well known, will stand repetition. Leaving Prince Rupert, the western terminus, the railway skirts the sea-coast to the Skeena river nearly opposite Port Essington; thence it follows up this river to Hazelton; thence up the valley of the Bulkley to its headwaters and across the low divide to the Nechako river; thence down the Nechako to the Fraser river at Fort George; thence up the Fraser to Tete Jaune and through the Yellowhead Pass into Alberta. From Prince Rupert to Copper City, on the Skeena river, the railway is in the Skeena Mining Division; from Copper City to a point twenty-five miles west of Fort George it is in the Omineca Mining Division; and for the balance of its distance is in the Cariboo Mining Division.

A route for the railway which left the Skeena river at Copper City and ascended the Zymoetz (Copper) river to its headwaters, crossed the divide and came down the Telkwa river to the Bulkley river at the town of Telkwa, was at one time considered, but, owing to considerations of grade, was abandoned in favour of the present line. This alternative route is known as the "cut-off," as it would obviate the long northerly swinging loop of the main line, and may be built at some time in the future as a spur line to tap the coal and mineral tonnage of the Zymoetz River region. The completion of the western portion of this transcontinental railway was accomplished in the summer of 1914, and about the end of September a tri-weekly passenger service was established between Prince Rupert and Fort William, Ont. The road had been completed from Prince Rupert to Hazelton and from Edmonton to Fort George in 1913, and during the past year this gap was gradually filled in; a local train service had been maintained and gradually extended until the eastern and western branches were united. The completion of this railway will undoubtedly hasten the growth of northern British Columbia, which has, during the last few years, been marking time while waiting for more adequate transportation. Agriculture and mining, which will always be the main industries of this section, can never attain much development without railway connections with outside points, but now that this has been done the whole district should take a more prominent place among the producing sections of the Province.

Previous to the completion of the railway, the main highway of transportation into this country was by river navigation up the Skeena river from Port Essington to Hazelton. The usual type of flat-bottomed river-steamer was used, and, although most of the river is easily navigable, there are a number of canyons, notably Kitsalas canyon, where the passage is extremely hazardous. Steamers did not go up the Skeena beyond Hazelton, and the Bulkley river is a foaming stream, with many rapids, up which it is difficult even to take a canoe. This river navigation was only possible at certain seasons of the year, the winter seeing it shut off altogether.

From Hazelton trails branch out in many directions, to the far-away Omineca placer-fields, across the Babine range to Babine lake, up the Kispiox to the Groundhog coalfield, and to many mining camps near at hand. A wagon-road extends up the Bulkley valley to beyond Telkwa and into the Fraser Lake country, while other roads run to adjoining ranching sections.

The country is not as yet by any means well equipped with roads and trails, but, taking into consideration the vast extent of territory to be covered, very fair progress has been made.

It should be remembered that the Grand Trunk Pacific only traverses the southern portion of the Omineca Mining Division, and that the greater part of the territory to the north of the line has been only slightly explored and not prospected to any extent. The main waterways have been travelled, but the intervening regions are but little known.

HISTORY.

In early years the Omineca Division only included the drainage area of the Peace river and other easterly flowing streams, but latterly has been extended as previously indicated. As is usually the case, placer-mining constitutes the early history of the Omineca, which has been followed in recent years by the development of lode-mining. The district was first entered in 1864 by placer-miners and worked for three years, when it was virtually abandoned for the Cassiar fields. In 1879 it again attracted attention, but in 1887 was once more nearly abandoned, and since that time it has only been worked more or less intermittently for placer. These placering operations centered around Germansen, Omineca, and Manson creeks and their tributaries.

The following table shows the placer returns for this district from 1874 to 1913:—

Year.	Amount.	Year.	Amount.
1874	$38,000	1895	No returns.
1875	32,040	1896	"
1876	No returns.	1897	"
1877	"	1898	$15,000
1878	"	1899	8,600
1879	36,000	1900	12,527
1880	45,800	1901	19,100
1881	39,300	1902	40,000
1882	25,330	1903	28,000
1883	21,000	1904	11,600
1884	12,000	1905	10,000
1885	16,500	1906	10,000
1886	17,600	1907	10,000
1887	13,000	1908	20,000
1888	No returns.	1909	15,000
1889	"	1910	15,000
1890	"	1911	10,000
1891	"	1912	8,000
1892	"	1913	6,000
1893	"	1914	6,000
1894	"		

This shows that since 1902 the industry has fallen away and is now not very important. The district has always been handicapped by its remoteness and inaccessibility, which made it very expensive to operate. The Grand Trunk Pacific Railway does not go very near this placer district, but still will have a considerable effect in reducing transportation costs, and should therefore encourage further work.

Prospecting for lode gold, copper, silver, and lead commenced about 1902, but nothing beyond assessment-work was carried out for some years. The first discoveries were made in the territory contiguous to the Skeena, Bulkley, Telkwa, and Zymoetz rivers. In 1909 and 1910 silver-lead deposits were discovered in the vicinity of Hazelton, and a little later copper-deposits in the Rocher Déboulé mountains were located. At first the various claims were but slightly prospected, and only enough work done to hold them, as it was recognized that no

active mining could be prosecuted until the completion of the Grand Trunk Pacific Railway; but each year, as the ultimate completion of the railway came a little nearer, saw an increase in the development of the claims. The railway was first finished from Prince Rupert to Hazelton in 1913, and in that year the first shipments of ore were made from the *Silver Standard* and other properties near Hazelton. In October, 1914, the gap between Hazelton and Fort George was finished, and the new transcontinental railway became an accomplished fact.

Coal has long been known to occur in different parts of the Omineca Mining Division. Along the Skeena and Bulkley rivers and their tributaries many coal-outcroppings have been discovered, but, owing to the disturbed nature of the strata and the general high ash content of the coals, most of these coalfields have not as yet proved to be of much value.

The Groundhog coalfield, which lies partly in the north-western part of the Omineca Mining Division, has been very fully reported on by the Provincial Mineralogist in 1912, and also by officers of the Geological Survey of Canada. The development of this field will never be possible until a railway of somewhere about 150 miles in length is built connecting it either with the Grand Trunk Pacific or to some point on the Coast.

A very promising coal area situated on the headwaters of the Zymoetz river was examined by the writer during the season and found to contain two seams of first-class coal. This will be described in detail later on. Other coal areas examined by W. M. Brewer during the past season will be found described in his report.

The Omineca district has in the past years been reported on by several writers. The first mention of it is by Dr. Geo. M. Dawson in the Geological Survey Report of 1888. In 1896 R. G. McConnell made a reconnaissance survey of parts of the Peace, Finlay, Omineca, and Manson rivers; his report is in the Geological Survey Report of that year. In 1905 W. Fleet Robertson, Provincial Mineralogist, made a trip through the Northern Interior plateau, going from Quesnel, on the Fraser river, westward to the Skeena river at Hazelton. Again in 1906 Mr. Robertson journeyed overland by boat, canoe, pack-train, and wagon from Port Essington to Edmonton. In 1908 Mr. Robertson reported on the Ingenika river and McConnell creek. In 1911 Mr. Robertson made a complete detail report on the mining properties from Rocher Déboulé camp eastwards to Telkwa; and in 1912 he made an extended report on the Groundhog coal-basin. Each of these reports can be found in the Annual Reports of the Minister of Mines for the different years.

W. W. Leach, of the Geological Survey, Ottawa, commenced a geological investigation and mapping of the Telkwa mineral district in 1906, and continued this work through the field seasons of 1907, 1908, 1909, and 1910; in the latter two years the work being extended down the Bulkley to Hazelton. Reports of this work are in the summary reports of the Geological Survey for those years, and in a special bulletin entitled "The Telkwa River and Vicinity."

In 1911 and 1912 Mr. Malloch, of the Geological Survey of Canada, reported on the Groundhog coalfield, which lies at the headwaters of the Stikine, Nass, and Skeena rivers, and is partly in the Omineca, Skeena, and Stikine Mining Divisions. In 1912 Mr. Malloch also examined the metalliferous deposits in the vicinity of Hazelton, while Mr. McConnell prepared a geological section along the Grand Trunk Pacific Railway from Prince Rupert to Aldermere. (It should be noted here that Telkwa and Aldermere are adjoining villages; Telkwa being situated right on the bank of the Bulkley river opposite the junction of the Te kwa river with the former, and Aldermere is up on a bench half a mile back from the river.

The following is a tabulation of the known bibliography:—

Name.	Publication.	Year.	Page.
Dr. Geo. Dawson	Geological Survey of Canada	1888	73B
R. G. McConnell	" "	1894	5C
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
"	" " "	1908	41
"	" " "	1909	61
"	" " "	1910	91
G. S. Malloch	" " "	1911	92
R. G. McConnell	" " "	1912	55
G. S. Malloch	" " "	1912	69
"	" " "	1912	103

GENERAL PHYSICAL FEATURES.

On the north and east the Omineca Division is drained by the Finlay and Parsnip rivers, which unite to form the Peace river, and by the Nechako, which joins the Fraser at Fort George; on the west and south by the Skeena and the Bulkley, which unite at Hazelton.

In the central portion there is a series of lakes with a general north-westerly trend and having only a slight width as compared with the length; the largest of these are Babine, Takla, and Stuart lakes.

Babine lake, which is 105 miles long, drains to the north-west by the Babine river into the Skeena, while Takla, Stuart, and other lakes east of Babine lake drain to the east by means of the Stuart river into the Nechako. To the south-east of the Bulkley river there is another prominent lake region in which are situated Francois, Fraser, Ootsa, Eutsuk, and many other smaller lakes. This is virtually an elevated plateau region, dotted with numerous lakes and with comparatively slight mountainous relief in the topography, from which the main drainage forms the headwaters of the Nechako river.

The western portion of the Division, lying to the south of the Skeena, is drained by the Zymoetz river, flowing westerly into the Skeena at Copper City, and the Morice and Telkwa rivers, flowing easterly into the Bulkley.

The main range of the Coast range lies to the west of this Division, terminating as it does with the long trench occupied by the Kitsumgallum river, which joins the Skeena at Terrace. To the south of the Skeena this trench continues to the head of Kitimat arm, and probably represents an old glacial valley. To the east of Terrace and extending for some distance beyond Copper City the Skeena cuts through a second range of high granitic mountains, which connect to the south with the Coast range, and hence may be considered a spur of the latter. Passing easterly from here up the Skeena, the character of the country changes, the topography becoming more irregular and not so cleanly cut and well defined. Isolated mountains and mountain ranges occur, with intervening country which tends towards the intermountain plateau type.

Between the Skeena and Bulkley rivers, on their southern and western banks respectively, the Rocher Déboulé mountains extend in an irregular crescent for a distance of fifty miles or more. This is a very rugged, precipitous range, consisting principally of granitic rocks, in which many of the peaks reach elevations of between 8,000 and 9,000 feet. They are

characterized by their inaccessibility and by the numerous basins, which are really cirques gouged out by former glaciers. Small glaciers are common at the higher elevations, while the steep rugged peaks give rise to beautiful alpine scenery. The appearance of the abrupt, angular peaks shows that they exceeded the limits of glaciation. To the south of these mountains and to the west of the Bulkley river near Telkwa, the Hudson Bay group of mountains rise to impressive heights, the main peak being about 9,000 feet.

The Bulkley river rises in Bulkley lake and flows nearly north-west to the Skeena river at Hazelton. It marks a divisional line between the Rocher Déboulé and Hudson Bay mountains and the Babine range, which latter extends from the Suskwa river (a tributary of the Bulkley coming in ten miles above Hazelton) to Telkwa, from whence these mountains gradually fade away. This range reaches elevations of 6,000 to 8,000 feet in the neighbourhood of the Suskwa river, and then gradually decreases in height towards Moricetown, where it consists mainly of ridges covered with scrub timber. Continuing south-easterly, it again rises to high peaks in the vicinity of Driftwood, Deep, and Canyon creeks. Immediately to the east of the Babine range is Babine lake, which parallels the range for a distance of 105 miles.

From the headwaters of the Bulkley easterly the country traversed by the railway is the northern extension of the Interior Plateau country of central British Columbia. This part is, however, more mountainous than the typical Interior Plateau country farther south, but no definite mountainous ranges exist. The peneplanation of this region previous to uplift had not proceeded as far as the southerly portion, and would not seem to have levelled the country to a base relief, as in the latter case.

Of the territory lying north of the railway-line it may be said in general that the western section drained by the Skeena is mountainous, while easterly from there the country changes to the intermountain plateau type.

The western section north of the railway is in large part directly drained by the Skeena river; the main watershed here is a north-and-south one, dividing the waters of the Skeena from those of the Finlay.

The Omineca Mining Division embraces many forms of topography, from the alpine rugged shapes of the Rocher Déboulé mountains to the undulating rolling country around Francois lake. The timber-line is generally at an elevation of 4,000 feet, but in places runs up to 4,500 to 4,800 feet. Near the Coast the timber consists of hemlock, spruce, balsam, fir, cedar, and cottonwood; in the Interior the cedar disappears and the main varieties are balsam, spruce, and hemlock, with cottonwood, poplar, and birch in the valley-bottoms. The whole country has been profoundly affected by glaciation, the ice having covered the country to a height of at least 6,000 feet, and only a few peaks reaching above this line. The influences of the moist Coast climate do not extend very far beyond Hazelton. Up the Skeena river to where the last spur of the Coast range is crossed the Coast influence prevails, giving rise to thickly timbered slopes, with a dense growth of underbrush up to the timber-line. Farther to the east the effect of a drier climate is soon noted in the lessening of the dense vegetation and the more open terraced nature of the country. The upper parts of the Skeena and the Bulkley rivers are enclosed in wide valleys, with the stream-channel sunk into the older valley for some distance and often forming rock canyons. The lower slopes of the Rocher Déboulé, Hudson Bay, and Babine mountains differ from those of the Coast range in not being nearly as heavily timbered and having considerable areas of mountain pasture land.

To the east of the Babine mountains the country, when viewed from the higher points, presents a somewhat undulating appearance of rounded, flat-topped hills broken by deep intersecting valleys and numerous higher mountains which stand out singly and in irregular

groups. This mountain plateau country continues easterly into the Cariboo District, where the irregular mountains become less prominent and the plateau topography is more thoroughly accentuated. This is well illustrated in the Fort George region.

Continuing east up the Fraser and along the Grand Trunk Pacific, the Rocky Mountain system is gradually entered. For some distance near its source the Fraser occupies the Rocky Mountain trench, which is a great north-and-south trough separating the Rocky mountain system from the Interior system of mountains. The Rocky mountains are cut in places in an east-and-west direction by passes, and it is through one of these (the Yellowhead Pass) that the Grand Trunk Pacific and the Canadian Northern Railways run.

GEOLOGY.

As has been previously said, the areal geology of that section of country lying along the Skeena and Bulkley rivers has been investigated in considerable detail by different officers of the Geological Survey of Canada. As many of the claims examined by the writer were in this district, a short summary of the geological formations will assist in a more complete understanding of the descriptions following.

The following tabulation and condensed description of the rocks found in this district has been taken from the before-mentioned published reports:—

Sedimentaries and Volcanics.

(Interbedded and sometimes metamorphosed.)

Sediments	Tertiary.
Skeena series	Lower Cretaceous.
Hazelton group	Jurassic.
Kitsalas series	Triassic.

Intrusives.

Coast Range batholiths	Triassic.
Bulkley eruptives	Post-Lower Cretaceous.

Commencing at Copper City, on the western boundary of the Omineca Mining Division, and extending easterly for fifty miles, the Kitsalas and Coast Range formations occur, the latter intruding, and over large areas entirely obliterating, the former. Beyond this point to Telkwa the main formation is the Hazelton group, overlain in places by the Skeena series and intruded in many places by the Bulkley eruptions.

Tertiary Sediments.—A few small areas of sedimentary measures carrying very thin seams of coal are known to occur, the most important instance being on Driftwood creek. The coal-seams are not of economic importance, as they are too much mixed up with shale. The age of these rocks has been determined by the Geological Survey of Canada as being Tertiary, from plant remains which were determined by W. J. Wilson as "clearly belonging to the Tertiary formation, and being very common in the Oligocene."

Skeena Series.—The Skeena series overlays the Hazelton group in many places, but as a rule the area of the outcrop is small. There is evidence to show that an unconformity exists between the Hazelton and Skeena series, but in many places they are folded together, and again the sedimentary measures of the upper horizon of the Hazelton group merge very gradually into the lower members of the Skeena series. This series is economically important, as it is the formation in which the coal-seams of the district are found. Mr. Leach says:—

"The Skeena coal-bearing series is met with in many localities, but as a rule in small patches. These appear to be the remnants of one or more great coalfields which, owing to the soft nature of the beds, have been unable, except in protected places, to resist erosion. The lower members of this series consist chiefly of conglomerates and coarse sandstone overlain by

thin-bedded, shaly sandstones, nodular shales, and coal-seams. Above the coal, shales are the predominant rocks, though in some places soft sandstones are found. There does not appear to be more than a few hundred feet of strata over the workable seams, except, perhaps, on the Morice river, where the denudation, to all appearances, was not so marked.

"Small patches of these rocks are to be found at many places from the Kispiox to the Morice rivers, folded in with the underlying Hazelton group.

"From a few fossil plants collected during the past three seasons, it appears that these beds may be referred to the Lower Cretaceous, about the horizon of the Kootanie series."

Hazelton Group.—The Hazelton group consists for the most part of a great series of volcanics which have, as a rule, been quite considerably metamorphosed at and near the contacts with later eruptives. In some places sedimentary rocks are interbedded with these volcanics, and in some localities it is evident that the volcanics have been largely laid down under water, thus giving them an incipient stratified structure. These rocks are very well developed in the region of the Telkwa river, Hudson Bay mountains, and Babine mountains, where they consist mainly of volcanics. Northward and eastward from these localities a gradual transition takes place in the rocks of this series from straight volcanics to others of aqueous deposition containing volcanic ash, tuffs, and sediments. The upper horizon of this series contains shales having fragmentary remnants of fossil plants, and occasionally some poorly preserved shells. To quote from the report of W. W. Leach (Summary Report, Geological Survey of Canada, 1909):—

"From the fossil evidence so far obtained, the upper beds of this group (sandstones and shales) appear to be equivalent to the Fernie shales of East Kootenay and Alberni, and the 'Lower shales' of the Queen Charlotte Islands series, now supposed to be Jurassic. No fossils have been secured from the lower part of the Hazelton group."

Kitsalas Formation.—This formation consists of volcanic rocks, with which are associated some interbedded sedimentaries. They are very completely intruded by igneous dykes and stocks which are apophyses from the Coast Range batholith. These intrusions have effected a considerable metamorphism, and in places a schistose character has been developed in the older rocks. This alteration makes it difficult to determine the original nature of the rocks, but they would appear to have consisted of basic lavas and volcanic ash, together with some bands of clay-formed sediments. The age of this formation is uncertain, but it is at least older than the Coast Range batholith, and hence is at least as old as Triassic.

Intrusives.

Coast Range Formation.—This formation is too well known to need any extended description here. The main mass consists of granodiorite, but wide variations are common, both in texture and composition, from acid to basic phases. Numerous inclusions of the older rocks through which the igneous rock has advanced are found. As a rule, these inclusions are so highly altered as to make a recognition of their origin impossible. A gneissic structure in the granodiorite is common, and is considered by McConnell to be due to strains set up in the cooling of the magma, and not to subsequent dynamic action.

Dykes of aplite and pegmatite, which represent the last stages of batholithic activity. are found cutting in all directions both the granodiorite and the included schists. Less numerous basic dykes, which are younger than the others, also occur.

Bulkley Eruptives.—The name "Bulkley eruptives" has been given by W. W. Leach, to a series of granitic rocks which intrude both the Hazelton and Skeena formations. This places their age as at least later than Lower Cretaceous. They probably represent the culmination of the period of vulcanism which had its inauguration and main expression in the intrusion of the Coast Range batholiths.

These eruptives are well developed in the Rocher Déboulé mountains, while other smaller areas occur on Nine-mile mountain, Twenty-mile mountain, the Telkwa river, Hudson Bay mountains, and the Babine range. This formation varies considerably in different localities, showing numerous gradations between granite and diorite, but as a general rule may be classed as a granodiorite. The structure is, as a rule, massive and crystalline, but again in places is distinctly porphyritic. Near the contacts many inclusions of the older rocks, in all stages of assimilation, can be seen. Numerous acid dykes, of the felsitic and aplitic types, besides cutting the granodiorite, radiate out from the central masses into the older rocks.

This formation is of great economic importance, as it is in these rocks and around their contacts with the older rocks that the ore-deposits, from Skeena Crossing to beyond Telkwa, have been discovered. There is no doubt that the intrusion of the Bulkley eruptives was the main mineralizing agent throughout the district.

The ore-bodies are of several different types; some occur in true fissure-veins either in the granodiorite or in the older volcanics, some as contact metamorphic deposits in and around the contacts, and some in shear zones in both the granite and volcanic rocks. In many places mineralization has taken place along the walls of the numerous apophyses and dykes given off from the main plutonic masses. The main mineral types are copper, copper-gold, and silver-lead-zinc.

Description of Mineral Claims.

As before stated, the writer's field-work commenced at Skeena Crossing. This place is a flag-station on the railway ten miles westerly from Hazelton, and now has a store, post-office, and a few houses. A commodious hotel was being finished at the time of the writer's visit in July, and was opened a month later. From this point access is most easily had to the section of country known as the Rocher Déboulé camp, which may be defined as the territory more or less contiguous to the *Juniper* group of claims, now owned by the Rocher Déboulé Copper Company, and commonly referred to as the *Rocher Déboulé* mine.

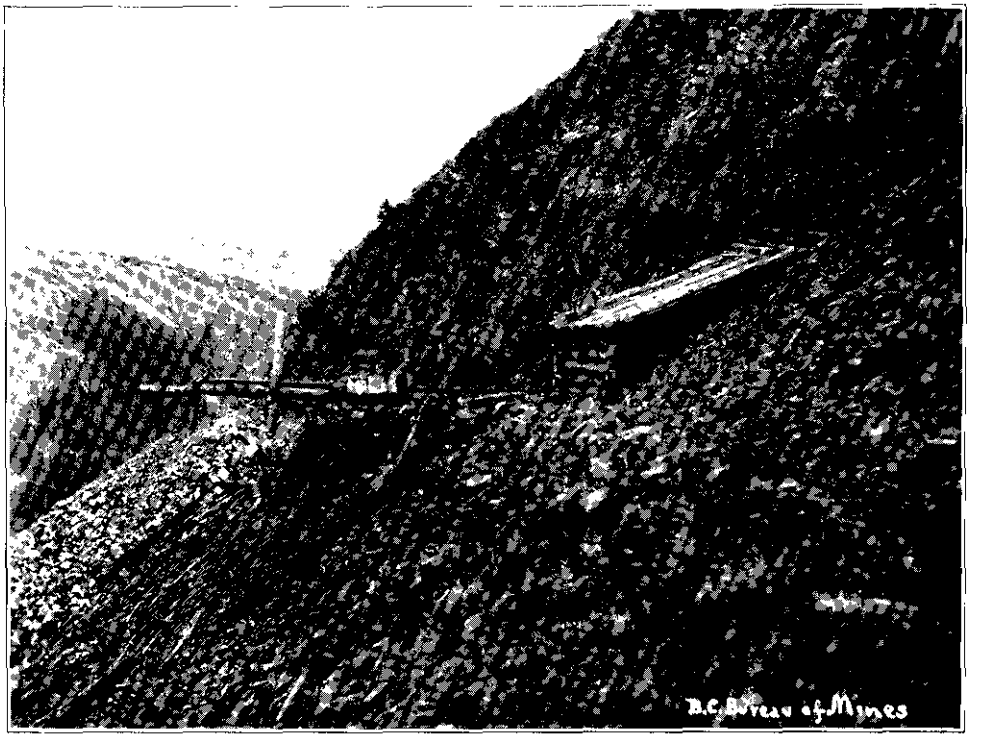
Rocher Déboulé Camp.

Rocher Déboulé camp is situated in Juniper basin, at the head of Juniper creek, and is distant ten miles from Skeena Crossing. Juniper and Balsam are two small creeks which join and flow into the Kitsequekla river, which in turn empties into the Skeena near Skeena Crossing. A rough wagon-road from this latter place extends to within a mile and a half of the property, and from that point to the mine a good trail, which is a sleigh-road in winter, is used.

From the end of the wagon-road Peterson and Ek have constructed a good trail up Balsam creek to the Red Rose basin, a distance of a mile and a half. Six miles up the wagon-road from Skeena Crossing a trail leads off to the Brian Boru basin, a distance of about six miles farther.

Rocher Déboulé mountain, at the head of Juniper creek, reaches an elevation of 5,800 feet. It is composed mainly of granodiorite, together with a few included remnants of metamorphics belonging to the Hazelton group. This granodiorite, which constitutes the predominant rock in the whole Rocher Déboulé range, is very hard and has therefore resisted erosion better than the surrounding rocks, thus giving rise to a high, rugged, and picturesque range of mountains. The streams and creeks are rapid mountain torrents having very steep gradients. The elevation at Skeena Crossing is 746 feet, and at the *Rocher Déboulé* mine camp 4,000 feet, or a rise of 325 feet to the mile. Timber continues to grow above the camp to an elevation of about 4,500 feet; the principal varieties are hemlock and balsam. Abundance of timber is available for mining purposes, but as the mine-workings are all above timber-line

Highland Boy Mountain—Juniper Basin—Omineca M.D.



Main Tunnel—Cronin's Mine—Omineca M.D.

it is necessary to carry up the timbers. All the properties in this section visited by the writer had their workings above timber-line, thus adding considerably to the labours of the prospector, as he has to carry uphill, sometimes for a considerable distance, whatever timbers are necessary.

Rocher Deboule.

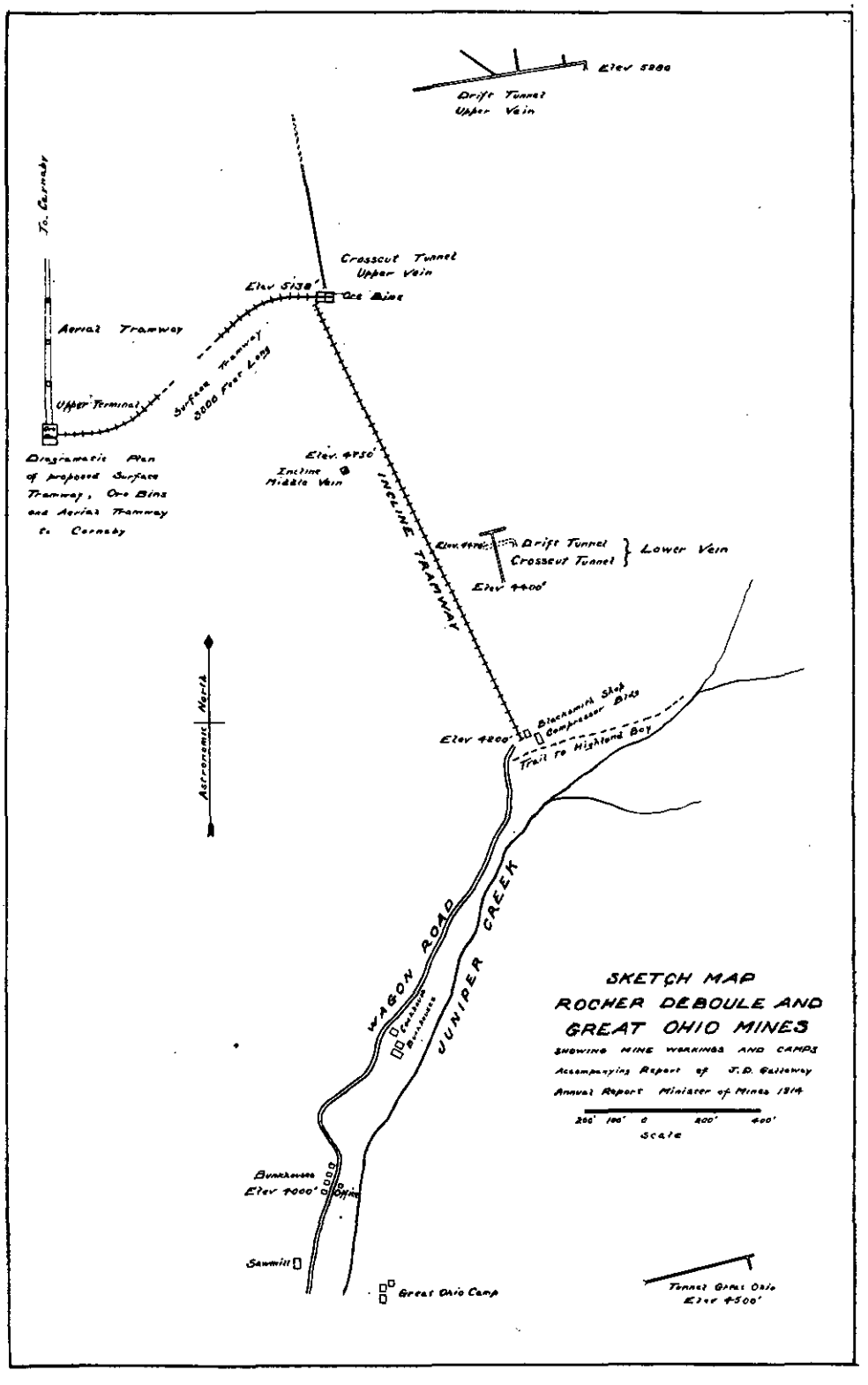
This property consists of six Crown-granted mineral claims and several others held by annual assessment, and is owned by the Rocher Déboulé Mining Company. It is situated on Rocher Déboulé mountain, on the north side of Juniper creek. The camp and compressor plant are situated at the creek-level at an elevation of about 4,000 feet, and the claims extend up and along the mountain-side to the top, which is at an elevation of about 6,000 feet.

There are three main veins on the property—the upper, middle, and lower—all of which have nearly parallel strikes and dips, viz.: N. 80° E. and 45° to 85° to the north. The whole mountain consists of granodiorite, with a few remnants here and there of highly altered and silicified rocks, which are probably quartzites, and would seem to be referable to the older "Hazelton group." A few black basic and some light, acid, micro-pegmatitic dykes cut the granite. The veins are apparently replacement fissure-veins, and would appear to have been formed mainly by the replacement of the granite by means of ascending solutions carrying metallic sulphides and silica. The gangue-filling of the veins is mainly siliceous matter, but is not a pure quartz; in places, however, small masses of quartz, showing an incipient banded structure, show that, in part, the veins were open fissures. The veins vary in width from 1 to 12 feet, and are unusually persistent, well defined, and strong. From the appearance nearly everywhere of well-defined walls it would seem that the original fissures consisted of two main outside fractures with crushed material between, thus making a network of passages in which the mineralizing solution flowed. In this way the ore is confined to a definite vein and does not gradually fade away into either wall. It is significant, also, that the pay-streaks of ore are as a rule confined to one or other wall, often with a strip of waste between which consists of granite in various stages of decomposition and alteration. The veins are characterized by having rich pay-streaks of copper ore, and in general it may be said that the mineral is not disseminated in a scattered fashion through the gangue, but occurs in solid or nearly solid shoots, and when these cut off, the gangue carries practically no values. The main ore-minerals are chalcopyrite, galena, and grey-copper, but there are also present pyrrhotite, pyrite, and zinc-blende. Only some of the veins carry galena and zinc-blende, however, and it would seem from the available evidence that the galena-zinc mineralization represents a secondary impregnation along the veins which had previously been filled with copper-iron minerals. Whether or not the galena-zinc mineralization is secondary in time occurrence, it is at least certain that it is distinct from the other, and that it so far is of lesser importance.

Upper Vein.—The upper vein on the *Rocher Déboulé* is the main one, and it only contains copper-iron minerals. The two lower veins carry galena and zinc-blende, and it is possible that at a corresponding depth from the surface the upper vein will also carry these minerals.

The upper vein was developed by the original locators and the Rocher Déboulé Company by means of open-cuts, shafts, and an adit drift on the vein for a distance of 600 feet. From a point half-way in this drift a raise has been put through to the surface, a distance of about 175 feet. In some places this vein apparently splits up, or has parallel associated mineralized fractures from 15 to 20 feet away from the main vein and occurring either in the hanging or foot wall. Several crosscuts and two short raises have been made from the main drift to explore these other veins.

Throughout these workings the vein varies from 2 to 12 feet in width, and, with the exception of from a point 200 feet in the tunnel to 400 feet in, carries a fairly regular pay-shoot of ore from 1 to 4 feet in width.


Elev 5086
Drift Tunnel
Upper Vein
To Cornish
Crosscut Tunnel
Upper Vein
Elev 5138'
Ore Bins
Aerial Tramway
Surface Tramway
3000 Feet Long
Upper Terminal
Diagramatic Plan
of proposed Surface
Tramway, Ore Bins
and Aerial Tramway
to Cornish
Elev. 4950'
Incline
Middle Vein
INCLINE TRAMWAY
Elev. 4700'
Drift Tunnel
Crosscut Tunnel
Lower Vein
Elev 4400'
Astronomic North
Elev 4200'
Blacksmith Shop
Compressor Bldg
Trail to Highland Boy
WAGON ROAD
JUNIPER CREEK
Explosives
Powderhouse
SKETCH MAP
ROCHER DEBOULE AND
GREAT OHIO MINES
SHOWING MINE WORKINGS AND CAMPS
Accompanying Report of J.D. Galloway
Annual Report Minister of Mines 1914
200' 100' 0 200' 400'
Scale
Bunkhouse
Elev 4000'
Office
Sawmill
Great Ohio Camp
Tunnel Great Ohio
Elev 4500'

The following samples were taken, which give an idea of the values:—

No.	Place taken.	Width sampled.	Gold.	Silver.	Copper.
			Oz.	Oz.	Per Cent
1	Top of 15-foot raise near end of drift	4 feet.	1.20	1.80	13.8
2	Main drift, 15-feet from face	4 feet	0.96	1.30	11.5
3	Winze level, foot of 175-foot raise to surface	2 feet 6 inches	0.02	1.40	9.0
4	Raise, 40 feet from portal of drift	15 inches	0.40	1.60	10.6

In August, 1913, the mine was leased to the Montana Continental Development Company, a Butte, Montana, company. The precise terms of the lease are not known, but the following is the main outline of it: The Montana Company agreed to equip the mine with machinery, construct the necessary aerial and surface tramways to transport the ore to the Grand Trunk Pacific Railway, and develop the upper vein by a crosscut tunnel, in return for being allowed to extract as much ore as possible during the tenure of the lease, which was to last for two years.

The leasing company commenced operations by installing a small hydro-electric plant on Juniper creek, five miles above Skeena Crossing, and running a power-line to the mine. A 12-drill Canadian Rand compressor was installed at the foot of the mountain at the creek-level, 1,125 feet below the cropping of the main vein. An auxiliary tramway 1,780 feet long was constructed from the compressor building to a point 825 feet higher up the mountain, and from this latter point the crosscut tunnel was started to tap the main vein. This is a single-track tramway operated by a compressed-air hoist from the lower-end. A portable sawmill, driven by a 20-horse-power electric motor, has been installed, and lumber cut with which office, cook-house, bunk-houses, etc., have been erected.

The ore, when mined, will not be brought down the hill to the Juniper Creek side, but it is to be taken over the mountain by aerial tramway and down to the Grand Trunk Pacific Railway at Carnaby. From the portal of the crosscut tunnel, which is at an elevation of 5,138 feet, the ore will be conveyed by a level surface tram to a point on the ridge overlooking the Skeena River side, where it will be dumped into ore-bins. From these bins an aerial tram in two independently operated sections will carry the ore to a siding on the Grand Trunk Pacific Railway at the foot of the hill, a distance of about four miles.

When the mine was visited in July the crosscut tunnel was in 300 feet, and it was considered that the vein would be struck at a further distance of 400 to 500 feet. Work was being pushed ahead as fast as possible on the tunnel, with three shifts, and also on the three tramways. The lower aerial tram, which extends from the railway spur to a point three miles and a half up the hill, was farthest advanced, the towers being all erected and the cable on the ground ready for stringing. J. D. Williams is superintendent in charge of the work and Paddy Quinn is foreman. This is the only company in the district that maintained work uninterruptedly for some time after the commencement of the European war.

Middle Vein—The middle vein on this property has not been developed to any great extent; the work done consists of three small open-cuts and an incline 30 feet deep. The vein outcrops at an elevation of 4,750 feet, and has a strike of N. 75° E. and dips at about 45 degrees to the north. It is from 4 to 12 feet wide, but where it is widest it is split up into parallel stringers, with altered granodiorite between. The incline was filled with water to a height of about 15 feet from the bottom, and so only the upper portion of the vein was visible. It is here about 4 feet wide, with a pay-streak from 1 to 2 feet wide. The whole vein is a rusty-red colour from the oxidation of iron pyrites, and has an appearance of being pretty thoroughly leached

out. A sample taken across 12 inches nearly at the surface assayed: Gold, 0.60 oz.; silver, 67.6 oz.; copper, 7.2 per cent.; and another taken across 2 feet at a point 15 feet above the bottom of the incline assayed: Gold, 0.12 oz.; silver, 73.7 oz.; copper, 9.8 per cent. The three open-cuts expose the vein for a distance of 200 feet. The above assays show that this vein, with what work is now done, has a very encouraging showing, and that further development is well warranted.

Lower Vein.—The lower vein on this property outcrops at an elevation of 4,460 feet a short distance east of the tramway. The first working on it is a tunnel which cuts the vein at a distance of 10 feet from the portal, and then runs on the vein to the west for 80 feet. The vein has a strike of N. 82° E., with a northerly dip, and the average width is about 3 feet 6 inches. This vein carries both copper and galena-zinc minerals, but as a rule these minerals are separated from one another quite distinctly. The galena and zinc generally occur on the hanging-wall and the copper on the footwall, forming distinct ore-bands separated by a strip of waste. In some places there is a partial mixture or intergrowth of the mineral types, but never a complete one. It is quite evident that the two different types of mineralization took place at different time periods and were independent of one another.

Four samples taken along the course of the tunnel gave the following returns:—

No.	Width sampled.	Gold.	Silver.	Copper.	Lead.	Zinc.
		Oz.	Oz.	Per Cent.	Per Cent.	Per Cent.
1	12 inches	0.08	25.0	7.3	....	....
2	24 "	Trace.	1.4	4.3	....	....
3	12 "	0.04	76.8	3.3	24.5	18.0
4	18 "	0.14	1.9	11.0	....	....

Sixty feet below this working, another tunnel has been run in for 180 feet to where it crosscuts the vein. From this point the vein has been drifted on 20 feet to the west and 55 feet to the east, and a raise put up to the upper tunnel. Throughout this working the vein does not carry much ore, only one small shoot being in evidence, which has a length of 12 to 15 feet. A sample across 8 inches of this pay-streak assayed: Gold, 0.08 oz.; silver, 180 oz.; copper 11.9 per cent.; lead, 1.5 per cent.; zinc, 10.9 per cent.

The values in this vein are quite good, and, although the lower tunnel shows very little ore, this is not a very discouraging feature, as it is quite possible that both above and below it good ore will be found.

Great Ohio.

The *Great Ohio*, which is situated on the south side of Juniper creek, nearly opposite the *Rocher Déboulé*, was staked in 1910 by Sargeant and Munroe, the locators of the *Rocher Déboulé* group. The property is now under lease and bond to Jennings and Trimble, who during the past year, have been engaged in driving a long tunnel to prospect the vein.

The vein is a well-defined fissure cutting the granodiorite in a direction N. 70° E. and dipping to the north at about 80 degrees. The vein outcrops on the surface, and can be traced up the steep rocky mountain-side above timber-line for a distance of 700 to 800 feet. A few small open-cuts have been made at different places along this outcrop. At an elevation of 5,000 feet the vein is split into two parts about 30 feet apart. Both sections are about 4 feet wide, and, while consisting mainly of gangue, there are in many places streaks of good-looking ore.

In an open-cut on the southerly split of the vein at an elevation of 5,300 feet a sample of a 4-inch streak of galena-copper ore assayed: Gold, 0.04 oz.; silver, 134 oz.; copper, 9.5 per cent.; lead, 22.5 per cent.; zinc, 8.6 per cent. On the northerly section of the vein near the same point a sample across 22 inches returned: Gold, trace; silver, 2.6 oz.; copper, 1 per cent.

At an elevation of 4,625 feet the two sections of the vein are joined together into one vein, which has a width of 4 to 5 feet; a small open-cut at this point exposes the vein. A sample taken across 8 inches of ore from the bottom of this cut returned only low values in gold and silver. Next to this streak there is a strip of waste and then 2½ feet of slightly mineralized material; a sample of this latter only gave traces in gold, silver, and copper.

The vein as exposed on the surface is much oxidized, decomposed, and leached out, but the abundance of iron oxide shows that at one time there was a considerable percentage of sulphides in the vein. The greatest depth reached in any of the cuts is not more than 8 feet, and this is insufficient to get below the zone of leached-out material. Hence it is quite possible that better values would be obtained at greater depth. The vein, mineralization, and other conditions are practically identical with the *Rocher Déboulé* veins, and there would seem to be every reason to suppose that the ore should carry as good values as in the latter property.

The leasers commenced a drift-tunnel on a small stringer which parallels the main vein about 70 feet to the north. This tunnel was not driven on the main vein, because, owing to the precipitous nature of the mountain, no suitable place was available for starting it, and, further, it was also thought that the small stringer might possibly develop a shoot of good ore. When the property was visited about the end of July this tunnel was in 355 feet, and from the face a crosscut was being driven, which was then in 12 feet towards the main vein. Work was stopped shortly after this, and the writer has been unable to ascertain whether or not the crosscut was continued far enough to strike the vein. Before anything definite could be said about the property it will be necessary to crosscut the main vein and drift for some distance on it in both directions.

Highland Boy.

The *Highland Boy* property is situated at the head of Juniper creek and to the east of the *Rocher Déboulé* mine. No permanent camp has been built, but the camping ground is at the head of the creek at an elevation of 5,150 feet, and the claims extend on up to the top of the mountain at a height of 7,000 feet. The group consists of several claims, and is owned by the Butte-Rocher Déboulé Copper Company. The property was idle when visited by the writer, and, so far as could be learned, no work had been done during the summer.

The ore occurs in fissure-veins cutting granodiorite as at the *Rocher Déboulé* mine, and conditions generally are very similar. There are two veins exposed (there may be more, but only two were observed by the writer) on the property, and these are developed by means of open-cuts and adit tunnels, The lower vein strikes S. 40° E. and dips at about 80 degrees to the north-east. It is developed by a tunnel 40 feet long, which shows the vein to be from 18 inches to 3 feet in width, and sparingly mineralized with iron and copper sulphides. A sample taken across a width of 20 inches near the face of the tunnel assayed: Gold, trace; silver, 0.5 oz.; copper, 1.5 per cent.

The upper vein is a clean-cut, well-defined vein, striking east and west and dipping at about 80 degrees to the north. The main working on it is a tunnel 85 feet long, which shows the vein to be up to 4 feet in width and carrying in places a pay-streak of chalcopyrite. A sample across 20 inches of this ore near the face assayed: Gold, 0.06 oz.; silver, 0.8 oz.; copper, 5.7 per cent.

By means of open-cuts and natural exposures of gossan-outcrop this vein can be traced up the mountain-side for some distance. In the largest open-cut the vein is seen to be 5 feet wide. At this point a sample was taken across 22 inches on the hanging-wall which assayed: Gold, 0.01 oz.; silver, 1.1 oz.; copper, 16.5 per cent. On the foot-wall at this place there is 15 inches of oxidized leached-out matter; a sample of this material only returned traces in gold, silver, and copper.

This property is well worth more development than has as yet been done.

RED ROSE BASIN.

The Red Rose basin is a small basin or amphitheatre in the Rocher Déboulé mountains, and lying to the south-east of the *Rocher Déboulé* mine and at the headwaters of Balsam creek. The wagon-road from Skeena Crossing to the *Rocher Déboulé* mine is followed up Juniper creek to where Balsam creek comes in, and from there a new trail made by Peterson and Ek is followed up Balsam creek to the camp. The camps of Peterson and Ek and a few other prospectors are situated at the foot of the basin at timber-line at an elevation of 4,000 feet, while the claims are located higher up on the sides of the mountains.

Red Rose.

The *Red Rose* group of claims, consisting of the *Red Rose*, *Yellowhammer*, *Prosperity*, *Juniper*, and *Summit*, is owned by Peterson and Ek. The claims are located on the northern side of Red Rose basin, and extend upwards from the head of Balsam creek to nearly the top of the mountain at an elevation of 8,000 feet. The main vein is on the *Red Rose* at an elevation of 5,625 feet, and is known as the "Lower showing."

This would seem to be a fissure-vein from 4 to 6 feet wide occurring entirely in a granodiorite formation, and is developed by a number of open-cuts, trenches, and an adit tunnel 30 feet long. In the tunnel the vein shows a width of 4 to 5 feet of considerably oxidized and leached-out siliceous vein-matter, and carries a considerable amount of pyrrhotite and some chalcopyrite. The sulphides occur mostly in a fairly well-defined pay-streak on the foot-wall, which at the face of the tunnel is 30 inches wide. The balance, or 2 feet, of the vein on the hanging-wall does not carry any appreciable amount of sulphides and is mainly siliceous gangue, which is not a true quartz, but is an alteration and silicification of the granitic wall-rock. The vein strikes N. 30° W. and dips to the south-west at 45 to 50 degrees.

An average sample across the 30-inch pay-streak returned the following values: Gold, 0.84 oz.; silver, 3.2 oz.; copper, 3.9 per cent.; while a sample across the 2 feet of vein-matter on the hanging-wall assayed: Gold, 0.02 oz.; silver, 1.4 oz.; copper, 2.1 per cent. At the time of visiting the property a rather severe snow-storm was in progress, so that it was rather hard to tell much about the surface exposures. Apparently, though, this showing is very close to the contact between the granodiorite and quartzites and argillites of the Hazelton group. The vein noted above in the tunnel is entirely in the granodiorite, but a number of other exposures of rusty material carrying pyrrhotite and copper-stain are evidences of the development of ore in and around the plunging contacts which the granodiorite makes with the older volcanic rocks.

Taking into consideration the assays above noted, and at the same time the very favourable conditions for the possible formation of a large ore-body, there is no doubt that this property is well worthy of further development-work.

The upper showing of this group lies up the mountain from the lower one at an elevation of 7,500 feet. The writer endeavoured to get Mr. Ek, who was showing him over the property, to take him up to this, but he refused, saying that owing to the heavy snow-storm alluded to before it would be difficult and even dangerous to attempt the climb, and that, in any case, with

a foot of snow on the ground it would be impossible to see anything. The showing has not been developed to any extent, most of the exposures being natural ones. Mr. Ek supplied the writer with the following description of this upper showing: "It is a large vein showing lenses or stringers of iron (probably pyrrhotite) across a width of 200 feet. In one place there is an 18-inch pay-streak of copper ore. Very little development-work has been done, but the owners intend to drive a tunnel on one of the best-looking places during the fall." A sample given to the writer by Mr. Ek, and said to represent an average of the 18-inch pay-streak referred to above, assayed: Gold, 0.30 oz.; silver, 2.3 oz.; copper, 8 per cent. A sample, similarly typical of the iron occurring across the vein in many places, assayed: Gold, trace; silver, 0.8 oz.; copper, 1.4 per cent.

The same men have staked two claims, called the *Slate* and *Slater*, lying south-east from this basin on Slate creek near the divide between this basin and the Brian Boru basin. Time was not available to see these claims, but the vein is said to be 2½ feet wide; a picked sample of which assayed: Gold, 0.14 oz.; silver, 40.4 oz.; lead, 32 per cent.

Brunswick Group.

The *Brunswick* group consists of the *Brunswick* and *Kaslo* claims, and is owned by Miller and Schofield. These claims are located at the head of the Red Rose basin, lying to the east of the *Red Rose* group. The *Kaslo* has a small distinct and clean-cut quartz vein striking N. 57° E. and dipping very slightly to the north-west. It varies in width from 6 inches to 3 feet and averages about 1½ feet. The wall-rock is quartzite and argillite, and the vein is separated from both walls by thin seams of talc. The ore-bearing solutions have replaced and altered the wall-rock to some extent on both sides of the central quartz vein. This alteration extends to a distance of 6 to 18 inches, but it does not seem as if any metallic sulphides had been deposited unless in the quartz proper. The ore-minerals in the quartz are galena, zinc-blende, and iron pyrites. The main development-work is an open-cut 20 feet long, with a 15-foot-face, while a few other small cuts have been made along the length of the vein. A sample at the face of the large cut taken across 18 inches assayed: Gold, 0.02 oz.; silver, 18 oz. An average sample of the dump from this working which contained about 5 tons of ore assayed: Gold, 0.02 oz.; silver, 18 oz.; lead, 8 per cent.; zinc, 4.6 per cent.

The *Brunswick* is located down the hill from the *Kaslo*, the elevation of the workings being 4,600 feet. At this point a 20-foot open-cut with a tunnel from the end 45 feet in length has been driven on a small quartz vein which cuts argillites. At the face of the tunnel the vein is shattered into three or four narrow stringers of ore 1 to 2 inches wide. The ore-minerals which are visible are zinc-blende, galena, and pyrite. A sample of high grade ore from the dump assayed: Gold, 0.04 oz.; silver, 61.6 oz.; lead, 12.2 per cent.; zinc, 5 per cent.

BRIAN BORU BASIN.

The Brian Boru is another one of the numerous basins in the Rocher Déboulé mountains which are really cirques, gouged out by former glaciers. This basin lies at the head of Glacier creek and about south-east of the Red Rose basin. To get to the camp the wagon road from Skeena Crossing is followed up Juniper creek for about five miles and a half, and from that point a rather indifferent trail leads off to the east and extends six miles to the head of the basin. The owners of one property in this section have put up a very small cabin right at the end of the trail and at an elevation of 4,750 feet, which is just about the timber-line. A few other prospectors have staked claims, but have so far accommodated themselves with tents.

The formation here consists largely of metamorphosed volcanics and sediments belonging to the Hazelton group, and intruded by numerous stocks and dykes of igneous rock, which vary in composition from a diorite to a granodiorite. Along the face of the mountain at the

head of the basin there is a prominent band of red rusty rock. This appears to mark a fissured zone running in a general north-easterly direction and following a line of igneous intrusions. In this fissured zone small stringers of iron-zinc ore occur, radiating in all directions. There are no well-defined veins, the stringers being short, irregular, and terminating abruptly. These stringers carry, as a rule, zinc-blende and pyrrhotite as the main minerals, with sometimes small amounts of galena, chalcopyrite, and pyrite. Quartz as a gangue occurs in some of the veinlets, but is often absent.

The results of assays made on samples taken from this region are somewhat disappointing, as they show that the iron-zinc ore does not carry appreciable values in gold or silver. The ore has, of course, no value for the zinc content, as it occurs in too small quantities and is too far from transportation. It should be remembered, though, that this and other sections of the Rocher Réboulé mountains can hardly be said to have been prospected yet. The occurrence of small quantities of galena and copper in the showings at this point leads to the hope that more thorough prospecting will discover commercial ore-bodies.

At the time the writer visited this camp none of the claim-owners were present, and he was therefore unable to obtain the names of the different claims and their owners. The main group is called the *Brian Boru* group; the workings seen and described were mostly on this group, but some other claims also have a little work done on them.

A short distance up the mountain from the cabin, at an elevation of 5,000 feet, a tunnel has been driven in for 30 feet on a small showing of mineral. This occurrence can hardly be called a vein, as it is quite irregular. At the face of the tunnel there are specks of pyrrhotite, chalcopyrite, and zinc-blende disseminated across a width of 4 feet; a sample across this assayed: Gold, trace; silver, 0.5 oz.; copper, trace.

About 500 feet to the east an open-cut has been made on a very slightly mineralized outcrop, but a sample across 4 feet of the material only assayed: Gold, trace; silver, 1.2. oz.; copper, *nil.*

At an elevation of 5,210 feet a tunnel has been driven in on a flat-lying stringer for 15 feet. At this place stringers of quartz up to an inch or more in thickness carry small quantities of galena and zinc-blende. With the present development, though, this showing is not of much importance.

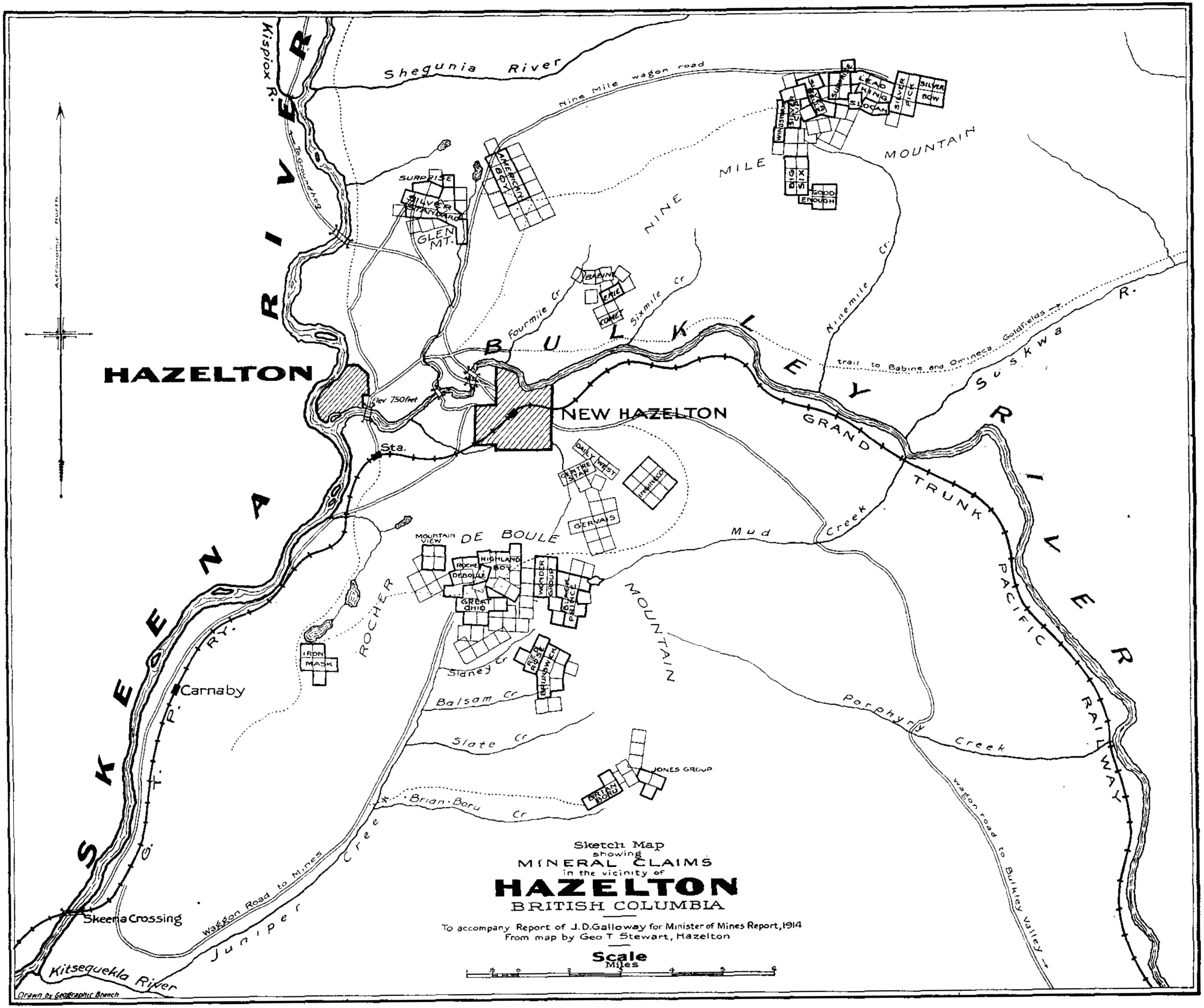
South Side of Brian Boru Basin.

Brian Boru basin is to some extent divided into two parts by a long hogsback running out from the main mountain. Claims are staked running over this hogsback and down into the other side, which may be called the south side of the basin. The showings on this side have been slightly developed by open-cuts and short tunnels, the main mineral being zinc-blende, with copper minerals almost entirely absent. Quartzites and argillites are the predominant rocks, with here and there intrusive dykes of diorite.

In one place a tunnel 20 feet long has been driven into a zone of iron-stained rock, but shows no mineral of value. Farther along a number of open-cuts show various stringers of zinc-blende which strike in all directions.

No. 1 open-cut, elevation 5,400 feet, carries zinc-blende in a number of stringers up to 4 inches in width across a width of 4 feet. A sample of the best-looking ore, selected in order to see if the zinc carried silver values, gave on assay the following results: Gold, trace; silver, 2.8 oz.; lead, trace; zinc, 44.3 per cent.

No. 2 open-cut lies east of No. 1 at an elevation of 5,300 feet. The vein exposed here is 12 inches wide and consists largely of zinc-blende; a sample taken here assayed: Gold, trace; silver, 1.8 oz.; lead, *nil.*; zinc, 17.8 per cent. Twenty-five feet below this cut a commencement has been made to drive a tunnel to cut under the upper showing.



Sketch Map
showing
MINERAL CLAIMS
in the vicinity of
HAZELTON
BRITISH COLUMBIA
To accompany Report of J. D. Galloway for Minister of Mines Report, 1914
From map by Geo T Stewart, Hazelton
Scale
Miles
HAZELTON
NEW HAZELTON
SKEENA RIVER
BULKLEY RIVER
Kispiox R.
Shegunia River
Nine Mile wagon road
NINE MILE MOUNTAIN
ROCHER DE BOULE MOUNTAIN
GRAND TRUNK PACIFIC RAILWAY
G. T. P. RY.
Suskwa R.
trail to Babine and Omineca Goldfields
Fourmile Cr.
Sixmile Cr.
Ninemile Cr.
Mud Creek
Porphyry Creek
Sidney Cr.
Balsam Cr.
Slate Cr.
Brian-Boru Cr.
Juniper Creek
Waggon Road to Mines
wagon road to Bulkley Valley
Kitsequekla River
Skeena Crossing
Carnaby
Sta.
Elev. 750 feet
SURPRISE
SILVER STANDARD
GLEN MT.
AMERICAN BOY
BABINE
ERIE
COMET
LEAD KING
SLOCAN
SILVER PICK
SILVER BOW
WINDSTORM
SILVER CUP
BIG SIX
GOOD ENOUGH
DAILY WEST
CENTRE STAR
GERVAIS
MOUNTAIN VIEW
ROCHER
DEBOULE
HIGHLAND BOY
GREAT OHIO
BLACK PRINCE
IRON MASK
RED ROSE
BRUNSWICK
JONES GROUP
BRIAN BORU
Astronomic North
Drawn by Geographic Branch

East of the last showings and at an elevation of 5,450 feet, there are several small open-cuts which show a little mineral. The stringers of blende are again small, while the wall-rock has evidently carried considerable iron which for the most part has been oxidized and leached out. In one place there is a 2-inch streak of galena; a sample of this was taken which returned on assay: Gold, trace; silver, 90 oz.; lead, 39.5 per cent.; zinc, 5.7 per cent. This result is interesting as showing that the galena in this section carries good silver values, and would therefore make it the important mineral to look for. Another surface opening lying still farther to the east has a mineralized vein showing a width of 30 inches. A sample across this width assayed: Gold, trace; silver, 11.6 oz.; lead, 1 per cent.; zinc, 12.3.

Jones Group.

Jones and Bush own a group of claims lying to the south of the previously mentioned workings; the workings on them which were seen are down in the flat on the south side of the hogsback. Several holes from 8 to 10 feet deep have been sunk, which show the rock to be sparsely mineralized with small stringers of zinc-blende and pyrrhotite. The rock appears to be mostly diorite, and the writer was unable to discern any definite system of strike in the different stringers. A sample of the best ore assayed: Gold, 0.06 oz.; silver, 1.3 oz.; lead, *nil.*; zinc, 20.5 per cent.

VICINITY OF HAZELTON.

The town of Hazelton is situated on land lying between the junction of the Skeena and Bulkley rivers. For many years past it has been the chief distributing-point for the district, and has latterly derived a considerable business from the construction of the Grand Trunk Pacific Railway. The Government offices, including that of the Gold Commissioner and Mining Recorder of the Omineca Mining Division, are situated here, while the Hudson's Bay Company has maintained a post here for years. The town now has hotels, stores, post-office, etc.

On leaving the Skeena the railway runs along the south bank of the Bulkley, while Hazelton is on the north bank and distant from the railway about three-quarters of a mile in a straight line. As soon as the route of the railway-line was definitely settled a number of townsites were plotted in the vicinity of Hazelton; in fact, all along the line numerous townsite schemes were started, many of which have never advanced beyond the initial stage. One townsite was laid out on the south side of the railway directly opposite the old town; this is known as South Hazelton and boasts of a flag-station, but little more. Four miles farther up the track New Hazelton was started, which soon gained sufficient importance to warrant a railway-station. Unfortunately, for some reason, after the station was first built, another change was decided on, and it was moved up the track another 3,000 feet, which has had the result of dividing the new town to some extent. Between South and New Hazelton at least two other townsites have been plotted, but have never progressed beyond the lot-selling stage. Near the point where the aerial tram from the *Rocher Déboulé* mine comes out on the railway another townsite, known as Carnaby, has been surveyed; this is about six miles down the track from south Hazelton and is another flag-station. In many respects Old Hazelton has many advantageous features for the growth of a town, but the fact that New Hazelton is on the railway-line will to a large extent offset these. With a view to furthering the interests of New Hazelton, the townsite promoters erected, at considerable expense, a high-level suspension bridge over the Bulkley river at the Awillgate canyon. This bridge provides a wagon route to Glen and Nine-mile mountains without dropping down to the level of the river. A large and commodious hotel has been built close to the railway-station at New Hazelton by R. J. McDonnel, which provides an additional incentive for patronizing this place instead of the old town.

Besides mining, the district has considerable possibilities in the way of farming which have not as yet been developed to any great extent.

The most important mineral camps that are tributary to Hazelton are Nine-mile and Glen mountains, which lie to the north, and the north-western slope of Rocher Déboulé mountain.

A map of the Hazelton district is included in this report, which shows the location of the various mining claims and camps.

GLEN MOUNTAIN.

Glen mountain is a small, detached hill about one mile long by half a mile wide, lying four miles east of Old Hazelton, which forms part of and might be called a foot-hill of the Babine range. Its greatest elevation is about 2,500 feet above sea-level, or 1,200 feet above the valley of the Skeena. The whole hill is covered with mineral locations, but the principal property is the *Silver Standard*, on which a considerable amount of development-work has been done.

Silver Standard.

The *Silver Standard* group of six Crown-granted mineral claims is situated on Glen mountain near the top of the hill, and partly on the slope into Two-mile creek. The claims were staked in 1910 by Long and McBain, who developed them for a short time and uncovered a promising showing of silver-lead ore. In 1911 the property was secured by Stewart, McHugh, and McLeod on a lease with option to purchase; after further exploratory work this syndicate completed the purchase and has since operated the mine nearly continuously.

As soon as the railway was in operation between Hazelton and Prince Rupert, shipments of high-grade silver-lead ore were sent out from this mine and have since been continued intermittently. During the past year, 1914, 736 tons of ore was shipped which contained about 200 oz. gold, 122,000 oz. silver, and 282,000 lb. lead. On account of the disruption of the market for this class of ore owing to the European war, the mine was closed down in August and has not since been reopened.

Comfortable camp buildings for the accommodation of the men have been erected about half a mile from the mine-workings. The mine is connected with Hazelton by a good wagon-road, over which the ore is hauled after being sacked at the mine.

Glen mountain is composed mainly of rocks of the Hazelton group, consisting of quartzites and argillites. These rocks are intruded and have been considerably affected by a series of quartz-porphyry dykes; in places the older rocks have been altered by the introduction of a considerable amount of calcite. Some relation exists between these dykes and the veins, but just what is not known; possibly the injection of the dykes has caused the fractures and fissures which are now filled with quartz.

There are several veins on the property, all of which are roughly parallel, with a general north-and-south strike and an easterly dip of from 50 to 80 degrees. They are fairly well-defined veins, varying in width from a few inches up to 6 feet, and are filled with a true quartz gangue carrying galena, pyrite, zinc-blende, and some grey-copper. The grey-copper carries very high values in silver, and the galena generally carries from 1 to 3 oz. of silver to the unit of lead. The zinc-blende carries practically no silver. Gold values are as a rule low.

The main vein is really a compound vein, with quartz veins developed on either wall of a wide fissured zone, and with bunches and stringers of quartz lying irregularly between. The main shaft was started on the foot-wall vein, and in which a rich shoot of ore was found to extend for some distance. This shaft is now down 385 feet and is sunk on an incline of about 55 degrees; it has main levels at 150 and 250 feet down and at the bottom. Numerous drifts, raises, and crosscuts have been made to explore and follow the streaks of rich ore occurring in

the foot-wall vein, the hanging-wall vein, and the intermediate stringers between. One long crosscut from the bottom of the shaft runs into the hill for 450 feet and taps the No. 2 Vein; this vein will be described later.

In places the sulphides are present in sufficient quantity to form almost solid ore, but as a rule the ore-minerals are disseminated in particles through the quartz gangue, while, in many places, the quartz is almost devoid of mineral. Up to the present time the work of mining has been devoted to discovering and mining these rich pay-shoots of solid ore. These often prove disappointing, however, as their continuity in length and depth is very irregular, and, when least expected, they fade away or break off abruptly. On the other hand, while no attention has yet been paid to the second-grade or concentrating ore, the development and mining work in connection with getting out the high-grade ore has exposed a considerable tonnage of good milling-ore. Mr. Haskins, superintendent, estimates 4,000 tons of this ore which will assay from $20 to $40 a ton.

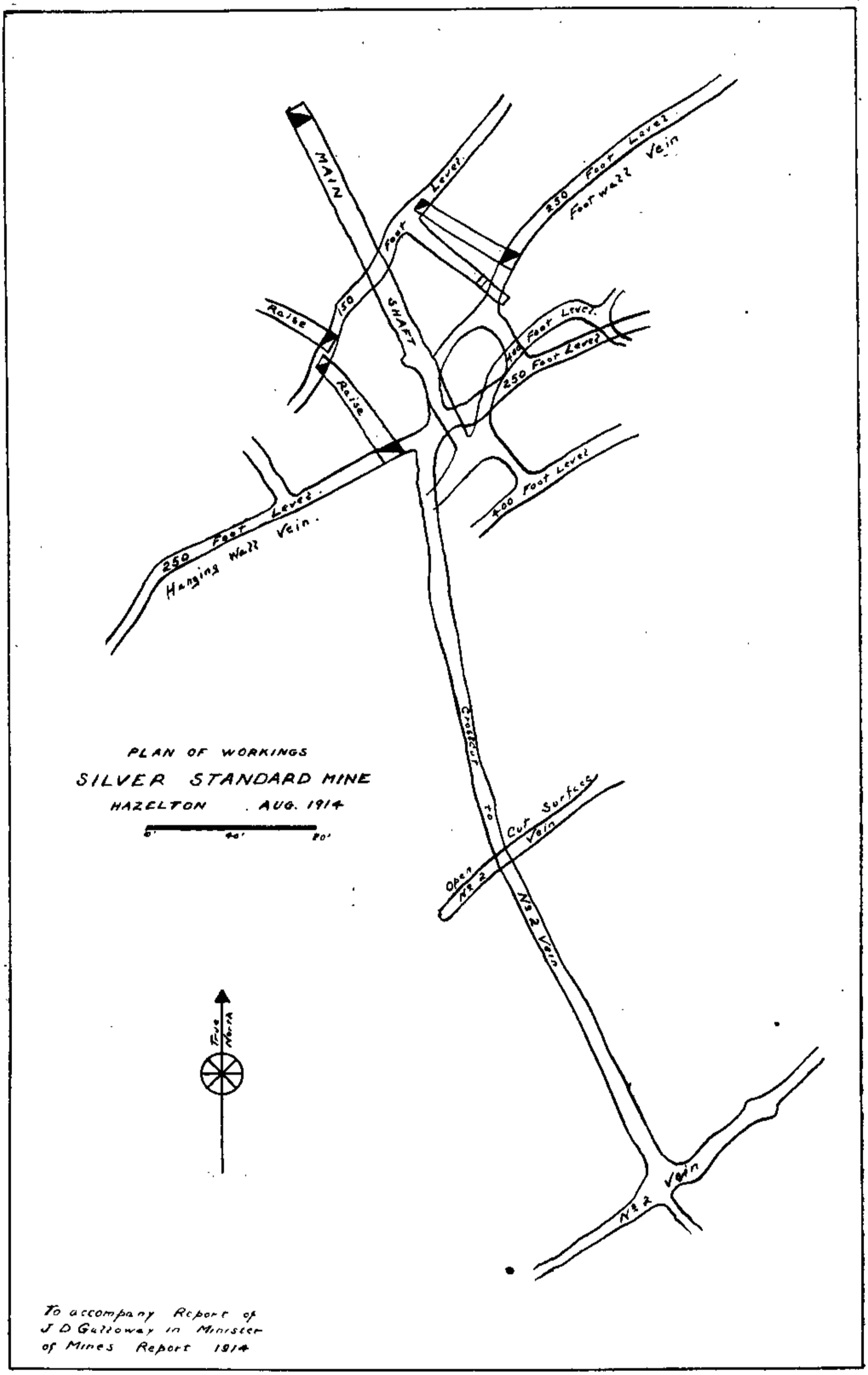
At the present time transportation and smelting costs amount to somewhere about $30 a ton. Smelting charges are high because of the fact that the ore carries a high zinc content, which is about 20 per cent., and is penalized by the smelters. As it therefore does not pay to ship anything but high-grade ore, close hand-sorting is resorted to, and the result is that, while the ore shipped is nearly solid sulphide, there is a considerable tonnage of second-grade ore rejected. The only way in which this ore can be utilized will be by first concentrating it up to a grade that can be shipped. The concentration of this ore would possibly present some difficulties, but there seems little doubt that by a little experimenting a suitable mill could be designed. With a concentrator which would handle all the ore extracted, a much more promising future for the mine would be opened up.

The larger part of the ore shipped from this mine has been taken out of the workings in the main shaft, which is equipped with a steam-hoist, a 5-drill air-compressor, boiler-house, blacksmith-shop, machine-shop, ore-bins and sorting-tables, and other necessary buildings.

An office and warehouse are situated near the shaft, while the mine camp is situated about half a mile away and lower down the hill. At the time of visiting the property work was confined mainly to the bottom level, where a small but rich streak of ore in the foot-wall vein was being followed.

No. 2 Vein.—This vein crops out to the east of and up the hill from the main vein, with which it has a parallel strike and dip. On the surface this vein showed a very promising ore-shoot, which unfortunately did not last long. This surface showing was described in detail by the Provincial Mineralogist in the Annual Report of the Minister of Mines for the year 1912. At the time that he saw it there was an ore-shoot about 200 feet in length, with a width of 18 to 20 inches of nearly solid ore, and a further width of from 2 to 3 feet of quartz and low-grade ore, which had been exposed by surface cuts and stripping to a maximum depth of about 5 feet. The 18-inch pay-streak assayed from 200 to 300 oz. in silver to the ton, according to samples taken along the outcrop. Unfortunately this rich ore only extended downwards for a short distance; a shaft has been sunk on it which passed out of the rich ore in a few feet, and was put down for 50 feet without finding another pay-streak.

The crosscut from the main shaft cuts this vein at a depth of 200 to 250 feet. The vein at this point is about 6 feet wide, and consists of quartz containing but little mineral; to judge by the eye, hardly sufficient to constitute it concentrating ore. There seems reason to suppose, though, that other pay-shoots of ore may exist in this vein than the one which was mined out at the surface.


PLAN OF WORKINGS
SILVER STANDARD MINE
HAZELTON . AUG. 1914
MAIN SHAFT
150 Foot Level
250 Foot Level
Footwall Vein
Raise
Raise
400 Foot Level
250 Foot Level
400 Foot Level
250 Foot Level
Hanging Wall Vein
Crosscut to No 2 Vein
Open Cut Surface
No 2 Vein
No 2 Vein
True North
To accompany Report of
J D Galloway in Minister
of Mines Report 1914

No. 3 Vein.—This vein lies to the west of the main vein, and is also a quartz vein from 2 to 5 feet in width, carrying galena and zinc-blende as the main minerals. A shaft has been sunk on it to a depth of 40 feet or more, but, as this was full of water, no examination was possible. The dump consists almost entirely of quartz carrying a considerable percentage of lead, zinc, and iron sulphides. A grab sample was taken of this dump, which was intended to be an average, but which was probably high, and assayed as follows: Gold, 0.15 oz.; silver, 130 oz.; lead, 0.5 per cent.; zinc, 1.5 per cent. The high silver content in this assay, with the low lead and zinc, suggests that the sample selected contained an unusually large percentage of grey-copper, which in this locality always carries high silver values.

This vein crops out again several hundred feet to the south, just above the wagon-road. Here the vein is 5 feet wide, and a sample across the full width gave an assay of: Gold, 0.14 oz.: silver, 22.0 oz.; lead, 5.5 per cent. A crosscut tunnel was being run to tap this vein and at that time was in 90 feet. This crosscut should soon strike the vein and will give a depth of 50 to 60 feet.

The *Silver Standard* is excellently situated for cheap mining; wood and water are plentiful, railway transportation is within easy distance, and, generally speaking, mining conditions are ideal.

Black Prince.

The *Black Prince* is one of the claims in the *Silver Standard* group, and is owned by the same people. At the time of visiting the property it was under lease to two miners who were at work. The conditions on this claim are similar to those on the *Silver Standard*, but with very much less development-work done. Several quartz leads occur cutting through altered sedimentary rocks, with strikes roughly parallel to those of the *Silver Standard*. One vein is developed by a shaft 40 feet deep which shows a little ore occurring in small pockets. On the surface, a short distance from the shaft, an open-cut has exposed some good ore in this vein, and the leasers were running a drift from the shaft in the direction of this ore-shoot, to get underneath it. Other veins on this property are exposed on the slope of Glen mountain, looking down into Two-mile creek. One open-cut with a tunnel at the end, with a total length of 25 feet, shows a vein from 1 to 2 feet wide carrying some good ore, but at the face of the tunnel the vein is cut off by a well-marked fault-plane striking N. 60° E. An upper tunnel on the continuation of this vein has been driven in 85 feet, but in this working the vein is badly broken up and stringered. At a point 50 feet in the tunnel the leasers have put up a raise for a distance of 15 feet and have taken out a little good ore. Several open-cuts above this tunnel also expose the vein, which is mineralized, to quite an extent, with arsenical iron. An assay of this material returned: Gold, 0.10 oz.; silver, 5 oz.

American Boy.

The *American Boy* group of eight Crown-granted claims is owned by the Harris Mines, Limited, in which the Harris Brothers, the original locators of the claims, are the principal stockholders. The property is situated on the south-western slope of Nine-mile mountain, about eight miles from New Hazelton. Access to the property is obtained by means of a wagon-road up Two-mile creek, which passes below the property, and from this road a switchback horse-trail going up the mountain-side to the camp and mine-workings.

There are a series of parallel veins on this property with a general north-and-south strike and dipping to the east at angles of from 60 to 80 degrees. The rock formation through which these veins cut is mainly sedimentary, consisting of sandstones, quartzites, and argillites of the Hazelton group, but in certain places there are quartz-porphyry dykes in close relationship to the veins. These dykes are no doubt offshoots from the main bodies of granodiorite in the vicinity, and would seem to have played an important part in the formation of the ore-deposits of the district.

No. 1 Vein.—The veins on this property are numbered in order going up the hill, so that No. 1 is the lowest vein. This vein has been developed by two shafts and open-cuts, and is exposed on the surface for some distance. The vein is from a few inches up to 2 feet in width, and is a quartz-filled fissure carrying galena and zinc-blende, together with lesser amounts of pyrite, chalcopyrite, and tetrahedrite.

The main shaft is 100 feet deep on a 60-degree incline, and has drifts at the 27-foot and 50-foot levels. Throughout this working the vein is fairly well mineralized, in many places the different minerals occurring with a well-defined banded structure. In places this vein is split up to some extent or sends off irregular stringers into the wall-rock; at the surface in the main shaft it consists of two bands, on either side of the shaft and separated by wall-rock, each of which is from 18 inches to 2 feet wide. This vein and all others on the property are generally free on the walls, with, in places, quite a development of talcose gouge.

The drift on the 27-foot level has been run in to the north for 12 feet; a sample taken across 20 inches at the face of this drift assayed: Gold, 0.04 oz.; silver, 47.4 oz.; lead, 11.0 per cent.

On the 50-foot level the drift only extends 6 feet to the south; a sample was taken at the face here across a width of 22 inches, which assayed: Gold, 0.02 oz.; silver, 15 oz.

North of the main shaft a short distance another shaft has been sunk to a depth of 25 feet, which at the time of examining the property, was also filled with water to a height of 15 feet. Between the two shafts the vein has been exposed on the surface by stripping, while, farther north, it is uncovered by a small open-cut. A sample of picked high-grade ore from this shaft assayed: Gold, 0.10 oz.; silver, 681.2 oz.; lead, 31 per cent.; and a grab sample of the dump assayed: Gold, 0.04 oz.; silver, 28.8 oz.; lead, 3.7 per cent. About 3 tons of ore was shipped from this latter opening which netted over 200 oz. of silver to the ton.

No. 2 Vein.—This vein lies 150 feet east of No. 1 vein and farther up the hill, and is exposed on the surface at intervals for a distance of 300 feet by means of open-cuts and trenches. It has a strike of N. 5° W. and a slight dip from the vertical to the east. The width of the vein is from 2 to 3 feet, and the quartz is sufficiently mineralized in some places as to constitute ore. A sample of selected ore from this vein assayed: Gold, 0.15 oz.; silver, 481 oz.; lead, 41.2 per cent.

No. 3 Vein.—This is the uppermost vein on the property, and lies about 600 feet easterly from the No. 2 vein. It has been exposed at intervals for a considerable distance on the surface, and if what is sometimes called No. 4 vein is the same as No. 3, and this seems likely, then it has a length of at least 1,500 feet, although for a considerable part of this distance it is covered by a heavy mantle of wash. A good deal more work has been done in opening up this vein than the others, and the major portion of the ore shipped from the property was taken out of the main shaft on this lead.

Commencing with a car-load in 1912, about 100 tons of ore in all has been shipped from this property, which has netted in the neighbourhood of $7,000. Practically all of this has been taken out in the course of development work, although some stoping has been done.

The No. 3 vein is very similar to the No. 1, but the banding of the ore-minerals is more marked, and the presence of a considerable amount of arsenical iron, was noted. The vein varies in width from 1 to 3 feet, with an average of about 2 feet. A number of small, steeply inclined faults, with planes of strike north and south, offset the vein for distances of a few feet. These faults apparently had a nearly vertical movement, thereby simply causing displacements along the length of the vein.

An incline shaft has been sunk to a depth of 180 feet on this vein, and, at different levels, drifts have been driven to the north and south. The wall-rocks are mainly sedimentary, varying between quartzites, sandstones, and shales, but along the foot-wall a quartz-porphyry dyke is seen, both at the surface and down at the 150-foot level. The exact relation between this dyke and the vein was not discovered. The faulting which is seen on the surface is in evidence again in drifts to the north between the 100- and 175-foot levels, but these faults are not large enough to cause any serious trouble in finding the vein. The following samples give an idea of the values obtained in the ore:—

Description of Sample.	Gold.	Silver.	Lead.
	Oz.	Oz.	Per Cent.
Ore-streak 5 inches wide	0.10	35.4	30.2
Second-class ore across 10 inches	0.02	8.0	....
Second-class ore: Average of dump. This material is sorted out of shipping-ore	0.04	20.0	10.4
Low-grade dump: Milling-ore	0.08	26.2	8.3

On the No. 4 vein, or the continuation of the No. 3 vein where it has been traced for some distance to the north, a tunnel has been started as a crosscut, this tunnel is in 50 feet and should strike the vein in another 10 feet, from where it will be carried on as a drift on the vein. It is estimated that this tunnel will give a depth of 700 feet when it reaches the shaft. The vein where exposed on the surface shows, in places, a little ore.

A crosscut tunnel has been run to strike the No. 2 vein, which it cuts at 310 feet and was then continued for 80 feet farther. The vein was also drifted on for some distance, when it split into two stringers; from the end of the drift on the right-hand stringer a crosscut was made to the foot-wall stringer, a distance of 16 feet. The vein in this working consists mostly of quartz varying from a few inches up to 1 foot in width, but only very slightly mineralized, and with no pay-shoots of ore of much importance.

The *American Boy*, like the *Silver Standard*, has a considerable tonnage of ore which could be handled at a profit if concentrated before shipment. Freight and treatment charges are now about $23 a ton, exclusive of the cost of hauling down the hill to the railway at New Hazelton, making it impossible to profitably handle anything but high-grade ore. Ore, such as shown by the average assay of the main ore-dump from the shaft on No. 3 vein, although it runs over $20 a ton, cannot be shipped as crude ore at the present time; it should, however, be possible to effect a simple water-concentration on this material, which would bring it up to a product running $150 to $200 a ton.

In order to determine the amount of milling-ore in the various veins on this property it would be necessary to make thorough assay plans, which, of course, the writer did not have time to do. But, from the information available, the writer is of the opinion that this property could be worked at a profit if it were equipped with a suitable concentrating-mill.

WESTERN SLOPE OF ROCHER DÉBOULÉ MOUNTAIN.

On the western slope of Rocher Déboulé mountain a number of claims have been staked, but as yet very little development work has been done on them. A visit was made to see the claims owned by Denis Comeau, as they were reported to have a good showing. The nearest point on the railway is the flag-station of Carnaby, which is about a mile down the track from the claims.

Cap Group.

The claims are known as the *Belton* and *Cap*, and are staked a short distance up the mountain from the railway track. The aerial tramway from the *Rocher Déboulé* mine passes over the property, coming out on the railway a mile above Carnaby. Mr. Comeau has also a ranch which is staked on rising ground just off the railway-track. He has a comfortable house and a nice garden-patch of potatoes, cabbages, turnips, and garden-truck generally.

The main showing is on the *Cap* claim, on which there is a well-defined vein from 2 to 5 feet wide, and very similar in appearance to the veins in the Juniper Creek section. The formation is entirely granodiorite, having a strongly marked porphyritic structure, with the fissure striking N. 80° E. and dipping in a northerly direction at about 80 degrees. As in the *Rocher Déboulé* mine veins, the gangue material consists for the most part of highly silicified and altered wall-rock, which, at this place, as it is on the surface, and has contained a large percentage of iron sulphides, has a red, rusty oxidized appearance, and is to some extent leached out; the ore-minerals are sulphides of copper and iron and a little galena.

The vein is developed by surface workings and a shaft 20 feet deep. At the bottom of the shaft the well-mineralized portion of the vein is 2 feet wide, although the full width may be greater. A sample of this 2 feet of ore assayed 40 cents in gold, 9.8 oz. in silver, and 1 per cent. copper. Another sample taken across 2 feet of ore, 10 feet above the bottom of the shaft, assayed: Gold, 0.04 oz.; silver, 21.4 oz; copper, 7.5 per cent. An ore-dump containing about 5 to 6 tons, which represents the best of the rock taken out of the shaft, has an average assay of about $1.20 in gold, 25.2 oz. silver, and 9.7 per cent. copper. This property warrants further development-work.

Adjoining this property is another claim owned by Victor Preston. The work on this claim has been done on what appears to be a heavy crushed gouge along a fault-plane. An open-cut shows 4 feet of white, sticky gouge which is really pulverized rock, kaolinized to some extent by infiltrating solutions. There is a little iron pyrites in this material which has been oxidized in places, giving rise to reddish streaks, but no copper.

Directly below this cut there is another which is the approach to a short tunnel, and also shows a wide, crushed, rusty zone. A sample of the material which looked best from its content of iron pyrite was assayed, but only returned 1.2 oz. of silver and a trace of gold.

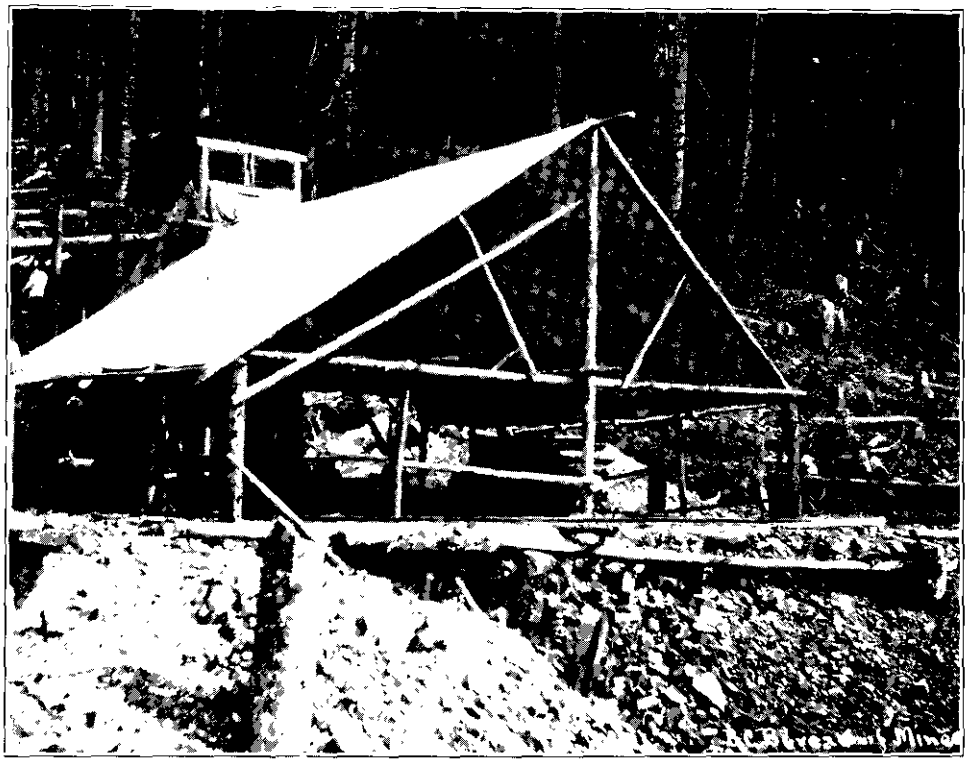
SIX-MILE MOUNTAIN.

On Six-mile mountain, which lies between Six-mile and Four-mile creeks, many claims have been staked; none of these were worked during the past year, and only one—the *Erie group*—was visited by the writer.

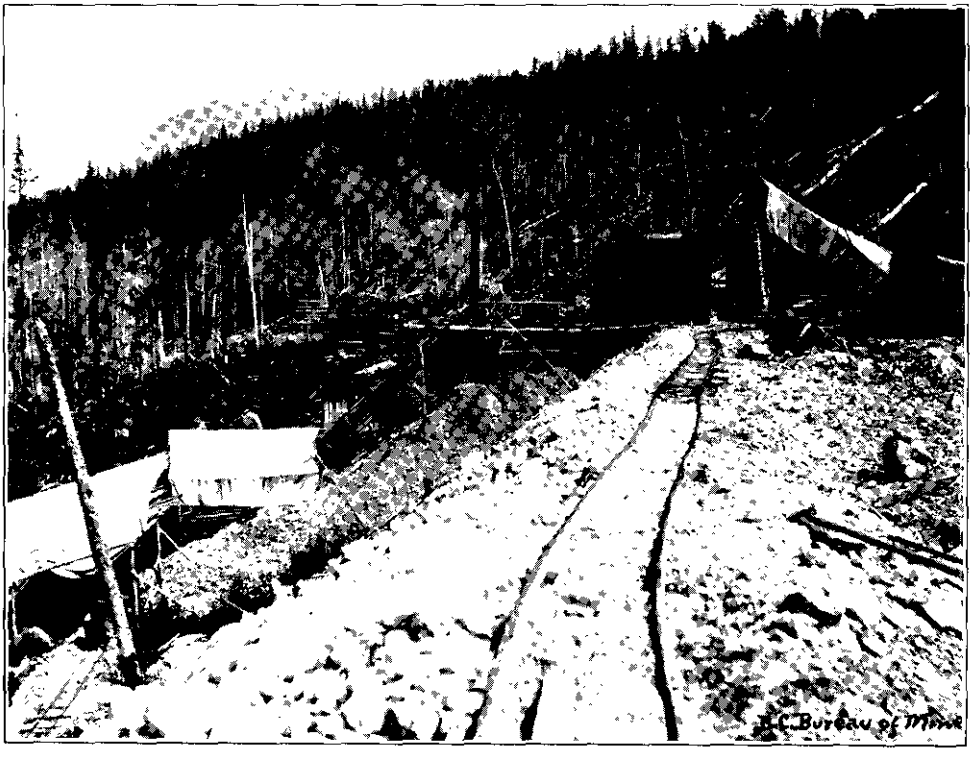
Erie Group.

This group consists of four Crown-granted claims, distant from Hazelton about five miles, from which it is reached by a good trail. The showings on this property are found at and near the contact of a granitic intrusive with the highly metamorphosed sedimentaries of the Hazelton group. A number of open-cuts in different places expose ore which would seem to occur in a rather irregular manner along fault-planes and in crushed zones.

One vein is exposed for 300 feet by a large cut 8 feet wide by 5 feet deep. On this vein there are two shafts, both of which, however, were full of water. One would appear to be about 20 feet deep and the other at least 50 feet. This vein has a width of from 2 to 4 feet, consisting for the most part of a silicious gangue, with here and there slight amounts of galena and zinc-blende. No samples were taken from this property, but it is known that assays of solid galena give high values in silver. It is probable that there is some grey-copper in this ore, which would account for the occasional very high silver assays obtained. Several other strippings and open-cuts have been made to uncover the vein at different places.



Ore-sorting Shed—American Boy—Omineca M.D.



Main Shaft—Silver Standard—Omineca M.D.

One hundred feet below these workings a crosscut tunnel was started to cut the vein, and is now in 200 feet. This tunnel commences in the altered sedimentaries, and is in these rocks at the face. In places it cuts through quartz-porphyry dykes. The tunnel has some distance to go yet before it can strike the vein. The property is owned by Mr. Kinman, of Vancouver.

NINE-MILE MOUNTAIN.

Nine-mile mountain lies about six miles in an air-line to the north-east of Hazelton, but by trail or wagon-road is about twice that distance. The mountain is a somewhat round-topped, crescent-shaped series of ridges, indented by numerous basins which are the heads of small creeks, and lying between the Shegunia and Bulkley rivers. The highest points reach elevations of 5,000 to 5,500 feet, well above timber-line. Many claims have been staked all over the mountain, but the most important centre around the *Silver Cup*, in the Silver Cup basin. Several trails lead to this basin, but a wagon-road has now been built up Two-mile creek and onwards for some distance; this wagon-road was being built last fall and had progressed to within a couple of miles of the Silver Cup basin. After leaving two-mile creek this road switchbacks along the slope of Nine-mile mountain looking down into the Shegunia river, and will eventually pass along the foot of Silver Cup basin, following along the present trail. The road thus passes below all the more important claims, the workings of which are generally on the steep slope up from the road; in this way it will be easy for the different properties to lower their ore down to the main road and thence out to Hazelton. Small amounts of ore from this camp have been packed out on horses, but very little could be shipped until the completion of the wagon-road.

Silver Cup.

The *Silver Cup* group consists of the four Crown-granted claims—the *Silver Cup*, *Silver Dollar*, *Duke*, and *Duchess*—all staked in 1909, and is owned by the Silver Cup Mines, Limited, a Prince Rupert company. During the past summer the property was leased by the Clothier Brothers, who with one other man were at work when the camp was visited by the writer in August. Two serviceable log houses have been built on the property some little distance above the foot of the basin, on a timbered ridge at an elevation of 3,800 feet. The claims cover a large part of the basin, while the main workings lie up the mountain from the cabin; three of the tunnels being situated on a very steep, precipitous, rocky slope, where ropes have been strung along rocky ledges to afford safer access. This site is rather exposed to snowslides, one man being swept away and killed by a slide in 1910.

The formation here consists of heavily bedded quartzites and argillites, in places having a high angle of dip. A large area of intrusive granodiorite lies to the west and north which is of a similar nature to the Rocher Déboulé granodiorite, and which is responsible for the fracturing and mineralization in the mountain. The general type of ore-deposit in the district is a more or less true quartz-filled fissure-vein, and on this property there are two or three such veins.

The main vein is developed by six drift-tunnels, which, starting with No. 1 near the top of the mountain, are numbered downwards to No. 5, the lowest one being called the *Duchess* tunnel. The vein cuts the mountain in a direction of N. 30° E., with an easterly dip of about 78 degrees, cutting the sediments obliquely. It runs up and down the rocky face of the upper part of the basin, thus giving an excellent opportunity for adit drift-tunnels.

No. 1 Tunnel.—This tunnel is at an elevation of about 4,500 feet, and is in the neighbourhood of 200 feet long. The vein in this working is from a few inches up to 2 feet in width, and would perhaps average 10 inches; in places it carries a fair pay-streak of ore consisting of galena, iron pyrites, arsenopyrite, stibnite, and zinc-blende. A sample taken at the face where the ore is 6 inches wide assayed: Gold, 0.02 oz.; silver, 45.4 oz.; lead, 33 per cent.; zinc, 22.7 per cent.

This tunnel has not been worked for some time, and at the time of visiting it the mouth was nearly choked up with snow from a snowslide of the previous spring.

A number of small normal faults along the bedding-planes of the wall-rock are in evidence in the tunnel, but as these only have a throw of a foot or two they do not cause any difficulty in following the vein.

No. 2 Tunnel.—This tunnel was being worked by the leasers, and contains the best showing of ore on the property. It is about 100 feet lower elevation than the No. 1 tunnel, and is in a little over 100 feet. Small faults or jogs in the vein are common in this working also; at the face the vein is partly cut off by one of these, only showing at the top. Forty feet from the portal a stope has been started upwards on the vein, which was up 25 feet, plainly showing the step-like character of these faults. The vein in this tunnel is from 1 to 3 feet wide, with a fair percentage of ore throughout; one place was seen where there was nearly 2 feet of solid ore, while in the stope there is a nice shoot of ore. About 10 tons of hand-sorted ore had been taken out by the leasers, and they expected soon to have a car-load. The refusal of the smelters to take ore in August, however, upset their plans, and it is believed they closed down shortly after without shipping any ore.* A sample, intended to be an average of this lot of ore, assayed: Gold, trace; silver, 116 oz.; lead, 46.1 per cent.; zinc, 12.4 per cent.

No. 3 Tunnel.—This working is 80 feet below the No. 2 tunnel. It was run in on a calcite stringer, supposed to be the vein, for some distance; crosscutting to the east then found the vein, and this was drifted on in both directions, but failed to show any material quantity of ore.

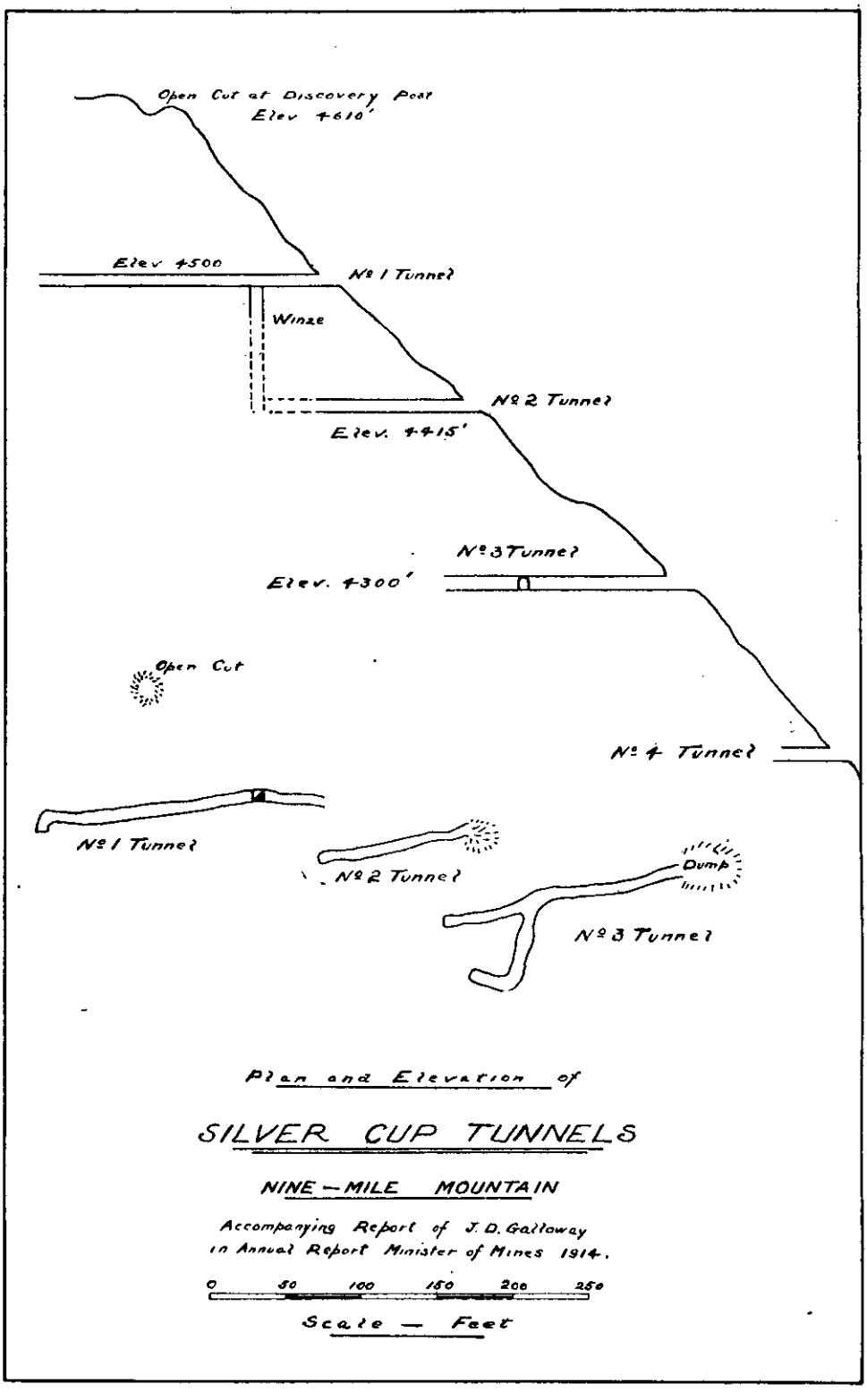
The Nos. 4 and 5 tunnels were started in slide-rock and never got in far enough to strike the vein, and are now caved in.

Duchess Tunnel.—These workings are much lower down the hill, being at an elevation of 3,500 feet and below the camp. The vein here has a strike of N. 5° E. and a dip of 30 degrees to the east. It is evident that the country here has faulted and slid down the hill, so that it is hard to say whether or not this is the same vein as in the upper showings, although it may be. From the broken nature of the ground this cannot be considered a promising place for long ore-shoots.

There are two short tunnels in these lower workings, a short distance apart; the upper one apparently having followed a slip plane with no ore. The lower one follows the vein proper, and is about 25 feet long, with some branches starting near the mouth and going in on the dip of the vein, which is in places nearly flat. Some ore can be seen throughout the vein, the face of the tunnel showing about 2 feet of mixed gangue rock and zinc-blende and a little galena. A sample across 18 inches of this material, which was probably the best place seen in the workings assayed: Gold, 0.06 oz.; silver, 92.2 oz.; lead, 14.9 per cent.; zinc, 11.6 per cent.

On the *Duke* claim of this group, which lies to the west, another vein has been prospected by means of a drift-adit 150 feet long, known as the *Duke* tunnel. This vein has a strike of N. 30° E., with an easterly dip at about 75 degrees, so that it is parallel to the main vein as shown in the upper tunnels. This vein is also cut by small normal faults along the bedding-planes of the argillites in which it occurs. These fault-planes strike about north-east and dip to the north-west at about 30 degrees, thus giving rise to step-like jogs in the vein. Ten feet from the end of the tunnel the vein has disappeared in one of these faults, but there is little doubt that it could be soon picked up again by swinging to the east.

* Since the above was written it has been learned that a car-load of ore containing 23 tons was shipped before the year ended, which carried about 140 oz. of silver to the ton.



Plan and Elevation of

SILVER CUP TUNNELS

NINE—MILE MOUNTAIN

Accompanying Report of J. D. Galloway
in Annual Report Minister of Mines 1914.

0 50 100 150 200 250

Scale — Feet

This vein is similar to the main vein, but so far has not shown nearly as much mineralization. Sparing amounts of galena occur, together with some arsenical pyrites and zinc-blende. No samples were taken, as the actual amount of ore is not sufficient to be of much importance.

Farther up the ridge and about west of Nos. 1 and 2 tunnels, main vein, further work consisting of five open-cuts and one crosscut tunnel 20 feet long has been done. At this point the argillites are tilted very steeply to the west, and slight mineralization has taken place along the bedding-planes and also in some cross-fractures; arsenical iron and zinc-blende are in evidence, but no galena was noticed. These showings are not of much importance.

To the east of the *Silver Cup* group there is a claim owned by Duke Harris, the name of which the writer was unable to learn. An open-cut on this property 10 feet long, with a 10-foot face, shows a nice-looking vein up to 2 feet in width. A sample taken across 18 inches of the best-looking ore assayed: Gold, 0.03 oz.; silver, 163.6 oz.

Silver Bell. This claim, which is owned by Geo. T. Stewart, of Hazelton, and partner, is located to the west of Duke Harris's claim. On this claim the contact between the sedimentary measures of the Hazelton group with the granodiorite can be seen, while numerous dykes radiate out into the older rocks. There are no definite well-defined leads on this claim, but there is considerable mineralization along irregular fractures in the quartzites and argillites. These stringers are from 1 to 6 inches wide, and in places are filled with solid galena and stibnite. A selected specimen of the ore assayed 72.4 per cent. lead and 160 oz. in silver, with a trace of gold.

Practically no work has been done on these showings, which are along the face of a very steep part of the mountain, but they would seem to be worth developing to some extent.

Sunrise Group. The *Sunrise* group of four claims lies over the ridge of the Silver Cup basin to the east, in another small basin. The property is owned by Hazelton people. The formation here is entirely granodiorite. On the surface there is no very distinct vein, but a wide shattered zone in the granodiorite, which is to some extent mineralized with galena, zinc-blende, stibnite, and iron sulphides. The main open-cut is 75 feet long and from 4 to 10 feet deep, and there are several irregular streaks of ore which, taken together, make a very good showing. A sample was chipped out across 5 feet at the best-looking place in the cut, and this assayed 24.2 per cent. lead, 5.2 per cent. zinc, and 49.8 oz. silver.

One man was at work on the property, getting out sufficient ore to make up a car-load shipment with some that had been taken out some years before. All this ore is carefully hand-sorted, so as to ship practically nothing but solid sulphide. It is believed, however, that this ore was not shipped during the past year, as in August and September the smelters refused to take this class of ore. Nearly a car-load was ready when the property was visited on August 5th. A selected sample of the ore, which will represent approximately the hand-sorted ore, assayed: Gold, trace; silver, 86 oz.; lead, 61.6 per cent.; zinc, 7.5 per cent.

There are some other open-cuts above this which show fractures in the grano-diorite reddened with iron oxide, but no ore of any importance.

Below the main workings there are two crosscut tunnels, neither of which, however, reached the vein. The upper one is in about 50 feet, with a right-angle crosscut 50 feet farther. The only thing to be seen in this working is a streak of quartz 4 inches wide. The lower tunnel is in 25 feet, but did not strike any ore.

Lead King.

The *Lead King* claim lies about half a mile to the east of the *Sunrise*, at an elevation of 4,500 feet. The mine cabins are in a little meadow some distance below the mine-workings. The first showing seen was a small stringer, 4 to 6 inches wide, carrying galena and zinc-blende, exposed in an open-cut. Below this a crosscut tunnel has been driven which, apparently, cuts the stringer at a point 15 feet in, and then continues for another 50 feet. A drift has been run on the stringer for 30 feet from where it was cut in the tunnel. All the rock on both walls is granodiorite, and no ore of any account can be seen.

One thousand feet to the south, another vein is exposed which is from 3 to 4 feet in width. It is dipping to the west at 30 degrees, and on it a flat incline has been sunk. This was full of water, but, as far as could be seen, the vein looked promising. A sample of selected ore taken from the ore-dump at this point assayed 26.7 per cent. lead, 31.7 per cent. zinc, and 33.4 oz. of silver, with a trace of gold.

On this claim the granodiorite is much shattered, and the ore occurs along slickensided fractures instead of in true veins. There are said to be other showings than those just described, and a tunnel 100 feet long.

A shipment of 5 tons of ore was made from this property in 1909. No work has been done on the property for the past two years.

Silver Pick Group.

This group consists of the *Silver Pick*, *Silver Leaf*, and *Silver Trust* claims, and is owned by W. Fred Brewer, Hazelton. These claims were staked in 1910 and lie to the east of the *Lead King*. Only one claim, the *Silver Trust*, was visited by the writer, and on this a tunnel 20 feet long was seen. This shows a vein striking N. 12° E. and dipping to the east at about 30 degrees, which is about 2 feet wide, and carries in places an 8-inch streak of ore consisting of galena, zinc-blende, and iron sulphides. The vein is apparently cut off at the face by a slight fault. A sample of selected ore assayed: Gold, trace; silver, 58 oz.; lead, 39.6 per cent.; zinc, 21.6 per cent. There are said to be good showings on the other two claims on this group.

When the wagon-road is completed into this camp, there seems no reason why several of the properties in this camp would not pay to work in a small way by leasers.

MUD CREEK.

Mud creek heads on the eastern side of Rocher Déboulé mountain and flows into the Bulkley river about ten miles above New Hazelton. The *Wonder* and *Black Prince* groups are situated at the head of this creek, and were bonded in 1913 by a syndicate of Spokane, Wash., and Wallace, Idaho, with O. B. Wallace as manager. Preliminary prospecting-work was commenced in 1914 and continued until the outbreak of the war, when everything was stopped.

The formation is granodiorite and the ore-bodies similar to those on the other slope of the mountain; the ore-minerals are chalcopyrite, galena, and iron sulphides. Some molybdenite and wolframite are also reported.

When the writer was in Hazelton a trail to the property was being constructed, but was not finished. A visit was not made to the property, as Mr. Wallace was sick, and, further, he reported that comparatively little, excepting surface showings, could be seen.

TELKWA.

The town of Telkwa is situated on the Grand Trunk Pacific Railway at the confluence of the Bulkley and Telkwa rivers. It is on the east bank of the Bulkley, the railway and railway-station being on the west bank. The adjoining town of Aldermere lies on the bench behind Telkwa and about half a mile away. Both places are small; Telkwa consisting of a hotel,

post-office, three stores, and some thirty to forty houses. Four miles below Telkwa and the same distance above it the railway has put in stations known as Tatlow and Hubert respectively. The former "town" is nothing but a flag-station at which trains rarely stop, while the latter boasts a few buildings, etc. In theory, the railway company does not recognize Telkwa, as tickets cannot be bought to that point, but must be taken to the next station beyond; actually, however, Telkwa is the central point, and will without doubt continue to grow at the expense of its near-by rivals.

Ten miles down the track from Telkwa, towards Hazelton, is the town of Smithers, a divisional point on the railway. This is quite a pretentious little town with graded streets and good buildings, but the first building boom would seem to have anticipated the needs of the town for some time to come.

It is said to be the intention of the railway company to make this an important divisional point, with extensive shops and yards. This, with the natural resources of farming and mining in the vicinity, should ensure a steady growth for the place. The town is unfortunately situated on swampy ground, thus necessitating large drainage-sewers along the streets, which are filled with semi-stagnant water and lend an unattractive feature to an otherwise pleasant place. Amongst other things, the town has a modern and up-to-date hotel run by the Carr Brothers.

The Bulkley valley has a varying width of from two to ten miles and the elevation at Telkwa is 1,700 feet. The present river-channel is cut into the old valley-level for a depth of 100 to 200 feet, and in many places runs through rock-walled canyons. It is a wild unnavigable stream which has a sharp fall for such a large river. In many places there are small lakes occupying the rim of the old glacial valley, which are now well above the present river-level. It is evident that the modern river-channel is the result of a recent Post-Glacial uplift which has given new erosion power to the stream.

The Bulkley valley contains a good deal of land suitable for mixed farming, but as yet the actual production is slight. With the advent of adequate railway transportation, however, the future should see considerable agricultural development.

The town of Telkwa is the central point for a number of mining camps, most of which are as yet in the development stage. To the south are Hunter, Howson, and Hankin basins; to the west is Hudson Bay mountain and the Zymoetz River coal-fields; and to the east lies the Babine range. Some of these camps are considerable distances away, but the writer found that Telkwa was a very convenient centre from which to examine the country.

As was previously stated, this mineral and coal section has been examined and reported on by W. W. Leach and W. F. Robertson in considerable detail in past years. Since the last report of Mr. Robertson in 1911 there has not been a great deal of development, but during the early months of 1914 several small shipments of ore were made. The curtailment of smelting operations by the commencement of the European war in August put a stop to these ore shipments, but it is probable that more ore will be shipped during the winter months. As the writer's time was limited, only a small proportion of the properties could be visited; as a rule, those examined were properties on which new work had been done since the last report by Mr. Robertson in 1911.

Coal on the Headwaters of the Zymoetz.

The Zymoetz river rises in a low divide between the Skeena and the Bulkley rivers, taking its source from Zymoetz and other small lakes which lie on the south-west flank of Hudson Bay mountain. It flows westerly for about twenty miles, then nearly southerly for twenty-two miles, and then westerly again for nineteen miles, joining the Skeena river at Copper City. W. M. Brewer proceeded up the river from Copper City and examined a num-

ber of mineral claims along this river, including a deposit of hæmatite iron ore at the headwaters of one branch of the river which comes in from the east. The writer went in by pack-trail from Telkwa to examine the coal claims on Coal creek, a small tributary of the Zymoetz which joins the river a few miles below Zymoetz lake, and on the way out inspected a number of claims on Hudson Bay mountain.

The trail from Telkwa starts from a point on the wagon-road half-way between Telkwa and Smithers, and immediately rises on to the bench land lying between the Bulkley river and Hudson Bay mountain. From here the trail follows along comparatively level land which forms the divide between the Bulkley river and Pine creek, a tributary of the Telkwa river; this bench land, which extends for some distance, lies to the south-west of Hudson Bay mountain. The trail continues, skirting around the base of that mountain and reaches the divide between the headwaters of Pine creek and the Zymoetz river; this divide is also very flat and is occupied by three lakes—namely, Aldrich, Denis, and Zymoetz. Aldrich and Denis lakes are quite small, while Zymoetz lake is about five miles long by one mile wide. The Zymoetz river has a very easy gradient for some distance, but where it turns south it falls very rapidly. The trail follows along the north side of the Zymoetz river to where Coal creek (now called Chettleburgh creek) comes in about nine miles below Zymoetz lake, and then turns up to the coal camp situated five miles up the creek from the river. The greatest elevation attained on the trail is 3,000 feet on Silver Creek flats just beyond Aldrich lake.

The coal formation is first seen where the trail crosses Sandstone creek about four miles before coming to Coal creek, but it is not known to be continuous throughout this distance. The writer was not able, in the time available, to accurately determine the boundaries of this sedimentary formation, but roughly it occupies an area of about five miles long by two miles wide, and is possibly considerably greater. The coal-measures are well exposed up and down Coal creek, which cuts across the formation for a distance of at least three miles. The rocks in the series are conglomerates, coarse gritty sandstones, shales, often carrying large nodules, and coal-seams. The measures, as a rule, dip at comparatively low angles, but are flexed and slightly faulted so as to have quite different dips and strikes at different points. No very large faults were noted; none that would be at all serious in mining operations.

Copper River Coal Syndicate.

The Copper River Coal Syndicate, which is a subsidiary company of the North American Security Company, and for whom the National Finance Company, Vancouver, is fiscal agent, owns seventy-five coal claims, twenty of which are surveyed, staked on the coal formation occurring on Coal creek. Coal-croppings were first discovered on Coal creek, and at first but two small seams were discovered; prospecting, however, eventually discovered five seams, all close together. These five seams are not quite parallel in strike and dip, but the differences that are to be seen are probably caused by the crumpling of the measures or irregularities in their original deposition. A short distance below the No. 1 seam, which is the lowest stratigraphically, and also the lowest in position on the creek, an igneous intrusive rock cuts across the coal-measures. From the nature of its occurrence it would seem as if this body of rock was younger than the coal-measures, but the absence of any contact action on the sedimentary measures makes the former conclusion doubtful. In the event of it being older than the coal-measures it would mean that erosion had at this point exposed the floor on which the coal-measures rest, and the further conclusion would follow that in this locality no very considerable thickness of sedimentary rocks could be expected. This igneous rock has a width, as exposed where the creek crosses it, of 600 feet or more; below this the coal-measures again come in, the bottom measure being a coarse conglomerate, and where it is in contact with the igneous rock no baking or metamorphic action is visible.

Below the igneous rock the coal-measures are, to some extent, distorted, and the dips and strikes change quickly in a short distance, and are quite different from those where the coal-seams are exposed farther up the creek. The writer made a vertical section of the measures, including the coal-seams, which represents the conditions where the seams are exposed up and down the creek. Owing to the irregularities of dip and strike of the seams, this section would vary considerably at different places; this difference is most noticeable with respect to seams Nos. 1 and 2. On one side of the creek these seams are within 15 feet of each other, but on the other side it is apparent that they are at least 90 feet apart, and that erosion has removed the No. 2 or upper seam. In making up the section an average has been taken which it is believed approximately represents the true condition. This section and map showing positions of seams and tunnels is included in this report.

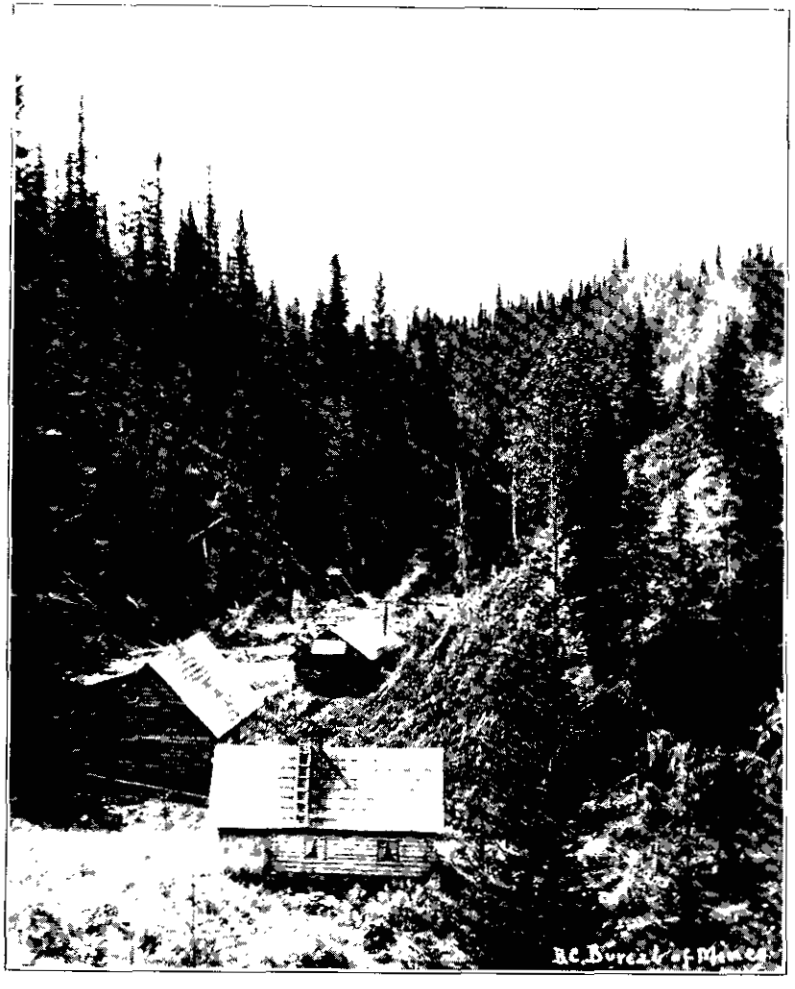
The different seams have been prospected by drift-tunnels after the preliminary surface work of exposing them had been done. No work was done during the past year; the last work which was done on the property being the taken-in of a diamond-drill during the winter of 1913. This drill was taken in over a rough sleigh-road in the winter-time, but has not yet been erected for operation.

The following is a description of the coal-seams:—

No. 1 Seam.—This is the largest seam on the property and is the lowest stratigraphically in the coal horizon. It was first explored and opened up by means of a drift-tunnel 178 feet long on the east side of Coal creek, 75 feet above the creek-bottom. The strike of the seam is N. 38° E., with an average dip of 24 degrees to the north-west; the dip varies in the tunnel from 20 to 35 degrees. The roof consists of alternating bands of clay and coal, while the floor is shale. The seam is practically constant in thickness, and at the face it was measured and sampled as follows: Starting from the floor, there is 1 foot of dirty coal, then 6 feet of clean coal, 7 inches of clay, 3 feet of clean coal, and above alternating layers of coal and clay from 6 inches to 1 foot in thickness. The seam thus contains two sections of commercial coal, the bottom coal (6 feet thick) and the top coal (3 feet thick) divided by a clay-parting 7 inches thick. In this bottom and top coal there are a few very small seams of clay from $\frac{1}{4}$ to $\frac{1}{2}$ inch in thickness, but, as these would be included in mining, the samples were taken to include them, and thus a fair average of the coal as it would be mined was obtained, At right angles to the dip there are occasional cross-fractures which contain calcite stringers $\frac{1}{4}$ inch in thickness, but these are not numerous enough to make any appreciable difference. The following are the analyses of samples from this seam (top coal (A) and bottom coal (B)):—

	(A.) Per Cent.	(B.) Per Cent.
Moisture	3.3	3.9
Volatile combustible matter	34.5	31.2
Fixed carbon	56.1	55.1
Ash	6.1	9.8
	100.0	100.0
Coking	Fair.	Fair.

This seam has also been prospected by a crosscut tunnel running easterly from the creek-level which strikes the coal at about 158 feet; no further work having been done beyond this point. The seam where cut is 75 feet below the upper tunnel and is almost identical in appearance; the bottom and top coal and various clay-seams being all in evidence in the same



Mine Camp—Coal Creek—Omineca M.D.

Looking up Coal Creek—Omineca M.D.

relation to one another as in the upper tunnel. Samples taken of the top coal (A) and the bottom coal (B) have the following analyses :—

	(A.) Per Cent.	(B.) Per Cent.
Moisture	2.4	3.3
Volatile combustible matter	36.7	31.9
Fixed carbon	56.2	52.8
Ash	4.7	12.0
	100.0	100.0
Coking	Fair.	Fair.

A section of this seam and also all the others is appended to this report.

No. 2 Seam.—This seam lies about 60 feet stratigraphically above the No. 1 seam. It is developed by a drift-tunnel 160 feet long which goes through a small hill and comes out on the other side on Balsam creek. The coal in this seam is quite similar to that in No. 1 seam, but is apparently a better coking-coal; it is a firm, compact coal, and evidence of this is very clearly shown by the fact that pieces of coal 2 and 3 feet square, taken out in driving the tunnel, have lain on the dump for four years exposed to the weather and do not as yet show signs of disintegration.

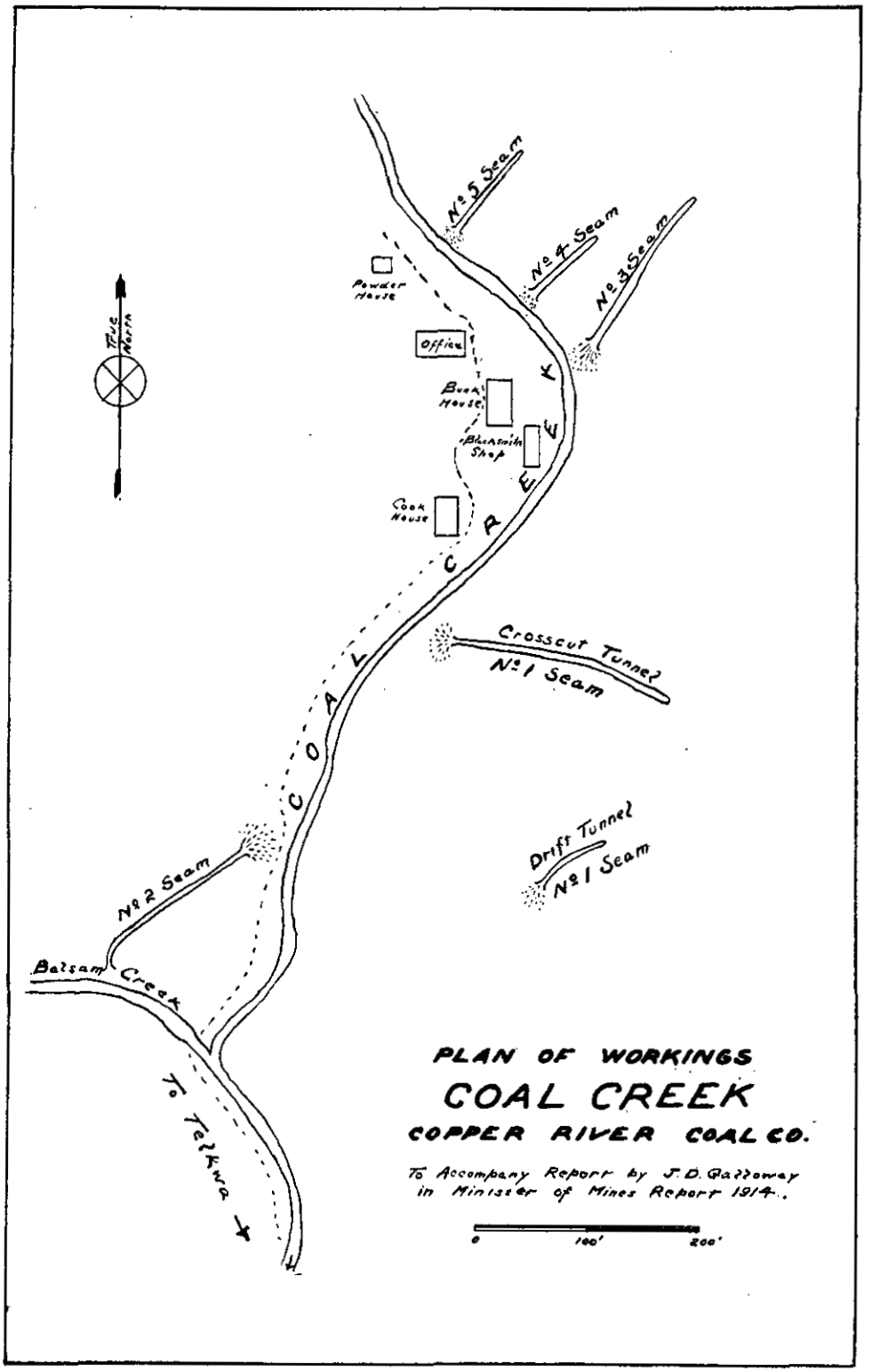
This seam can also be divided into top and bottom coal; the top coal being 37 inches thick, including a 4-inch clay-parting, 10 inches from the roof, while the bottom coal is 32 inches thick, including a 2-inch clay-parting. Between these bands of coal there is 14½ inches of clay with a little coal, which would be all waste. Sample (A) in the following analyses is across 33 inches of the clean top coal, excluding the 4-inch parting, and sample (B) is the bottom coal across 32 inches, including the 2-inch clay-parting, which was taken into the sample as it could hardly be excluded in mining.

	(A.) Per Cent.	(B.) Per Cent.
Moisture	3.1	3.1
Volatile combustible matter	31.3	31.4
Fixed carbon	55.3	51.0
Ash	10.3	14.5
	100.0	100.0
Coking	Fair.	Poor.

These two seams are the only ones which are of sufficient size to be considered of commercial value.

No. 3 Seam.—This seam lies 28 feet stratigraphically above No. 2 seam. It is developed by a tunnel 161 feet long driven on the seam, commencing on the outcrop on the east side of Coal creek. Another opening called the B level and connected to the first by a crosscut had been made, but these latter workings are now caved in. The strike of this seam is N. 32° E. and it dips at about 26 degrees to the north-west. The seam is 3 feet 11 inches wide, including a clay-parting in the centre of 4 inches. A sample taken across this seam, but excluding the 4-inch clay-parting in the centre, had the following analysis: Moisture, 2.5 per cent.; volatile matter, 31.7 per cent.; fixed carbon, 58.4 per cent.; ash, 7.4 per cent.; coking qualities, fair.

No. 4 Seam.—This is a narrow seam of somewhat impure coal outcropping in the bed of Coal creek a short distance above the No. 3 seam. It has a thickness including a 4-inch clay-band in the centre, of 22 inches, and has a shale roof and a band of fireclay on the floor. A tunnel, starting a few feet above the water-level, has been driven in 84 feet along the course


No 5 Seam
No 4 Seam
No 3 Seam
Powder House
Office
Boarding House
Blacksmith Shop
Cook House
COAL CREEK
Crosscut Tunnel
No 1 Seam
Drift Tunnel
No 1 Seam
No 2 Seam
Balsam Creek
To Telkwa
True North
PLAN OF WORKINGS
COAL CREEK
COPPER RIVER COAL CO.
To Accompany Report by J. D. Galloway in Minister of Mines Report 1914.
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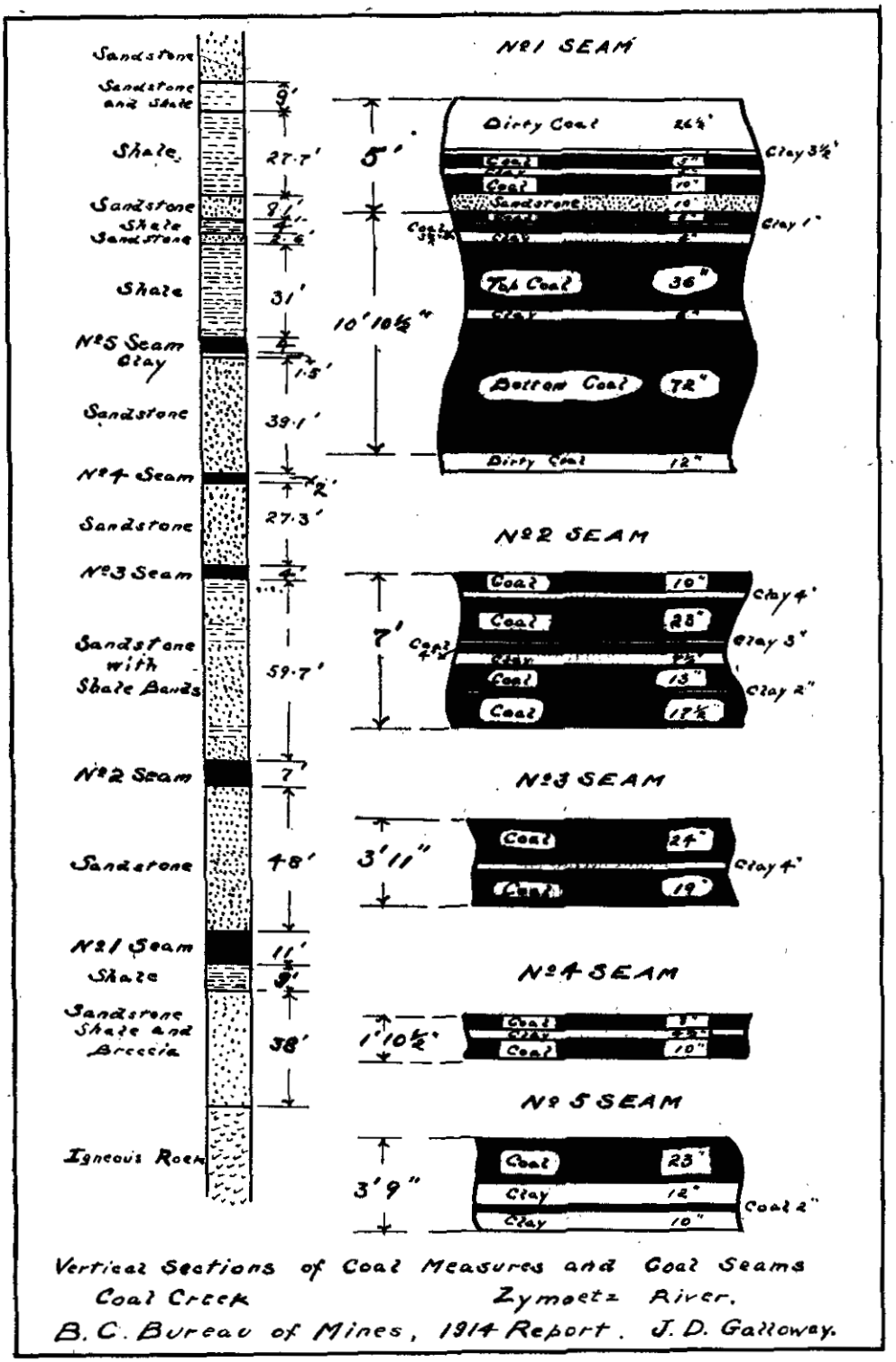


Vertical Sections of Coal Measures and Coal Seams
Coal Creek Zymoetz River.
B. C. Bureau of Mines, 1914 Report. J. D. Galloway.

of the seam, which strikes N. 48° E. and dips at 33 degrees to the north-west. A sample taken at the face, but excluding therefrom the central clay-parting, had the following analysis: Moisture, 2.4 per cent.; volatile combustible matter, 29.5 per cent.; fixed carbon, 50.7 per cent.; ash, 17.4 per cent.; coking qualities, poor.

No. 5 Seam.—No. 5 seam outcrops farther up the creek from No. 4, at which point a tunnel has been driven in on it for a distance of 112 feet. The seam strikes N. 40° E. and has a westerly dip of 28 degrees, with a nearly constant thickness of 2 feet; a sample from near the face having the following analysis: Moisture, 2.4 per cent.; volatile combustible matter, 32.6 per cent.; fixed carbon, 47 per cent.; ash, 18 per cent.; coking qualities, poor.

So far as is known, none of these seams crop out on the surface anywhere but along the short section exposed on Coal creek; in any case, no work has been done elsewhere, although a lot of exploratory prospecting for coal-outcrops has been done all over the company's property. Farther down the creek and at one place above the workings there are narrow seams of coal, but these are of no importance. The value of the field is entirely dependent on seams Nos. 1 and 2, as the others are not of sufficient size to be considered of commercial value.

The analyses of samples from the large seams show the coal to be of a good bituminous grade, suitable for steaming or domestic purposes; the ash content is as low as the average of coals mined and sold in the Province. The coking quality of this coal is only fair, but a coke could be made from it, and possibly in a suitable type of oven a coke good enough for metallurgical purposes could be produced.

With the amount of development so far done, it is not possible to estimate any very large tonnage of coal as being proven, but if, as seems reasonable to suppose, the seams are continuous throughout the sedimentary formation, then a considerable tonnage of probable coal exists.

As was previously noted, a diamond-drill was taken into the property, but has not yet been assembled. The next step in the development of the property should be by means of extensive drilling to prove the continuity of the seams throughout the sedimentary formation. The drill is fitted to go to a depth of 2,000 feet, which is quite sufficient to test the property thoroughly. The drill is at present lying at a place three-quarters of a mile north-west of the workings in Coal creek, where it had been intended to commence drilling. The manager estimates that the drill should strike the coal at a depth of 1,200 feet at this point.

The nearest point to this coalfield on the line of the Grand Trunk Pacific Railway is Telkwa, a distance of at least thirty-five miles. It is obvious, then, that the exploitation of this coal cannot be accomplished without the building of a branch railway-line into the field. A route for such a railway is possible up the Telkwa river to Pine creek, and then up this stream to the divide, and thence down the Zymoetz river. This railway would be comparatively easy and inexpensive to build, as the country is nearly level, with only a slight grade up the rivers. It would be about forty miles in length, and would also bring the claims on the southern slope of Hudson Bay mountain into touch with railway transportation.

The property of the Copper River Coal Syndicate would have to be developed to a very much greater extent than it is now before the expense of putting in such a railway-line would be seriously considered. A large tonnage of coal will have to be definitely proven before the construction of such a road would be warranted. A comparatively small expenditure on diamond-drilling would prove the continuity of the seams, and, in the opinion of the writer, this is the line of development which the company should pursue in future.

A market for this coal would be provided by the Grand Trunk Pacific Railway and by the domestic demand throughout the district. If it was found that a suitable coke could be made, the smelters on the Coast would be probable purchasers. So far as they are at present

developed, there is no other coalfield along the route of the Grand Trunk Pacific in British Columbia which is as promising as a source of coal, and there is certainly none of them that have as yet reached the productive stage. With the development and growth of this northern country, there is bound to be an increasing demand for coal, and it seems reasonable to suppose that a coal-mine in the centre of the district could compete successfully with coal brought in from Vancouver Island and the Prairies, which, at present, are the sources of supply.

HUDSON BAY MOUNTAIN.

Hudson Bay mountain is an isolated mountain mass lying between, and forming the divide of the watershed between, the Bulkley and Zymoetz rivers; it is about twenty miles long by ten miles wide and is roughly oval in contour. The mountain is rugged and a considerable part of it lies above timber-line; the central peak rises to over 9,000 feet. Many claims have been staked on different parts of the mountain, perhaps the most important camp being on the southern slope, which rises from the Pine-Zymoetz divide. As before noted, the trail from Telkwa to the Zymoetz River coalfields passes around this side of the mountain, passing over Silver Creek flats at the mouth of Silver creek. From this flat, which is a beautiful camping-place with abundance of horse-feed, excellent water, and good fishing in the neighbourhood, trails lead off up the mountain-side to the various mineral claims.

This camp is also connected by a good trail with Smithers, the new town on the railway-line. During the past summer a rough wagon-road was cut out and partly constructed, which closely followed this trail. This road was sufficiently completed to form a sleigh-road on which ore could be hauled out in the winter.

GEOLOGY OF SOUTHERN SLOPE OF HUDSON BAY MOUNTAIN.

Hudson Bay mountain consists mainly of bedded volcanic and sedimentary rocks belonging to the Hazelton group. It is intruded by a central core of quartz porphyry, and from this core numerous dykes radiate in all directions. These dykes have shattered the mountain and provided the channels by means of which mineral-bearing solutions have followed later. The ore-bodies occur along the walls of, and sometimes in the body of, the dykes. The ore-bodies are of the replacement type, the wall-rock having been dissolved out and replaced by metallic sulphides. Very little true quartz can be seen, the gangue consisting mainly of altered and silicified wall-rock. The minerals present are galena, zinc-blende, pyrite, arsenopyrite, pyrrhotite, and a little grey-copper, and the values are in silver and lead. Gold values as a rule are small, or absent altogether.

Coronado Group.

The *Coronado* group of claims lies up the hill a short distance above Silver Creek flat and only half a mile from the main trail. The property consists of two claims and a fraction, and is owned by R. J. McDonnell, Jim Halley, and others. The claims are all below the timber-line at elevations from 3,000 to 3,500 feet. A comfortable camp with cook-house and bunk-houses has been erected.

The main vein on this property has been traced on the surface for at least 800 feet, and is developed by means of adit drift-tunnels and surface cuts. It strikes about north-east and dips at about 85 degrees to the north-west, and is apparently a replacement vein, the wall-rock, consisting largely of volcanic breccia, but, in places, it changes to diabase, felsite, and porphyrite. The main valuable mineral is galena, which carries fair values in silver, but in addition there are found sulphides of iron and zinc, occurring in a gangue which is mainly silicified wall-rock. The gold values in the ore of this property are a good deal higher than usual throughout the district.

No. 1 tunnel, which is the lowest on the hill, is in 155 feet, and has a winze down 12 feet below the floor-level; this working shows the vein to be mineralized in irregular bunches and to vary in width from 1 or 2 inches up to 2 feet. The best pay-streak of ore seen was at a point 110 feet in the tunnel, where there is a width of 10 inches of good-looking ore. A sample across this assayed: Gold, 0.45 oz.; silver, 129.4 oz.; lead, 38.1 per cent.; zinc, 14.4 per cent

The ore taken out in the driving of this tunnel has been roughly sorted into two grades, of which there is about 25 tons of first-class ore; a sample representing an average of this assayed: Gold, 0.20 oz; silver, 46 oz.; lead, 23.5 per cent.; zinc, 15.4 per cent. The winze was full of water, but it is said to have a showing of good ore at the bottom.

One hundred feet up the hill a cut 50 feet long has been made on the vein, and from the end of this the No. 2 tunnel is driven in 35 feet. There is a nice shoot of ore exposed in this tunnel; at the entrance the pay-streak is 2 feet wide, being nearly continuous for the length of the tunnel, and has a width of 10 inches at the face. An average sample taken at the face assayed: Gold, 0.30 oz.; silver, 16.5 oz.; lead, 4.8 per cent.; zinc, 45.3 per cent.

About 30 tons of first-class ore has has been sorted out of the material taken out from this working, and there is another dump of second-class ore containing about 30 tons. Average samples of these dumps assayed as follows: First class—gold, 0.24 oz.; silver, 51.4 oz.; lead, 27 per cent.; zinc, 21.6 per cent. Second class—gold, 0.20 oz.; silver, 6 oz.; lead, 2.2 per cent.; zinc, 16.5 per cent.

A short distance farther up the hill is the No. 3 tunnel, which is 20 feet long. This tunnel has apparently been driven in on one side of the main vein, as what appears to be the vein is cropping on one side at the mouth of the tunnel and then passes into the foot-wall. The only mineral showing in the working is a little arsenical iron pyrites which occurs along fracture-planes.

One hundred and fifty feet farther up the hill a surface cut shows what is probably the same vein, and with a width of 10 inches, the mineralization here consisting of zinc-blende and arsenopyrite. A sample across the full width assayed: Gold, 0.76 oz.; silver, 4.9 oz.; lead, 0.8 per cent.; zinc, 19.2 per cent. This assay is worthy of particular note, inasmuch as the gold content is much higher than any other sample. This sample contained zinc-blende and arsenopyrite as the main minerals, with only a slight amount of galena.

From this point up the hill for another 800 feet, attempts have been made by stripping, etc., to find the vein, and in two or three places fractured seams containing some mineral have been found, which may be extensions of the main vein. The cut, which is highest up the hill, 1,200 feet or more from the No. 1 tunnel, shows a rather poorly defined vein about 2 feet in width, and carrying a little galena and zinc-blende. No sample was taken here, but to judge by the eye the values would be low.

No. 2 Vein.—Near the eastern boundary of the *Coronado*, on the west bank of Sloan creek, another vein has been developed to some extent. This vein is also of the replacement type, having been formed in a fractured dyke. An open-cut 15 feet long forms the approach to a 60-foot tunnel driven on the vein, which strikes about N. 60° E. and dips quite steeply to the north-west. The tunnel was commenced on a seam showing some nice galena, but after a short distance this stringer apparently goes into the foot-wall, and another seam is followed to the face. A crosscut to the north-west 12 feet long has been made at the face, but did not find anything; if the crosscut had been made in the opposite direction it might have picked up the seam on which the tunnel was started, and which lies in the foot-wall. A few tons of ore has been taken out of this working which will assay about 0.40 oz. gold, 57.2 oz. silver, 30.2 per cent. lead, and 18 per cent. zinc.

A shaft has also been sunk on this vein to a depth of 15 feet, which shows ore up to 18 inches in width for 10 feet down from the top. Below this the shaft was filled with water, so that it was impossible to see what the vein looked like there. A few surface cuts also show the vein in different places, one of these showing 6 inches of galena and most of the others just disseminated mineral.

It will be of some advantage to consider the assays of the different samples taken from this property, and for this purpose they are now tabulated as follows:—

No.	Description.	Gold.	Silver.	Lead.	Zinc.
		Oz.	Oz.	Per Cent.	Per Cent.
1	No. 1 tunnel, sample across 10 inches	0.45	129.4	38.1	14.4
2	No. 2 tunnel, average vein at face	0.30	16.5	4.8	45.3
3	Open-cut, vein 10 inches wide	0.76	4.9	0.8	19.2
4	First-class ore-dump, No. 2 tunnel	0.24	51.4	27.0	21.6
5	Ore-dump, No. 1 tunnel	0.20	46.0	23.5	15.4
6	Second-class ore-dump, No. 2 tunnel	0.20	6.0	2.2	16.5

From a comparison of these results it will be seen that the silver content is dependent on the lead content, varying from about 2 to 3.4 oz. of silver to the unit of lead. By comparing Nos. 1 and 2, and 5 and 6, it can be seen that the silver is in no way related to and is evidently not contained in the zinc. Turning to the gold content, it is not so evident what relationship, if any, exists between it and the other metals. The gold does not vary proportionately with the silver, lead, nor zinc, and, in fact, seems to be quite independent of these. The writer believes, though, that the gold occurs in association with the arsenopyrite which is found in the ore. To some extent this is proven by No. 3 sample, which consisted almost entirely of arsenopyrite, zinc-blende, and a siliceous gangue; it will be noted that this sample contained a good deal more gold than the others, and, as it also contained a higher percentage of arsenopyrite it is reasonable to assume that the gold is carried in this mineral. As a rule, this arsenical iron has been considered as of only slight value in this district, but it is quite possible that in many instances it carries good gold values, and that in rejecting it from samples, as is generally done, the prospector is unintentionally throwing away the best of the ore.

By proper hand-sorting this ore could be made into a product assaying from 100 to 150 oz. silver and from 40 to 60 per cent. lead, and this will probably be done before much of it is shipped.

White Swan Group.

This property lies to the east of the *Coronado*, and is owned by Mark Hannah and Geo. Carlton. It is developed by a tunnel, shaft, and some open-cuts. The shaft, which is 15 feet or more in depth, has been sunk in reddish oxidized material which, on the dump, does not appear to carry much mineral. This working was not in shape to permit of examining it. A little farther down the hill a number of open-cuts disclose a few narrow stringers of mineral, probably developed along the walls of, or in close proximity to, different dykes. In one place a stringer of galena 3 inches wide was noticed, but in most of the others arsenical iron and zinc-blende are the predominating minerals.

Still farther down the hill a tunnel 90 feet long with a 20-foot approach cut has been driven in under the upper workings. This tunnel follows along a very clean-cut wall for most of its distance, but does not show any mineral.

Henderson Frac.

This claim lies to the east of the *White Swan*, and is owned by Boyd, Henderson, and others. A number of small stringers of galena and blende have been shown up by open-cuts, but with the present development the property is unproven.

Humming Bird.

This property lies up the hill above the last-mentioned claim, and is owned by Mark Hannah, Geo. Holbrook, and Geo. Charlton. Development-work consists of several open-cuts, in one of which a fairly well-defined vein is disclosed; in the face of the cut there is 10 to 12 inches of ore carrying sulphides of iron, zinc, and lead. A sample of this material assayed: Gold, 0.36 oz.; silver, 16.6 oz.; lead, 12.1 per cent.; zinc, 21.1 per cent.

A short distance away another, probably parallel, vein is exposed by some small cuts, most of which are caved in; it strikes N. 53° E. and dips to the south-east at 65 degrees. Mineralization is with iron and zinc sulphides, the greatest width being 12 inches. An average sample of a few tons of ore saved from one cut assayed: Gold, 0.02 oz.; silver, 15.6 oz. Both these veins are simply mineralizations along the walls of dykes.

Newcastle and Dominion.

These claims are located on the east bank of Sloan creek near its head, and are owned by C. Hastings. The vein on this property is a mineralization along the walls of, and partly in the body of, a dyke which cuts the usual brecciated volcanic rocks in a general north-east direction. The chief minerals are zinc-blende, arsenopyrite, and pyrite, with subordinate amounts of galena and chalcopyrite, occurring in a gangue of silicified and altered dyke rock and some quartz. The development-work consists of a shallow shaft (full of water at time of examination) and several open-cuts and trenches exposing the vein up the side of the mountain. One cut which is 40 feet long and has a 10-foot face shows a width of 4 feet of mineralized material; an average sample of which assayed: Gold, 0.17 oz.; silver, 2.7 oz.; zinc, 3.8 per cent. The vein is exposed for some distance by surface trenching, but nowhere contains much galena.

Myrtle.

This claim is situated some distance up the mountain at an elevation of 5,500 feet, well above timber-line. It is owned by J. Aldrich. The lowest showing is an open-cut 25 feet long, with a 10-foot face, which shows a very well-defined wall with slight mineralization in a fracture-seam along it. In the centre of the cut there is another stringer a few inches wide; both of these carry arsenical iron and a little zinc. A sample of the first one assayed: Gold, 0.30 oz.; silver, 2.3 oz.; and the latter—gold, 0.20 oz.; silver, 3.2 oz.

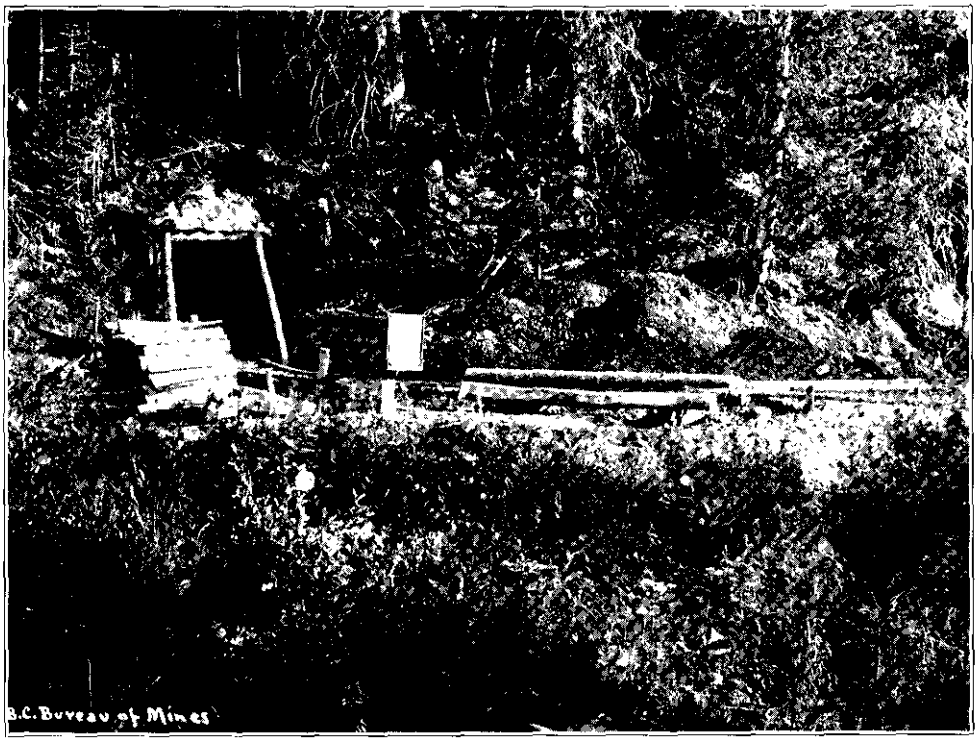
Continuing on up the hill, several more cuts have been made which show a little mineral, but, with the present development, none of them is well enough defined to prove its importance. A sample of the best-looking mineral taken from one of the showings assayed: Gold, trace; silver, 5.2 oz.; copper, 1.7 per cent.

Iron King.

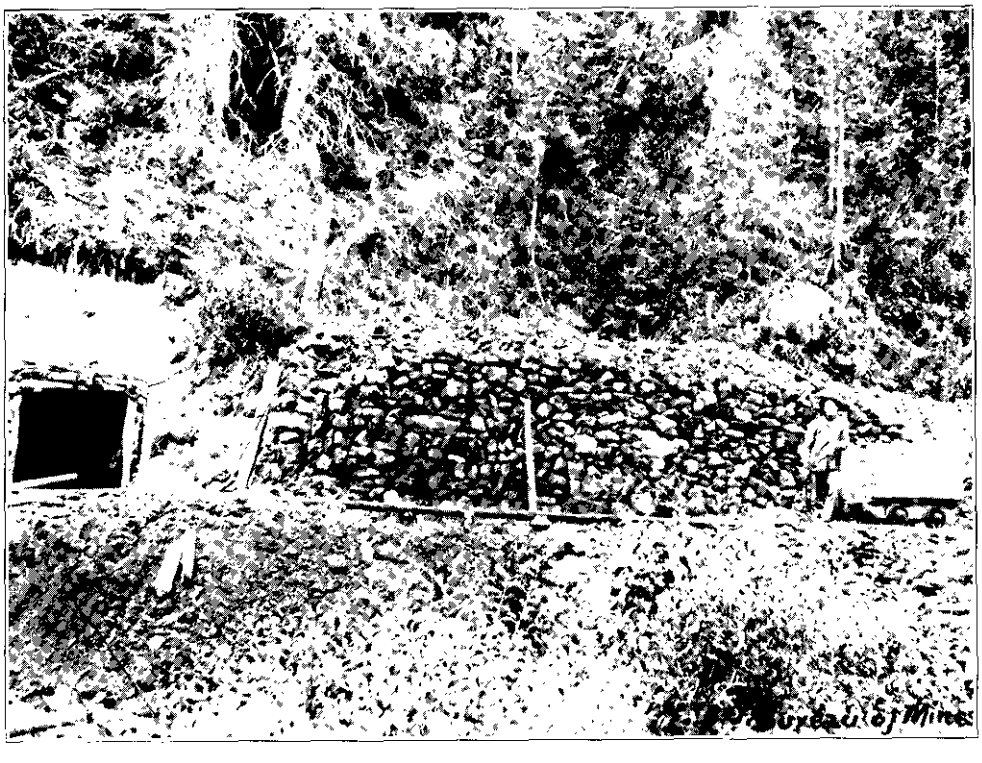
This claim lies up the hill from the *Myrtle*, and is also owned by J. Aldrich. No defined vein can be seen, but in places along fracture-lines some mineralization has taken place. One open-cut shows stringers carrying arsenopyrite, zinc-blende, and chalcopyrite scattered across a width of 8 to 10 feet; the general strike of these stringers is N. 54° E., with a south-easterly dip. A sample taken across 3 feet of the best-looking material assayed: Gold, trace; silver, 3.6 oz.; copper, 0.8 per cent.; zinc, 15.8 per cent.

Victory Group.

This property lies to the west of the *Coronado* group and consists of the *Victory*, *Standard*, and *Triumph* claims and is owned by Donald C. Simpson, who staked it some ten years ago, and since then has, single-handed, done a considerable amount of development-work. The three claims are staked up and down the



Crosscut Tunnel, No. 1 Seam—Coal Creek—Omineca M.D.



Tunnel, No. 2 Seam—Coal Creek—Omineca M.D.

hill, or roughly in a north-and-south direction. The *Victory* is the central claim and on this the greater part of the work has been done. Several veins have been found on the property, but as yet only the No. 1 vein has been developed to any great extent. These veins are all developed in sheared zones, and are probably connected more or less directly with intrusive dykes; as a rule, the mineralization has been by means of replacement, accompanied by silicification of the wall-rock.

No. 1 Vein.—This vein has a strike of N. 62° E. and dips to the south-east at 80 degrees. It runs roughly up and down the hill, and is therefore well situated for the driving of drift-tunnels along the course of the vein. The lowest, or No. 1, tunnel has a length, including the approach, of 90 feet. This working shows a good shoot of ore from the portal of the tunnel inwards for about 25 feet; the width of the vein in this section being from 1 to 2 feet. Beyond this the vein is split up and seems to go into both walls, while at the face there is some mineralization, with iron sulphides, but no ore. From this tunnel about 10 tons of sorted ore has been taken out; a sample intended to represent an average of this assayed: Gold, 0.18 oz.; silver, 78.1 oz.; lead, 52.8 per cent.; zinc, 11.3 per cent. The whole shoot of ore exposed in the beginning of the tunnel would not assay quite as well as this sample, as the latter was taken from sorted ore.

Above the tunnel the vein has been stripped on the surface for some distance, where it can be seen that the mineralization is spotted and irregular. At a point which would only be a short distance beyond the face of the tunnel, but on the surface, there is another shoot of ore from 15 to 20 feet long and from 12 to 15 inches wide. A sample taken across 14 inches here assayed: Gold, 0.13 oz.; silver, 33.7 oz.; copper, 1.5 per cent.; lead, 23.6 per cent.; zinc, 36.6 per cent.

A short distance above is the No. 2 tunnel, which is 10 feet long. The face shows several seams of mineral scattered across a width of 4 to 5 feet. A sample was chipped out across 4 feet 6 inches which returned on assay: Gold, 0.30 oz.; silver, 16.3 oz.; lead, 9 per cent.; zinc, 12.4 per cent. Above No. 2 tunnel there are a series of open-cuts extending up the hill to the No. 3 tunnel which disclose irregular mineralization along the vein.

No. 3 tunnel has an approach of 15 feet and only a few feet of actual tunnel under cover. At this place there are narrow stringers of mineral disseminated across 7 to 8 feet. A sample taken across 6 feet at this place assayed: Gold, 0.10 oz.; silver, 2.5 oz.; lead, 1.6 per cent.; zinc, 5.3 per cent. The dump from this tunnel seems to be fairly well mineralized and would probably average slightly better than the above sample.

No. 4 tunnel has a long open-cut approach, but is hardly under cover as yet. This working shows more solid ore than in the Nos. 2 and 3 tunnels. At one section, 5 feet from the face, there are two parallel streaks of ore 12 and 8 inches wide respectively, separated by a strip of waste. A sample of this ore assayed: Gold, 0.44 oz.; silver, 15.4 oz.; lead, 12.6 per cent.; zinc, 13.8 per cent. A few tons of good-looking ore has been saved from this working, while the waste-dump contains a fair percentage of mineral. Open-cuts and stripping between tunnels Nos. 3 and 4 also show a fair amount of mineralization. Above No. 4 there is one more exposure of the vein, but it is unimportant. From No. 1 tunnel to this uppermost cut is about 1,500 feet, and it may be said, therefore, that the continuity of the vein is proven for this distance.

No. 2 vein lies about 300 feet east of No. 1 and is roughly parallel; this is really a dyke about 1 foot wide, altered to some extent by iron- and silica-bearing solutions; no ore is visible in this vein and no work of importance has been done on it.

No. 3 vein lies 50 feet to the east of the No. 2 vein. An open-cut 24 feet long, with a 12-foot face, shows a small fissure from 6 to 12 inches wide which has a core of 3 inches of galena and on either side red oxidized materal. A sample across 10 inches, including the 3 inches of galena, assayed: Gold, 0.16 oz.; silver, 53.9 oz.; lead, 33.2 per cent.; zinc, 4.3 per cent.

Two or three other veins or slightly mineralized dykes are known, but as yet they have not been developed to any extent; one of these, containing only arsenical iron, is said by the owner to carry fair gold values.

North-eastern Slope of Hudson Bay Mountain.

A number of claims are staked on the north-easterly slope of Hudson Bay mountain, which are reached by trail from Kathlyn lake. One property was bonded in 1913 by a London company, and developed for a time under the superintendency of A. H. Bromly. The writer intended visiting this property, but by the time he reached Telkwa it was found that the company had thrown up the bond, stopped work, and that Mr. Bromly had left the country. As it was getting late in the season and it was desired to get on into the Cariboo Mining Division, the writer therefore did not visit this section at all.

The ore on this property is said to be somewhat low grade and would require concentrating before it could be handled, and, further, that it is high in zinc, which is a disadvantage. It is believed that the throwing up of the bond by the London company was largely due to the outbreak of the European war, and that the property cannot yet be said to have been thoroughly tested.

From other claims in this section specimens of bornite are reported to carry very high values in silver, but very little development work has been done on them.

Hunter Basin.

Hunter basin is at the head of Cabin creek, a tributary of Goat creek, and at a distance of fourteen miles from Telkwa, to which place it is connected by a good trail. It is the usual characteristic basin, encircled with mountains on all sides, excepting the outlet for the creek, of which it forms the head. The elevation of the basin is 4,800 feet, while the mountains around rise to about 7,000 feet. Timber-line is at about the level of the basin, and as the claims are all up the mountain-sides it is unfortunately necessary to pack all timbers required in mining for some distance. William Hunter is the pioneer prospector of the camp, having first staked claims in 1905, but a number of other prospectors have also taken up property.

In general it may be said that the rock formation consists dominantly of altered volcanic rocks showing incipient bedded structures and having intercalated sedimentary bands. These rocks are intruded by dykes and apophyses from a body of granite porphyry which lies two miles to the south. These dykes have shattered and fissured the rocks, and thereby provided channels by means of which the mineral-bearing solutions were able to attack and replace the shattered zones of rocks with metallic sulphides. The veins are generally of the replacement sheared-zone type, but in some places mineralization has taken place on the walls or in the bodies of the dykes themselves. It is probable in these latter instances that movement has taken place along the dyke after its injection, due to its being a line of weakness, thus crushing the dyke rock and making it permeable to infiltrating solutions.

Copper minerals predominate, occurring in the form of bornite, chalcopyrite, chalcocite, and tetrahedrite. The bornite and tetrahedrite generally carry good values in silver, but gold values are almost absent. Galena, pyrite, and pyrrhotite are found, but are not as common as the copper minerals.

William Hunter's property is mostly situated on the eastern side of the basin, and he has a good camp cabin down in the basin.

Idaho. This claim, owned by William Hunter, lies up the hill to the east from the camp, the workings being at an elevation of 5,325 feet. In one place a prospect-hole has been put down 8 feet, which shows that 3 to 4 feet of the bottom is sparingly mineralized with bornite and chalcopyrite. The rock is an amygdaloidal andesite and the mineralization is not very pronounced. To the south is a small vein which strikes N. 55° E. and has a slight dip to the south-east; this vein is developed by a shaft 18 feet deep, in which the vein is seen to be 1 foot wide, with a pay-streak of bornite ore on the hanging-wall from 1 to 4 inches wide.

Mohock. The *Mohock*, adjoining the *Idaho* to the west and extending farther up the hill, is another of Wm. Hunter's claims. The ore on this property occurs in a dyke of reddish brecciated volcanic rock lying between highly chloritized greenish andesites. The mineralization consists of thin streaks of bornite and chalcopyrite disseminated across a width of 4 to 5 feet. The only work so far done is a few shallow open-cuts, which show the apparent strike of the ore-body to be S. 85° E., with a vertical dip.

From one open-cut a sample was taken across the dyke where it is 3 feet 6 inches wide, and this assayed 5.4 per cent. copper, 0.08 oz. gold, and 20.6 oz. silver. With the very slight amount of work done on the property, all that can be said is that it is an encouraging surface showing and warrants further development.

Rainbow. The *Rainbow* adjoins the *Mohock* on the west, and has more work done on it than either the preceding claims. The vein in this instance is a shattered zone, occurring in a porphyritic lava rock which, in composition, is somewhat of a diabase. This shattered area, which in places is up to 20 feet wide, has to some extent been mineralized with chalcopyrite, bornite, and some specular iron, which occur in a very irregular manner in bunches and lenses. As much as 2 feet of nearly solid copper ore is visible in some places.

A number of open-cuts and trenches have been made, all of which disclose more or less mineralization, and also a shaft 10 feet deep. In this latter working there are two streaks of ore from 1 to 2 feet wide separated by a 4-foot strip of waste. An average sample of about 6 tons of ore taken from this shaft and lying on the dump assayed: Gold, 0.06 oz.; silver, 5 oz.; copper, 2.9 per cent.

North of the shaft a large open-cut has been made, together with stripping and underhand stoping. The stoping was done in order to take out the ore from a small seam a few inches wide which is said to be very rich copper-silver ore. A considerable amount of specular iron, together with a little copper, is disseminated through the rock exposed in these workings.

King and Jackpot. The *King* and *Jackpot* claims adjoin the *Rainbow*, up the hill, to the south, and are also owned by William Hunter. The vein on the *King* claim is an irregular fissure situated in a line of crushing and not far from an intrusive dyke. It varies from 6 inches to 2 feet in width, and strikes N. 65° E. and dips very slightly to the south-east. Bornite and chalcopyrite and a little tetrahedrite are irregularly distributed throughout the siliceous gangue of the fissure; the solid ore carries high values in copper and silver.

The main working is a shaft about 20 feet deep and from which, in both directions along the vein, ore has been stoped from the surface downwards. This opening was full of water, but there is said to be a width of 10 inches of solid ore in the bottom. The larger part of a

30-ton shipment made by Mr. Hunter from his properties in this camp came from this claim. This ore was packed down to Telkwa in August of 1914, but so far as is known has not yet been shipped to any smelter, the owner preferring to hold it for better terms and metal rates. This shipment is all carefully selected high-grade ore, principally bornite and chalcopyrite, with a little grey-copper, and, in addition to good copper values, is expected to carry a high silver content.

Four hundred feet east of the shaft an open-cut has been made on what is supposed to be the same vein. This working shows a vein or dyke 4 feet wide with a few small stringers of ore in it. A sample across the 4 feet assayed: Gold, 0.03 oz.; silver, 4.8 oz.; copper 2 per cent.

The strike of this vein is N. 87° E., so that, if it is a continuation of the vein in the shaft, it has been twisted around a good deal. Six hundred feet west of the shaft what is probably the shaft vein crops out on a high rocky pinnacle at an elevation of 5,925 feet. Several open-cuts have been made which disclose mineralization in places. Farther west the same vein is traced down the other side of the bluff, and here a large cut has been made which is called the "West showing." The vein here is from 2 to 3 feet wide and carries a considerable amount of mineral. A sample across 18 inches assayed: Gold, 0.14 oz.; silver, 26.9 oz.; copper, 14.6 per cent. A sample of bornite mixed with magnetite from this working assayed: Gold, 0.20 oz.; silver, 25.8 oz.; copper, 29 per cent.; while a sample of solid clean chalcopyrite showed the following values: Gold, 0.08 oz.; silver, 87.2 oz.; copper, 32.8 per cent.

Mr. Hunter is now engaged in running a short crosscut tunnel to tap the vein at a point somewhat below the bottom of the present shaft. This will provide drainage for the workings, which has handicapped the operations so far.

Farther up the hill from the *Mohock* there are some claims owned by A. Carr; on one of these a tunnel driven in 60 feet shows quartz stringers, but with very little ore in evidence. Open-cuts show decomposed leached-out material, with here and there some copper-stain, but as yet nothing very definite has been shown up.

North-west Side of Hunter Basin.

The north-west side of Hunter basin is covered with a number of locations, the *Colorado* having the most work done on it; this property is owned by the Colorado Exploration Company.

Colorado.

The vein on the *Colorado* is a silica-filled fissure varying from 12 to 24 inches in width between walls of light-coloured volcanic rock approaching a rhyolite in appearance. The fissure is well defined with good walls, and a considerable amount of talcose-gouge matter has been developed along the fissure. The wall-rock adjacent to the vein is considerably decomposed, and small fault-planes of a few inches and numerous seams are filled with talcose-gouge. The vein is mineralized mainly with grey-copper, which occurs disseminated throughout, more particularly on the foot-wall side. The chief values are in silver carried in the grey-copper, together with the copper values. The development-work consists of two adit tunnels only a short distance apart, both being driven on the vein, which strikes N. 22° E. and dips to the north-west at about 75 degrees. The upper tunnel has been driven in for a distance of 150 feet, but is not now being worked. The property is now under lease to Charles Seeber and partners, who have driven in the lower tunnel a distance of 150 feet, raised to the other tunnel 50 feet, and stoped out ore in places. The leasers shipped about 50 tons of ore from the property during the summer. When the property was visited in September, five men were at work and the tunnel was being driven ahead steadily.

While this vein appears to be, and has been, described by other writers as a true quartz vein, the writer is of the opinion that it is an extremely acid phase of a felsite dyke cutting the older volcanic rock. This dyke has evidently afforded a channel for unusual amounts of mineralizing solutions, as is shown by the extensive development of gouge material. These solutions have completed the silicification of the body of the dyke, as well as depositing the valuable minerals.

A sample of the dump, which is the run of the vein without sorting, assayed: Gold, 0.02 oz.; silver, 69.2 oz.; copper, 6.5 per cent. Another sample of picked high-grade ore returned: Gold, 0.02 oz.; silver, 298 oz.; copper, 25.5 per cent. This vein carries very nice values wherever mineralized, but as is usually the case in this section, the mineralization is somewhat irregular, there being stretches of barren gangue-matter. The leasers claimed to be doing quite well on their lease and intended to keep at work all winter. The ore is packed out to Telkwa and then shipped to either Tacoma or Trail.

Tribune. This property is situated to the north-east of the *Colorado*, and is owned by Chester Thoman and Joe Cochrane. An open-cut and 6-foot shaft show up a quartz vein 12 to 14 inches wide carrying copper and silver minerals. It has a strike of N. 32° W. and dips to the south-west at 70 degrees. A sample across 12 inches at the face assayed: Gold, trace; silver, 29 oz.; copper, 1.8 per cent. Farther down the hill and to the north a crosscut tunnel 115 feet long has been driven. From a point 40 feet in, a crosscut has been driven 20 feet at right angles to the main tunnel, where a small stringer was encountered, but not of sufficient size to be important. The owners intend to drive ahead the main tunnel, but are not at present working on the property.

Hunter. This claim adjoins the *Tribune* to the north, and is owned by William Hunter. The vein on the claim is a small stringer 6 to 8 inches wide carrying grey-copper, galena, and specular iron. It is developed by means of open-cuts and a tunnel 15 feet long. North-east of this there occurs what might be called a bedded vein, which is exposed along the contour of the hill for a distance of a 100 yards or more. This is really a mineral impregnation along one thin bed of volcanic rock which lies somewhat flat. The mineralizing solutions probably came up some fissure or dyke until meeting this particular layer of rock, and then replaced it with mineral. A number of open-cuts have been made which show an ore-streak varying in width from 6 inches to 3 feet. A dump of about 25 tons of this ore taken from cuts and piled in one place was sampled, and gave the following returns: Gold, 0.02 oz.; silver, 73.6 oz.; copper, 1.2 per cent.

Western Group. These claims lie to the north-west of the *Colorado* and up on top of the mountain at an elevation of about 6,000 feet. The mountain on this side of the Hunter basin is flat-topped and level, and although well above timber-line there is good feed for horses. There are two claims in this group, the *Grace* and *Foundation*, and they are owned by Chas. Seeber and James Fleming. Fleming was at work on the property when visited, and he was engaged in sinking an incline, which was then down 20 feet. There had been a small showing of ore on the surface which was blown out in the first few shots, and now the face only showed a 3-inch talc-seam with some decomposed rock on either side, which apparently was a diabase, and did not look very encouraging.

Several open-cuts show "veins" of decomposed matter which are apparently dykes that have been slightly mineralized and considerably leached out on the surface. One of these dykes has been developed by a shaft 20 feet deep, which shows 12 inches of talcy matter at the bottom. Practically no ore is visible now, but a little was obtained near the surface.

NORTH SIDE OF HUNTER MOUNTAIN.

On the north end of Hunter mountain several claims have been taken up and three prospectors were found at work. This section is on the west side of the mountain that lies on the west side of Hunter basin, and is on the slope into Glacier creek.

Hannah Group. This group, consisting of the *H. & O.* and *W. J.* claims, was located two years ago by Mark Hannah and James Oberholtzer, who at the time of visiting the property were at work on the *H. & O.* Considerably more than the usual annual assessment-work has been done on this property. The rock formation is entirely volcanic, consisting of alternating and semi-bedded flows of rhyolite, andesite, diabase, and porphyrites. Cutting this volcanic formation there is a scattered zone of considerable width, striking N. 10° E. to N. 30° W. Throughout this zone there are numerous veinlets of quartz only a few inches wide and separated from one another generally by a distance of several feet. While a number of these stringers may consist of true quartz, there are some of them that have a considerable intergrowth of feldspar, thus forming a pegmatite or felsite, and therefore some at least, and possibly all, of these veinlets are in reality igneous dykes intrusive into the volcanics.

Some of the stringers show a little copper-stain and grey-copper, but the total amount of mineral is not sufficient to be of much importance. On the *H. & O.* claim a tunnel is being run to crosscut some of the stringers below the surface. At the time of visiting the property this tunnel was in 65 feet and the owners were at work on it. A stringer had just been cut which showed a width of about 6 inches of white glassy quartz with intergrown feldspar. Mineralization was very slight and so no sample was taken.

The discovery on the *W. J.* claim is a yellowish decomposed zone about 4 feet wide containing a few seams filled with glassy-looking quartz. The only evidence of mineral was a slight amount of copper-stain. No work had been done on the showing, except a little surface picking.

Gipsy Queen and Blue Grouse. These claims adjoin the *Hannah* property, and are owned by Paddy Quinn and partner. The outcropping on the surface of this property is a vein or dyke of decomposed talcy material carrying considerable quartz and showing a little copper-stain. A tunnel has been driven in 30 feet, but is off to one side of the vein, in the wall, and at the face is in rock which appears to be a porphyritic andesite and shows no sign of mineral. A sample of the best-looking mineral from the outcrop only assayed: Gold, trace; silver, 1.2 oz.; copper, *nil.* Another tunnel which is in 20 feet shows diabase rock at the face carrying some iron sulphides, but no ore nor any evidences of a vein.

Some open-cuts and shallow pits have been made above this tunnel which disclose a vein or veins of yellowish, decomposed, and leached-out material from 4 to 6 feet in width. These veins are probably acid dykes considerably altered on the surface by percolating waters. A few specks of bornite and some copper-stain are visible, but not sufficient to constitute ore.

SUNSET CREEK SECTION.

While in camp at Hunter basin some specimens of ore showing native silver were brought in by Joe Cochrane from the *Highgrade* claim on Sunset creek, and so it was decided to make a trip to see the property. Sunset creek is distant six miles south by west from Hunter basin, and is reached by a very rough trail which is simply a track up and down over mountain ridges. Leaving Seeber's camp, the trail rises to a height of 5,900 feet on the divide at the head of Hunter basin, crosses a small glacier, goes level for a mile, then drops into the valley of Glacier creek 4,800 feet, then rises to 5,200 feet, then drops to 4,225 feet in the valley of

Sunset creek, then goes up the creek to Cochrane's camp at 4,800 feet, and then on to the claim at an elevation of 5,400 feet. The ridge on which this claim is located is the divide between the Telkwa and Morice rivers, while Howson Lake basin lies five miles to the south.

Highgrade.

Many locations have been made in this vicinity in years past, but the only property visited by the writer was the *Highgrade*, as it is the only one on which any work had been done lately. The writer rode over from Hunter basin with Mr. Fleming as guide, examined the property, and back again the same day. No time was available for examining any other claim during that day, and the camp was not sufficiently important to warrant moving camp from Hunter basin and spending several days.

The *Highgrade* claim was staked about two years ago, and is owned by Joe Cochrane and Chas. Seeber. The showing consists of a small quartz vein cutting into the mountain with a strike of about N. 35° E. and dipping to the south-east at about 60 degrees. It is exposed naturally on the face of a steep bluff on the rocky mountain-side, and here, at an elevation of 5,400 feet, a tunnel has been run in on the vein for 15 feet. The vein is from 4 to 12 inches wide and is mineralized in places with grey-copper. The gangue is mainly quartz, but there is also a little calcite. Some specimens of the ore show native silver, and it was expected, therefore, that the grey-copper would carry high silver values, but unfortunately the assays made do not show this to be the case. The rock formation in which the vein occurs is of volcanic origin and is mainly diabase. The vein is traceable on the surface for a few hundred feet, but is in places badly stringered up. Excepting the tunnel, practically no work has been done besides a little surface scratching in places and small open-cuts.

From the tunnel about 5 tons of ore has been extracted and piled up; an average sample of this assayed: Gold, 0.03 oz; silver, 27.6 oz.; copper, 18.8 per cent.

From a point 10 feet in the tunnel a sample across 4 inches of supposedly high-grade ore only returned: Gold, 0.02 oz.; silver, 13.6 oz.; copper, 8.5 per cent. Another sample taken at the face gave: Gold. 0.02 oz.; silver, 7.8 oz.; copper, 3.5 per cent.

Above the tunnel an outcrop of the vein shows a width of from 18 inches to 2 feet, and a sample was taken here across 12 inches. This assayed: Gold, trace; silver, 0.9 oz.; copper, 0.8 per cent.

The writer is rather surprised at the low silver results of these assays, as the ore looked very promising. However, the inaccessibility of the property is such that it cannot be considered of any present value, unless with ore of a very much higher grade than shown by these assays.

HANKIN BASIN.

Hankin basin lies at the head of Goat creek, and is reached by a trail which leaves the Hunter Basin-Telkwa trail at Goat Creek crossing. A number of claims have been staked and held here for many years by Loring, Forrest, and the Hankin Brothers. When the camp was visited by the writer, Tom Forrest was at work doing annual assessment-work. He has a cabin near the head of the basin and good feed for the horses is abundant, so that the place is suited for camping. The writer arrived there in a pouring rain-storm, and the dry cabin and hospitality of Mr. Forrest made a very agreeable impression on his mind.

This basin is not so well defined as many others, but is more of a long narrow valley with, towards the upper end, a very steep gradient. The cabin is in the creek-bottom a short distance below timber-line, with the claims staked along both sides of the mountains fringing the creek, and others right at the head of the basin A fair amount of prospecting has been done, consisting of tunnels and open-cuts, but as yet the actual development cannot be considered as very material.

The country-rock consists of typical beds of volcanics, agglomerates, tuffs, etc., belonging to the Hazelton group, which lie nearly horizontal and are well exposed on both sides of the valley. These rocks are cut by a series of quartz-prophyry dykes which are roughly parallel, and strike in a N. 25° E. direction and dip to the south-east at from 50 to 70 degrees. This direction is nearly at right angles across the valley.

The ore-bodies are developed along the bedding-planes of the volcanics and associated rocks, and generally show decided enrichment near the contacts with the dykes. The mineral-bearing solutions have apparently found a channel along and upwards by means of the dykes, and have then followed along the bedding-planes of the volcanic rocks, attacking and dissolving the more readily soluble ones and replacing them to some extent with metallic sulphides and silica. The dykes are from 1 foot upwards in thickness, and have a very pronounced cleavage in a direction parallel to the strike. These cleavage-planes are from ½ to 1 inch wide and are very strongly marked.

The ore-minerals found are iron pyrites, chalcopyrite, pyrrhotite, and magnetite, occurring in a gangue of altered country-rock, epidote, quartz, etc.; yellow crusts of epidote are common on the face of bluffs. Very little quartz is seen, but silicification of the country-rock is quite common.

Loring Group. This group consists of four claims—the *Stirling*, *Big Blue*, *Yellowhead*, and *Yellowhammer*—and is owned by Tom Forrest and E. Louis Loring. The claims are staked at the head of the basin and cover ground on both sides of the creek. The showing on the *Stirling* is a mineralized zone varying in width from 5 to 10 feet and developed by open-cuts. In one place where this ore-body is exposed on the face of a bluff there is copper-stain across a width of 25 feet. The chalcopyrite is disseminated in an irregular manner and there is not much solid ore. A sample taken across 6 feet, which would give a fair average of the general run of the ore, assayed: Gold, trace; silver, 1.2 oz.; copper, 1 per cent.

This zone or bed of ore can be traced for a short distance into a rock-slide, and what is supposed to be a continuation of it is found about 1,000 feet away on the other side of the creek, on the *Big Blue* claim. Two small open-cuts show the rock to be mineralized with iron and copper sulphides, while one band 2 or 3 feet wide would, to judge by the eye, run about 5 per cent. copper. One of these cuts is intended to be a tunnel, but was only so far faced up and was hardly under cover. A sample of the dump from this place which gives an idea of the grade of the ore across, perhaps, 10 feet, without sorting of any kind, assayed: Gold, trace; silver, 1.8 oz.; copper, 1 per cent.

On the *Yellowhammer* claim there is a tunnel 13 feet long and several open-cuts, but the showing here is not as good as those previously described, as there is not much mineralization. This band has no connection with that found on the other claims.

On the *Adelaide* claim there are two tunnels—one 15 and the other 40 feet long—which show a flat bed of volcanic rock very sparingly mineralized. The best showing is in a cut about 200 feet south-east of the short tunnel, where the thickness of the bed is about 4 feet. An average sample of the dump from this cut assayed: Gold, trace, silver, 0.9 oz.; copper 1.8 per cent.

Forest Group. There are six claims in this group—the *Camosun*, *Lion*, and *Orient* staked in a line along the east side of the creek, with the ground going across the creek and partly up the mountain-side, and the *Telkwa*, *Daisy*, and *Discovery*, paralleling the former three farther up the mountain to the east. The principal owner is Tom Forrest, and his cabin is situated on the *Camosun* claim at an elevation of 3,600 feet.

On the *Lion* claim, at an elevation of 4,000 feet, there is a tunnel 10 feet long, which is driven in on a flat-lying ore-body which has a thickness of 5 to 8 feet and carries the usual small quantity of chalcopyrite. One hundred feet south of this tunnel one of the quartz-porphyry dykes cuts across the formation, and at this point some mineralization is apparent along the walls of the dyke.

Southerly from here, a number of cuts have been made which all show a little mineralization. These different cuts are not supposed to be on the same mineralized band of rock, but may be on parallel ones up and down the mountain-side. Proceeding to the south, the *Telkwa* claim is reached, and on this a porphyry dyke 3 to 4 feet wide is seen. Considerable mineralization is evident here in parallel bands of volcanic rock 6 to 8 feet wide, cut by the dyke. A tunnel 30 feet long and two large open-cuts show the mineral to be fairly continuous. An average sample from a large dump here assayed: Gold, 0.03 oz.; silver, 1.3 oz.; copper, 2.8 per cent.

The owners of property in this camp claim that many assays have shown appreciable gold values in the ore, and while the few samples taken by the writer did not, it is quite possible that gold values occur here and there, through the mineral zones. The copper and silver values are very low, unless large tonnages of ore were shown up, and as yet the development-work is insufficient to form any idea of tonnage. It would require extensive sampling to determine whether or not there are any streaks of high-grade copper ore of sufficient size to pay to work, or if the chalcopyrite is only disseminated throughout in small particles. But, with the extensive mineralization that is evident, the camp is worthy of further investigation.

SOUTH-EAST SIDE OF HUDSON BAY MOUNTAIN.

On the face of Hudson Bay mountain opposite the town of Smithers, a number of claims have been staked, and intermittent assessment-work has been carried on for years. The most important of these—the *Empire* group—was visited by the writer. This group is at the head of Simpson creek, distant a few miles by trail from either Smithers or Kathlyn Lake post-office. It is owned by Simpson Brothers, one of whom, with another man, was at work on the property when the writer visited it in September.

The group consists of the *Excelsior*, *Empress*, *Empire*, *Imperial*, and *Emperor* claims, staked on both sides of the basin at the head of Simpson creek. The owners have built a cabin down in the basin at an elevation of 4,500 feet, which is just at timber-line. Development-work by means of open-cuts has been done on several of the claims, but the main showing is on the *Imperial*, where a tunnel and shaft have been driven.

Geologically, conditions are very similar to the south-west side of the mountain; the rock formation is again the volcanics of the Hazelton series, intruded by dykes from the central quartz-porphyry core of the mountain.

On the *Empress* claim a flat-lying bed of andesitic rock is slightly impregnated with galena, zinc-blende, and iron sulphides, but the mineralization is too slight to make this showing of much importance. Development consists of small open-cuts. One hundred feet north of this a small vein or dyke about 6 inches wide and carrying arsenical iron was observed.

On the *Empire* claim a large open-cut shows what is probably a felsitic dyke from 4 to 6 inches wide mineralized sparingly with arsenical iron, galena, and zinc-blende.

On the *Imperial* claim there is a small vein or highly siliceous dyke striking north and south and dipping slightly to the west, which is well exposed running up and down the face of a high bluff.

Near the top of the bluff a tunnel has been driven in 20 feet, a shaft sunk at the portal of the tunnel to a depth of 10 feet, and some stripping and open-cut work done. Throughout

these workings the vein varies in width from a few inches to 1 foot, but comparatively little ore is in evidence, only a few bunches of galena and zinc-blende being seen along the course of the tunnel and none at the face. A specimen of the best-looking ore was selected, which gave on assay the following returns: Gold, 0.06 oz.; silver, 207 oz.; lead, 25.3 per cent.; zinc, 18.6 per cent. A narrow streak of ore is visible in the shaft which would probably assay well. Some 3 tons of ore was shipped from these workings and is said to have returned good values.

The owners are at present engaged in running a tunnel at the foot of the bluff in which the vein is exposed, some 500 feet below the upper workings. This tunnel will be driven on the vein after crosscutting for a few feet, but was not into it when the property was visited; only a start having been so far made.

SAWMILL CAMP.

This camp is practically a new discovery, many of the claims having only been staked during the past summer, and as good reports were prevalent in Telkwa about the claims it was decided to take a trip to see some of them. The camp is situated in the foot-hills on the north-east side of the Bulkley valley, some eighteen miles above Telkwa. The name is derived from the fact that a sawmill was erected a few years ago near the locality, which, however, is not now in operation.

The Bulkley valley in this section from Telkwa up-stream is a fine fertile strip of land, several miles wide and well suited for farming. A good wagon-road runs up the valley on the eastern side of the river, nearly following the old Telegraph route; in places this road is three to four miles away from the river; while the railway runs along the western bank of the river. Many fine farms can be seen from this road; growing hay and stock-raising are the principal types of farming. The claims are reached by short trails branching off the main road, and all are at comparatively low elevations and are easy to reach.

It is in this section that the Babine range begins to fade out into undulating rolling hills instead of the rugged mountain chain which it is farther to the north-west. The hills rising from the west side of the valley at this point are the foot-hills of the Babines, and are more or less open and free from timber. The country back from the valley might be described as mountain pasture land and forms suitable grazing-ground for stock. Looking across the valley to the westward and southerly can be seen the high rugged mountains in which lie the head-waters of the Telkwa and Morice rivers, and in which are situated Hankin, Hunter, Howson, Sunset, Dominion, and other basins; these mountains are part of the Telkwa range, which are in turn a spur of the Coast range.

The writer examined several claims near Barrett's ranch, and another group about two miles nearer Telkwa; these latter claims are the ones which were staked quite recently.

The predominating rocks in the district are argillites, quartzites, and tufaceous or volcanic-ash rocks, all of which are members of the Hazelton series. These are intruded by a porphyritic rock which is characterized by having extremely large phenocrysts of quartz and feldspar; from examination of a hand specimen this rock might be called a granite porphyry. This intrusive rock was noticed in different places, but it is not known whether or not it is continuously exposed over any large area, but it is probable that there are a number of isolated stocks which are, however, larger than dykes. Fine-grained acid dykes also cut the older rocks, and may be offshoots from the main masses of igneous rock. This porphyritic rock is considered to be similar and analogous to the other bodies of igneous rock throughout the Telkwa district which are referred to as the "Bulkley eruptives."

This igneous intrusive rock has been the source of the mineralizing solutions which have deposited mineral in fractures, both in the older rocks and in the eruptives themselves; these fractures were probably also caused by strains set up by the intrusion.

Lone Pine Group.

This group, consisting of the *Venus*, *Centre Star*, *Uranus*, and *Lone Pine*, is located up the hill at a short distance from Barrett's ranch, and is distant about eighteen miles from Telkwa. It is owned by Joseph Bussinger and Chas. Barrett. At an elevation of 2,560 feet a small vein is exposed which strikes north and south and dips to the east at 75 degrees. The gangue of the vein is quartz, with a little galena, iron pyrites, and chalcopyrite scattered throughout. The rock formation here consists mainly of argillite with some volcanic-ash rock.

A shaft 16 feet deep has been sunk on this vein which shows in the bottom about 6 inches of quartz on the hanging-wall, and in addition a number of irregular stringers. From the shaft about 5 tons of ore has been sorted out and piled to one side; an average sample of this assayed: Gold, 0.05 oz.; silver, 86.4 oz.; copper, 3.7 per cent.; lead, 24.7 per cent.

Grafter Group.

This group, consisting of the *Grafter*, *Iron King*, and *Iron Mask*, is owned by the same people as the preceding claims, and was only staked on August 20th, 1914, so that no work has been done. On the *Bluebell* there is a quartz vein 2 feet wide carrying iron pyrites and a little chalcopyrite. From surface appearances it is worthy of a little development-work. The other claims also have small showings of mineralized quartz which is said to assay well. This group adjoins the *Lone Pine* to the south-west.

Up the hill from the *Lone Pine* group there are some claims owned by Fred Clark which have had a little work done on small quartz veins.

Silver King Group.

The *Silver King*, *Motherlode*, and *Maggie* claims, owned by Michael McCormick, are staked above and to the north of the *Bluebell* claim. Development-work consists of open-cuts and a tunnel. The formation here is granite porphyry, which has very large phenocrysts of quartz and feldspar. Quartz veins occur wholly within this porphyry, and it is on one of these that the *Silver King* is located. A tunnel 30 feet long, with a 10-foot approach, shows a quartz vein considerably decomposed and up to 3 feet in width. Iron pyrites in the quartz has been largely oxidized, resulting in a yellowish reddish decomposed mass for the most part, but on the foot-wall at the face there is a 6-inch streak of clear quartz carrying pyrite. A sample taken across 2 feet 6 inches, the full width of the vein at the face, assayed: Gold, trace; silver, 5 oz.

Another quartz vein, or possibly the same one, to the north-west is developed by a prospect-hole 8 feet deep. This lies very flat and strikes N. 10° E., and has a width of from 2 to 4 feet sparingly mineralized with iron pyrites. A few scattered flakes of molybdenite were also noted. An average sample of the dump, which contains 20 to 25 tons of quartz, assayed: Gold, trace; silver, 1 oz.

Bush Group.

A couple of miles nearer Telkwa, but along the same foot-hills, a number of claims with copper-showings were staked during the past year. The most of the claims are owned by Samuel Bush, Louis Schorn, and Joe Bussinger. As the claims were only staked a short time before the writer's visit, little work had been done on them, but Sam Bush has shown considerable energy in the amount of work he has done in such a short time. These claims are easily reached by a trail which leaves the main wagon-road, and are situated on the hill at an elevation of 4,000 to 4,300 feet.

A granite-porphyry intrusive, characterized by extremely large phenocrysts of feldspar, cuts across the older rocks, which consist of volcanic rocks, quartzites, and argillites. Along the contact some mineralization has taken place, but the most important showings of ore are wholly within the argillites. The older rocks have been shattered along a general north-east line, and along the small fractures mineralization has proceeded. These fractures are from

½ to 4 inches wide and are filled with solid chalcopyrite. In places these fractures are 2 and 3 feet apart and parallel across 50 to 100 feet; in other places they are bunched up, so that across 4 to 6 feet the chalcopyrite forms a very considerable proportion of the total rock-matter. The main mineral found is chalcopyrite, but along the contact small amounts of zinc-blende and galena were noticed; these, however, are quite unimportant.

On the *Ruby* claim an open-cut shows about 4 to 5 feet of fairly well-mineralized rock; to judge by the eye, this would carry 6 or 7 per cent. of copper. In addition to the chalcopyrite, a little zinc-blende, pyrrhotite, and galena can be seen.

On the *Copper Crown* there are numerous stringers of chalcopyrite across 50 feet or more, and in some places these are close enough together to make fairly good ore across 2 to 3 feet. A shaft 8 feet deep shows about 5 feet of ore. A sample of the ore dump from this shaft assayed: Gold, trace; silver, 13.6 oz.; copper, 15.8 per cent. This ore-dump represents about half the material taken from the hole. Another open-cut on this claim on the shore of a small lake shows a fair amount of copper ore.

The *Eureka* claim also has a shallow shaft near the shore of the lake which shows some nice copper ore. A sample was taken across 5 feet at the bottom of this shaft, which is 10 feet deep, which assayed: Gold, trace; silver, 4.8 oz.; copper, 6.2 per cent.

The showing on the *Lakeview* lies across the lake from the previously mentioned ones. On the surface here there is a showing of iron-stained rock containing a little zinc and copper. About 20 feet below this and nearly on the level of the lake a tunnel has been started, which is in 20 feet and shows at the face there is 2 feet of ore which is mostly zinc. The whole showing is not as favourable as those previously described.

On another claim some work has been done right on the contact of the porphyry with the older rocks. An open cut 15 x 3 x 5 feet shows irregular fractures mineralized with galena, copper, and zinc, but in very small quantities. A sample taken across a width of 2 feet of the best-looking material only assayed: Gold, trace; silver, 2.8 oz.

TELKWA RIVER.

The writer was unable to personally visit the Telkwa River section, but sent his assistant, D. A. MacKinnon, who went to the claims at Goodwill's camp, about forty miles up the river from Telkwa. Mr. MacKinnon reports as follows:—

"I left September 9th with cook, guide, and pack outfit, and arrived at Andy Goodwill's cabin about 6 p.m. on the following day. The next day I visited the *Helen* group of four claims, owned by Andy Goodwill, Jack Goodwill, and the estate of Joe Thompson.

Helen Group.

"Work has been done on three of the claims, the most westerly one not having any. A large and persistent quartz vein is uncovered and exposed by several open-cuts and trenches. Commencing at its most westerly showing, the vein is seen to strike N. 60° E., with a south-easterly dip, and is traced from this point for about 1,200 feet. Beyond this the vein swings to N. 15° E. for 500 feet, and then is apparently cut off by a fault. The vein is found again 200 feet farther up the hill, where it again has the normal strike of N. 60° E., and is traceable for 150 feet, beyond which it becomes entangled and stringered with a dyke.

"The vein throughout consists of a quartz gangue rather sparingly mineralized and varying from 1 to 25 feet in width. The formation is granodiorite. No attempt was made to sample the vein as a whole, but a number of samples of the more highly mineralized portions, or pay-streaks, in the vein were taken. At a point 300 feet from the westerly end the vein is 4 feet 6 inches wide, with a 20-inch pay-streak in the centre; a sample across this pay-streak assayed: Gold, 0.18 oz.; silver, 0.9 oz.

"Easterly from here the vein varies from 4 to 8 feet in width and is slightly mineralized throughout; in one place it is 25 feet wide, of barren-looking quartz. At the easterly end of the portion striking N. 15° E. there is an open-cut 15 feet long with a 10-foot face. At the bottom of this the vein is 3 feet wide, with a 10-inch pay-streak; a sample across this latter assayed: Gold, 0.18 oz.; silver, 1.3 oz. Farther to the east there is another cut which shows the vein to be 8 feet wide; from this cut about 5 tons of ore is piled on the dump, an average sample of which gave on assay: Gold, 0.32 oz.; silver, 4.4 oz. The elevations of these claims are from about 4,500 to 4,800 feet, which is just above timber-line. The greater part of the assessment-work that has been done on the group has been with the object of tracing the vein on the surface.

Big Four and Hidden Treasure.

"This property lies about a mile to the south-west of the *Helen* group, and is owned by P. Powers, J. Beaman, R. Hamilton, and Geo. Charlton. These claims are lower down the hill than the *Helen* group, being at an elevation of 3,500 feet and in the timber on the side of Milk creek. A large quartz-filled fissure, striking north-west through granodiorite, is seen outcropping at several places. Towards the south-east this vein is faulted and twisted up considerably, and is apparently intruded and broken up by quartz-porphyry dykes. At one place the vein shows a width of 20 feet and has been stripped for 20 feet in length; it is fairly well mineralized throughout. About 2 tons of the best-looking ore taken out here has been saved; a sample of this material assayed: Gold, 0.02 oz.; silver, 7.2 oz.; lead, 36.3 per cent.; copper, 2.5 per cent. By means of open-cuts and trenches the vein has been traced for about 300 feet, but no work has been done which gives any depth on the vein.

"September 13th. Moved camp from Andy Goodwill's cabin to a point four miles up Milk creek. It snowed heavily during the night, the snow being as low down as 4,100 feet elevation.

"September 14th. An attempt was made to discover the claims owned by J. Hatch and P. Powers, which lie some distance up the north side of Milk creek. At an elevation of 5,750 feet a number of cuts had been made which exposed a quartz vein on one of Hatch's claims. It was difficult to see much, as the cuts were pretty well drifted in with the snow. In one place a cut, 20 feet along the vein, had been made which showed some quartz sparingly mineralized with galena and chalcopyrite. An average sample of the pile of ore which had been extracted from this working gave the following assay: Gold, 0.10 oz.; silver, 11.3 oz.; lead, 7.2 per cent.; copper, 1.7 per cent. Hoop's claims lie to the west of and higher up the hill than Hatch's claims. It was evident that with the covering of snow on them it was useless to attempt to find the workings, which consist of surface cuts, so a return was made to camp.

"September 15th. Between Goodwill's claims and the *Big Four* there is a group of claims owned by Springsteen and McLean. A well-marked trail led to the camping-place, and from there another trail followed up a creek-bottom to the bottom of a sheer bluff. From here on a search was kept up for the rest of the afternoon, but no sign of workings nor outcrops of ore could be found, and eventually the search had to be given up without accomplishing anything.

"September 16th. Left for Telkwa, arriving there the night of September 17th."

CRONIN CAMP, BABINE RANGE.

In 1909 James Cronin secured a group of claims at the head of the Tuchi river in the Babine range, and has been prospecting and developing them more or less continuously since that time. This property, which is now owned by the Babine-Bonanza Mining and Milling Company, of which Mr. Cronin is a large shareholder and general manager, is situated a short distance to the east of the divide at the head of Driftwood creek. The divide is at an elevation of

6,000 feet, the property being about 700 feet lower. The present means of access to the property is by means of an indifferent pack-trail up Driftwood creek and across the divide; this trail commences at McPhee's ranch, on the Hazelton-Telkwa wagon-road, about ten miles from Telkwa. By this trail the distance from the mine to Smithers, the new town on the Grand Trunk Pacific, is about twenty-two miles and but little farther to Telkwa.

The ore-bodies on the property occur at and near the contact of a granite porphyry with a series of highly altered sediments of the Hazelton group. These latter rocks are mainly argillites, but in places have a slaty or schistose structure, and again, in places, consist of tuffs and quartzites. Two types of ore-bodies are found here; one being a true shear-zone fissure in the porphyry, and the other a contact replacement deposit in which the wall-rock on either side of the contact has been replaced by ore-minerals.

The dominant ore-minerals found are galena and zinc-blende, together with lesser amounts of pyrite, arsenopyrite, and copper pyrites. The values are chiefly in silver and lead, although certain shoots of the ore would carry a high percentage of zinc, which under improved transportation conditions might be looked on as marketable ore. The gangue is often quartz, but in other places consists of brecciated and silicified porphyry.

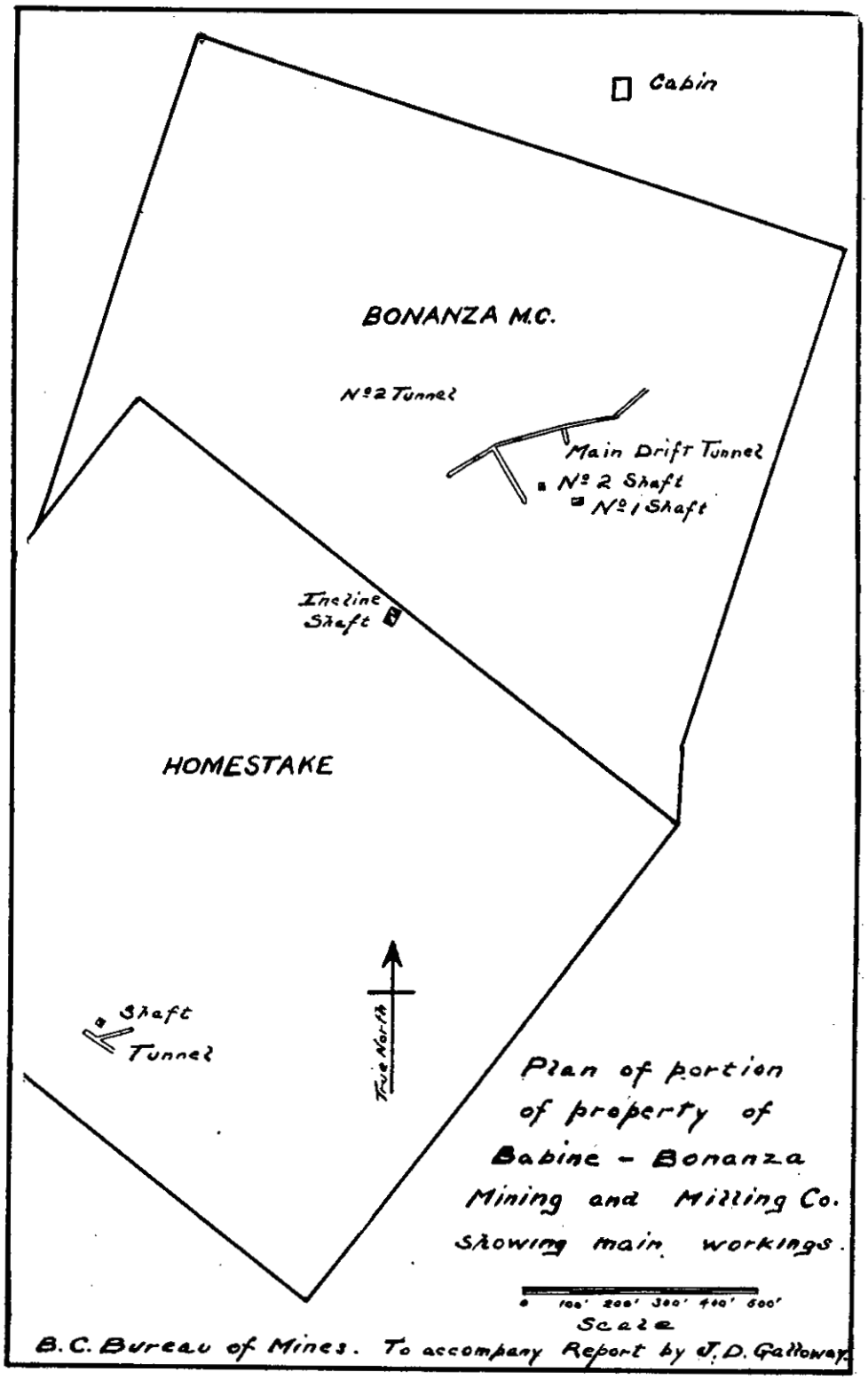
The sheared-zone ore-body has a strike of about N. 60° E., with a slight dip to the southeast. The main working on this ore-body is a tunnel 400 feet long; a plan of this working is shown on the map accompanying this report. For the first 300 feet of this tunnel the vein consists of slightly mineralized quartz varying from 1 to 3 feet in width. The tunnel then enters a shoot of heavy sulphide ore which continues for 75 feet; a sample taken across 20 inches, which gives an idea of the values in this ore-shoot, assayed: Gold, 0.02 oz.; silver, 19.8 oz.; lead, 22.1 per cent.; zinc, 34.1 per cent. A short distance beyond this ore-shoot the vein apparently disappears. No work has been done in this tunnel for some years, and the covering of iron-rust on the rock makes it hard to determine what has happened to the vein. The writer is of the opinion that the vein is split up into stringers which may, farther on, unite again, but W. W. Leach* says that it has been cut off by a fault. At a point 390 feet from the mouth of the tunnel a raise has been driven up 30 feet on the ore, but here again the vein has stringered out and disappeared.

The best showings on the property are in two shafts which would seem to have been worked on during the past summer. These are 100 feet apart and are sunk on the same or nearly parallel veins, which have a strike of N. 60° W. and a northerly dip of about 55 degrees. No. 1 shaft, the most easterly one, is 105 feet deep on the incline and shows a well-mineralized vein from 2 to 3 feet in width. At the bottom the vein is 30 inches wide; an average sample of it assaying: Gold, 0.02 oz.; silver, 59.6 oz.; lead, 54.6 per cent.; zinc, 11.8 per cent.

The vein has been stripped for 50 feet west of the No. 1 shaft, then 25 feet is not stripped, and then 25 feet more is stripped to No. 2 shaft, which is 85 feet deep. The vein, where exposed, is continuous throughout, with an average width of about 3 feet, and everywhere shows a good deal of mineralization. At the bottom of the No. 2 shaft there is a pay-streak 18 inches wide on the hanging-wall which carries a high percentage of zinc-blende, but also carries galena and copper pyrites. An assay of this material gave: Gold, 0.04 oz.; silver, 44 oz.; lead, 17 per cent.; zinc, 30.4 per cent.; copper, 2.5 per cent.

On the foot-wall there is 10 inches of nearly solid galena, and between the two pay-streaks a width of 26 inches of fairly well-mineralized quartz, making a total width for the whole vein of 4 feet 6 inches.

*Summary Report, Geological Survey of Canada, 1910.


Cabin
BONANZA M.C.
No 2 Tunnel
Main Drift Tunnel
No 2 Shaft
No 1 Shaft
Incline Shaft
HOMESTAKE
Shaft
Tunnel
True North
Plan of portion of property of Babine - Bonanza Mining and Milling Co. showing main workings.
100' 200' 300' 400' 600'
Scale
B.C. Bureau of Mines. To accompany Report by J. D. Galloway.

The outcrop ore from this shaft and adjoining stripping has been piled into a dump containing perhaps 20 tons. A sample, intended to represent an average of this dump, was taken which assayed: Gold, 0.04 oz.; silver, 45.6 oz.; lead, 24.2 per cent.; zinc, 12.4 per cent.

Another small dump has some good ore, but apparently not much effort has been made to sort out the high-grade ore as it was mined. These shafts are, of course, only prospecting workings, and no stoping or drifting has been done from them. The strikes of the veins in both shafts are about the same, but the strike between the two shafts is different, and it is probable there are two separate, parallel veins, or if it is one vein, then it is bent or faulted.

These showings look very promising and would without doubt be vigorously worked if means of transporting the ore were available. This vein occurs entirely in the granite porphyry, and is possibly the same vein as the one in No. 1 tunnel, but, although this opinion has been given by W. W. Leach, the writer does not consider it likely, as where exposed by workings the two veins strike nearly at right angles to one another. When Mr. Leach examined the property in 1910, the vein on the top of the hill was not as well shown up as it is now.

A number of shafts, cuts, and a tunnel have been made on different exposures of mineral occurring at the contact of the igneous rock with the schists. An adit-tunnel 33 feet long, which was evidently driven during the past summer, shows a good deal of ore. For half its distance this tunnel is in loose slide-rock which carries considerable float-ore, and then strikes solid granite porphyry with stringers of mineral. The face of the tunnel is practically at the contact of the two rock formations and shows a width of 4 feet of ore. The ore in this tunnel does not occur as a vein, but is a typical replacement deposit showing extreme irregularity. The ore-dump from this working contains about 10 tons of ore, and an average sample of it assayed: Gold, 0.04 oz.; silver, 57.4 oz.; lead, 31.5 per cent; zinc, 10.5 per cent. A number of open-cuts have been made along the contact, which all disclose bodies of quartz more or less mineralized.

Farther up the hill a shaft has been sunk vertically to a depth of 40 feet in the porphyry, and right alongside an incline has been put down about 40 feet following the contact, which dips at an angle of 70 degrees. The ladders and timbers were gone from these shafts, so that it was impossible to examine the bottom, but there would seem to be some ore here, occurring again in lenticular masses and irregular stringers.

Along the hill to the south another quartz vein has been uncovered by open-cuts and stripping; this vein strikes N. 65° W. and dips to the north-east, and is therefore practically parallel to the other vein on which the two shafts have been put down. In an open-cut 15 feet long and 4 feet deep this vein shows an average width of about 10 inches of quartz carrying disseminated galena; a sample across 10 inches assayed: Gold, 0.02 oz.; silver, 20 oz.; lead, 11 per cent.

Beyond this latter working, and on the slope of the hill over-looking the deep draw in which the water from the divide drains towards Babine lake, another parallel vein is exposed. This is developed by a shallow shaft and a tunnel which show it to be similar to the others already described. The tunnel did not apparently catch the vein, so, after driving it in nearly 100 feet, a crosscut was driven to the north-east, which does strike the vein after going about 50 feet. The showing at the face of the tunnel is sufficiently encouraging to warrant further work.

The following tabulation of assays taken on the Cronin property will make it easier to see how the values occur:—

No.	Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
		Oz.	Oz.	Per Cent.	Per Cent.	Per Cent.
1	No. 1 tunnel	0.02	19.8	..	22.1	34.1
2	No. 1 shaft	0.02	39.0	..	38.8	21.1
3	No. 1 shaft (selected ore)	0.02	59.6	..	56.4	11.8
4	No. 2 shaft	0.04	44.0	2.5	17.0	30.4
5	No. 2 shaft (outcrop ore)	0.04	45.6	..	24.2	12.4
6	No. 2 tunnel	0.04	57.4	..	31.5	10.5
7	No. 3 vein	0.02	20.0	..	11.0	..

It is easily seen that the silver values are in no way connected with the zinc content of the ore, but that they do fluctuate nearly proportionately with the percentage of lead; in other words, the silver is carried almost entirely in the galena in the ore. The samples from the No. 1 shaft show that the ore there carries approximately 1 oz. of silver to the unit of lead; the samples from the No. 2 shaft show, however, that there the ore runs about 2 oz. of silver to the unit of lead. The number of samples taken by the writer would be sufficient alone to be sure of this, but these ratios of silver to lead are confirmed by many assays taken by Mr. Cronin. This difference in the proportional content of silver would tend to prove that the veins in the shafts, instead of being the one vein, are different veins, although they are closely parallel.

The single assay from the No. 1 tunnel would show that there the proportion of silver is about 1 oz. to the unit of lead, which is again in accordance with Mr. Cronin's assays. No samples were taken by the writer from the most southerly vein, which is developed by a 100-foot tunnel, but, Mr. Cronin says, the silver there runs about 2 oz. to the unit of lead.

This property is at present handicapped by being so inaccessible, but if suitable transportation facilities were provided it would probably before long develop into a shipping mine. Besides this mine, there are other prospects which have encouraging surface showings, but the problem is to provide an outlet for the possible ore.

The present trail up Driftwood creek and across the divide could be much improved, but even then it would be too costly to pack ore out to the railway at Smithers. It would be possible to build a wagon-road from Cronin's mine to the shore of Babine lake, and then the ore could be taken out that way to the head of the lake. In order to open up the Babine Lake country there will probably be a road put in from the railway, starting either at Fraser or Burns lake. When this is done the properties on the Babine range, which lie on the slope towards Babine lake, will find that their best method of transporting ore.

SIBOLLA CREEK.

Placer gold and quartz veins carrying free gold have at different times been reported from Sibolla creek, but the stories were too indefinite to warrant taking the time necessary to visit the section. In any case, it is known that no work has been done, although both placer claims and mineral claims have been staked and recorded.

DEEP CREEK.

A number of claims are staked in this section, which can be reached by trail from Telkwa, a distance of twelve to fifteen miles. The showings are said to be quartz veins carrying iron pyrites and arsenopyrite with fair values in gold. This section was not visited by the writer.

BOB CREEK.

A large porphyry dyke carrying low values in gold is reported from the vicinity of Bob creek, but as far as is known no development-work has been done on it as yet, although claims have been staked there.

In the Omineca Mining Division, easterly from Telkwa along the line of the railway, no important mineral discoveries have been reported, so after finishing with the camps in this vicinity the writer proceeded by train to Fort George, thus passing on into the Cariboo Mining Division.

In conclusion, the writer wishes to express his thanks for the uniform courtesy and assistance in his work given to him by the different people in the districts visited.

NORTH-EAST KOOTENAY DISTRICT.

GOLDEN MINING DIVISION.

F. H. BACON, ACTING GOLD COMMISSIONER. (OFFICE AT GOLDEN.)

NOTES BY PROVINCIAL MINERALOGIST.

No report has been received this year from the Gold Commissioner of this Division, probably due to the fact that there was a change of officials during the latter part of the year.

The Acting Gold Commissioner submits the office statistics, and says: "The mining industry in this district is at a standstill and there is no work of any account going on."

The Canadian Pacific Railway has completed building a branch railway south from Golden, up the valley of the Columbia river, connecting with the line built northward from the Crowsnest branch of the same railway, starting near Fort Steele.

This being now completed, it will afford transportation facilities and enable the mining properties in the southern end of this Division and in the Windermere Division to do effective work; some of these properties are very promising.

The only mine in the Division which has produced of late years is the *Monarch*, situated near Field, on the main line of the Canadian Pacific Railway. This property was shut down during the year, but the high price of zinc has induced a syndicate to take steps to open it up again this coming spring.

OFFICE STATISTICS—GOLDEN MINING DIVISION.

Mineral claims recorded	4
Certificates of work issued	14
Mining leases in force	2
Rerecorded leases	1
Free miners' certificates (ordinary)	85
" " (company)	3

Revenue.

Free miners' certificates	$587 00
General mining receipts	51 25
Tax on Crown-granted mineral claims	298 25
	$936 50

WINDERMERE MINING DIVISION.

REPORT OF RONALD HEWAT, MINING RECORDER.

I have the honour to submit the annual report on mining operations in the Windermere Mining Division for the year ending December 31st, 1914.

There has been very little done in the development of the different mining properties in this district during 1914.

A San Francisco concern took hold of the *Hot Punch* group of mineral claims, and the Windermere Mining Company, Limited, was incorporated under the laws of British Columbia, Dr. Schurtz being the representative for Canada.

This company built about three miles of road leading to the claims, and nearly 200 feet of tunnel has been drifted, which produced about 200 tons of ore at an average gross value of $80 a ton. As soon as conditions allow to do so, the company intends to install machinery on the property and to ship ore to the smelter regularly.

On the *Black Diamond* 237 feet of tunnel has been drifted by the Black Diamond Mining Company.

On the rest of the claims in this district nothing but the necessary assessment-work has been done.

OFFICE STATISTICS—WINDERMERE MINING DIVISION.

Location records	67
Certificates of work	95
Free miners' certificates	73
Conveyances	13

SOUTH-EAST KOOTENAY DISTRICT.

FORT STEELE MINING DIVISION.

REPORT BY N. A. WALLINGER, GOLD COMMISSIONER.

I have the honour to submit a report on the progress of mining in the Fort Steele Mining Division for the year 1914.

The following table shows approximately the number of mineral claims held during each year since 1899:—

Year.	Held under Crown Grant or Certificate of Improvement.	Certificate of Work.	New Locations.
1899	37	718	729
1900	71	704	470
1901	104	642	455
1902	117	451	253
1903	142	335	200
1904	167	260	169
1905	189	193	181
1906	241	235	160
1907	254	160	115
1908	264	150	100
1909	280	154	116
1910	294	161	179
1911	307	167	96
1912	316	143	145
1913	319	139	104
1914	345	189	179

In making a report upon the mining industry for the year 1914, it would be difficult to show that the year was an improvement over 1913, and yet it certainly was so, not so much in the actual amount of mining done, but in the increase in general interest, as reflected in the mining receipts, which are nearly double those of 1913, the preliminary work of inspection of at least two camps, and the completion of the Kootenay Central Railway through the main valley, which affords transportation facilities to a large extent of country.

The *Sullivan* group at Kimberley, which has been described in former reports, is steadily increasing its shipments and is now the largest producer of lead in British Columbia, and last year produced 35,500 tons of ore carrying 12,000 tons of lead and 500,000 oz. of silver.

The *St. Eugene* at Moyie, with the exception of a few car-loads, about 900 tons, earlier in the year, has not been shipping.

The Perry Creek section came in for inspection, and the result was so satisfactory that it is the intention of one company to put in a deep exploratory tunnel of 2,200 feet length and obtaining a depth, approximately, of 1,200 feet, and, if warranted, to build a large cyaniding plant with pebble-mills; the lumber is now being hauled into place.

The St. Mary River section also received some attention, and it is understood that the large low-grade copper-deposits are to receive a thorough inspection and sampling to determine their economic value. Some of these deposits cannot be described as being in ledge form, but apparently are part and parcel of the formation and are probably "sills."

There is desultory work going on in Tracy creek, and some development between Four-mile and Six-mile, where 300 or 400 feet of drifting is being done with satisfactory results; while on Wild Horse creek, where a small galena-outcrop was exposed by the old placer-works, a little development has demonstrated that the ore-shoot is increasing in size and value and gives promise of some strength.

OFFICE STATISTICS—FORT STEELE MINING DIVISION.

Mineral claims recorded ("B")	166
Placer claims recorded or rerecorded ("B" placer)	13
Certificates of work ("E")	189
Certificates of improvements issued ("G")	17
Conveyances and other documents of title (bills of sale)	29
Documents filed	13
Affidavits filed	289
Mining leases in force	38
Free miners' certificates (ordinary)	321
" " (company)	1
Crown grants issued	26

Revenue.

Free miners' certificates	$1,406 75
Mining receipts	1,390 75

FLATHEAD RIVER OILFIELD.

NOTE BY PROVINCIAL MINERALOGIST.

Through the courtesy of Guy Kirkpatrick, of Vancouver, a member of the Flathead Oil Syndicate, the Provincial Mineralogist has been provided with a copy of a report on this oil-field—with permission to print it—which was made for the syndicate by Ralph Arnold, a well-known geologist of California, who for some years has made a special study of oilfields. A report on this same district was made by the Provincial Mineralogist in 1903, which can be found on pages 79 *et seq.* of the British Columbia Minister of Mines' Report for that year.

REPORT ON THE OIL POSSIBILITIES OF THE FLATHEAD DISTRICT, B.C.

BY RALPH ARNOLD.

INTRODUCTION.

This report is based on eight days' field-work, from June 29th to July 6th, inclusive, and, as to the Cambrian stratigraphy, on the report of Professor R. G. Daly, entitled "Geology of the North American Cordillera at the Forty-ninth Parallel," Memoir No. 38, Canadian Geological Survey. The field investigations covered the region from Belton to Kintla lake and seepage, Kishinena creek and seepage, and as far up as Gloyn's on Kishinena creek, Sage creek and seepages, Commerce creek, including the southernmost fork, and the region of Daly's coal claims. Information regarding the Oil City seepages and wells was obtained from Daly's report and from notes by L. J. Pepperberg.

The writer wishes to extend his thanks to Messrs. Kirkpatrick, Langley, and Raviez, who accompanied him on the trip, and to Arthur Lockwood, for courtesies extended and information furnished.

LOCATION.

The Flathead oil district of British Columbia occupies a narrow belt on the east side of the North fork of the Flathead river, extending from the International Boundary north of the Kintla lakes in Glacier National Park, Montana, to five miles above the mouth of Commerce creek, about fifteen miles north-west. Seepages along a well-defined anticline mark the core of the district. Other seepages and so-called oil indications are reported from adjacent territory, but, up to date, nothing indicating oil in commercial quantities has been discovered outside the belt mentioned.

Access is had to the region from three directions: (1) Over a fair wagon-road from Belton, Montana, a town on the Great Northern Railway fifty miles south of Sage creek; (2) over a poor wagon-road from Corbin, on the Crowsnest branch of the Canadian Pacific Railway, thirty-five miles north; (3) over a road from Oil City, thirty miles east of the Flathead river, but now abandoned for the stretch from Gloyn's to the International Boundary on Kishinena creek. Oil City is connected by good roads with Pincher Creek, on the Canadian Pacific Railway, forty miles away.

At the present time route No. 1 from Belton is the best. This can be traversed by wagons and saddle and pack animals, but not by automobiles. Should it become necessary to build a pipe-line out of the district, route No. 2, or that to Corbin, probably would be the most desirable to follow.

TOPOGRAPHY.

The region is dominated by the Clark range of the Rocky mountains, along the western flank of which the determining anticline follows in a general S. 40° E. and N. 40° W. direction, paralleling the range. The Clark range is characterized by sharp, often inaccessible peaks, lateral ridges, and rather narrow canyons which widen out on the west as they approach the broad valley of the Flathead river. Sage and Kishinena creeks, with which this report will principally deal, occupy valleys varying from a quarter of a mile to a mile wide in the general region of the anticline. The country between and adjacent to the valleys of these two creeks and to Commerce creek is occupied by high, often precipitous ridges, and can be practically ignored for economic purposes at the present time.

Abundance of timber of various sorts grows in the valleys and on the flanks of the lower ridges, thus furnishing a source for all lumber and fuel necessary for development. The streams flowing down from the higher mountains are capable of furnishing an abundance of water-power should development prove this desirable for the operation of producing and transporting plants.

GEOLOGY.

The rocks exposed on the surface in the Clark range, with a portion of which the anticline and seepages are involved, are given by Daly * as follows, from the top downward:—

Kintla Formation.—Argillite, quartzitic, and dolomitic interbeds; red; 820 feet. Chiefly Middle Cambrian.

Sheppard Formation.—Upper part: Dolomite; grey, weathering buff; 500 feet. Chiefly Middle Cambrian. Lower part: Buff-weathering dolomite and reddish sandstone; 100 feet. Middle Cambrian.

Siyeh Formation.—Dolomitic limestone with metargillite interbeds; grey and greenish, weathering buff; 4,100 feet. Middle Cambrian.

Grinnell Formation.—Metargillite and sandstones, generally red; 1,600 feet. Lower Cambrian.

* Memoir No. 38, Canadian Geological Survey, Table VIII., page 178, 1912.

Appekunny Formation.—Metargillite; grey or greenish-grey, weathering grey or brownish; 2,600 feet. Lower Cambrian.

Altyn Formation.—Siliceous, often sandy dolomite; light grey, weathering buff; 3,500 feet. Beltian.

Waterton Formation.—Dolomite; grey; 200 feet. Beltian.

The Appekunny formation is exposed at the axis of the Sage Creek-Kishinena Creek anticline in the region under discussion, and it is from the beds well down in this formation that the seepages come and the oil is obtained in the Sage Creek well. Joint cracks in the metargillite and sandy beds yield the oil rather than true oil-sands.

STRUCTURE.

The structure in the region of the prospective oil territory is unique in so far as the experience of the writer has extended. It involves (1) possibly the great, practically horizontal thrust fault which carries the Cambrian sediments out over the folded Cretaceous beds of the Great Plains; (2) a normal or thrust fault which has formed the great Flathead Valley depression by a down-throw on the west side of the Clark range; and (3) a well-defined arched anticline, here called the Sage Creek-Kishinena Creek anticline, caused by the drag of the last-mentioned fault on the eastward-dipping Cambrain beds which form the western part of the Clark range. The dips on the flanks of this anticline, where observed, were from north to south.

(1.) Commerce creek, southernmost fork: East flank, about 5 to 15 degrees; west flank, 25 to 40 degrees.

(2.) Sage creek, north side of valley: East flank, about 10 to 15 degrees; west flank, 25 to 28 degrees. The arched top of the anticline is between one-quarter and one-half mile across.

Sage creek, south side of valley: East flank, 5 to 15 degrees; west flank, 5 to 25 degrees. The arched top of the anticline is much broader on the south side of the valley than on the north side.

(3.) Kishinena creek: East flank of anticline, 10 to 15 degrees; west flank, 8 to 25 degrees. The width of the arch of the anticline at this creek is about a mean between that on the north side and that on the south side of Sage creek.

(4.) Kintla creek, between the two lakes: No well-defined anticline, but the topographic rise between the two lakes suggests an upward folding of the beds here.

The anticline, throughout its observed length, keeps a fairly uniform trend of about S. 40° E. and N. 40° W., bending a little more towards the north near its northern end. It is asymmetric, the east flank dipping from 10 to 15 degrees, while the west dip ranges from 25 to 40 degrees. The apex, being arched, offers ideal conditions for the accumulation of oil.

SURFACE INDICATIONS OF OIL.

Oil and gas escape from the surface in the form of slow seepages, and gas springs at or near the crest of the Sage Creek-Kishinena Creek anticline on Sage, Kishinena, and Kintla creeks. The oil is greenish-brown in colour, has a pleasant odour, and is probably of a paraffin base. The largest seepage is on Sage creek, and this has been cleaned out to yield small quantities of oil, possibly a gallon daily. Several minor seepages are found on the banks of Sage creek on the west flank of the anticline and some little distance from the main seepage, which is almost directly on the axis of the anticlinal fold. The seepages in Kishinena and Kintla creeks are small, but their occurrence at the axis of the anticline gives them favourable significance. With the exception of the small seepages along the banks of the old bed of Sage creek, all of the seepages emanate from the detrital valley fillings, so that their real source can only be surmised.

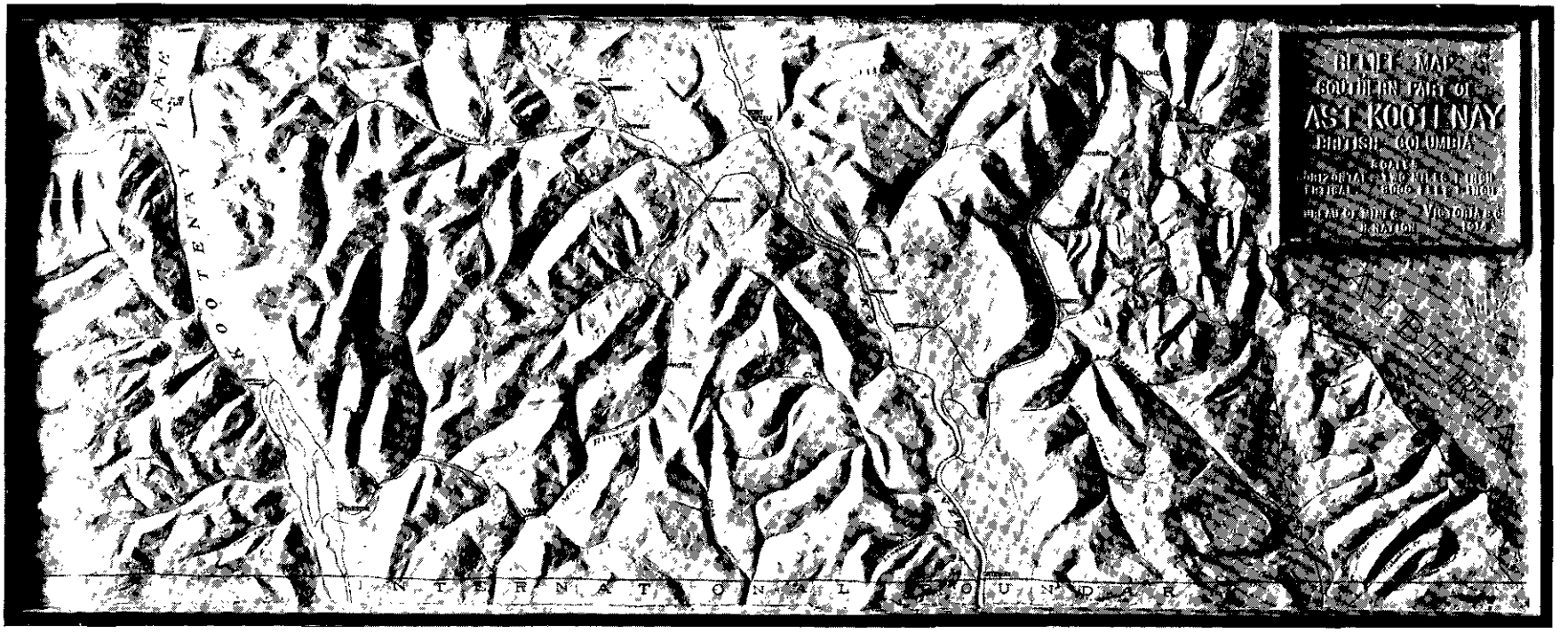


Photo of Model of Relief Map, South-East Kootenay.

PROBABLE ORIGIN OF OIL AND GAS.

Even to a more marked degree than in most other oilfields, it is practically impossible to secure direct evidence as to the ultimate source of the oil. Three * sources are possible :—

(1.) The organic Cambrian sediments underlying those in which the oil occurs or with which the oil-bearing beds are associated.

(2.) The Carboniferous † shale formations which underlie the Cambrian along the east front of the Clark range, and which probably extend west under the Cambrian, at least so far as the fault defining the west face of the Clark range. The general character of the oil, the apparent lack of adequate organic remains in the Cambrian, and the semi-metamorphosed condition of the Cambrian leads the writer to believe that the oil originates in the Cretaceous formation and has migrated to the joint cracks, crevices, and possibly porous beds in the overlying Cambrian along the crest of the anticline.

RESULTS OBTAINED BY DRILLING.

Of all the wells drilled in or near the anticline, but one has been successful in obtaining oil. This is well No. 4 of the British Columbia Coal and Oil Company, Limited, which is located on the north bank of the old bed of Sage creek, a short distance west of the crest of the anticline. It is 130 feet deep and yields some light, bluish, paraffin-base oil of about 48° to 50° Beaumé gravity (0.7865 to 0.7777 sp. gr.). It is said to have flowed over the casing-head when the oil reservoir was tapped. The oil is believed to occur in the joint crevices of the grey sandy metargillite of the Appekunny formation (Lower Cambrian). No estimate is possible of the capacity of the well, as it never has been properly tested, but little can be expected of it—possibly a few gallons daily—as it is so shallow.

Well No. 3 of the same company, a little farther west, and down the dip from No. 4, obtained a little gas at 205 feet in the same type of rock as that yielding oil in No. 4. This well is opposite some seepages on the banks of the old bed of Sage creek. Considerable quantities of water, some gas, and a little oil are continually escaping from this well.

Another well was drilled by the British Columbia Coal and Oil Company, Limited, to a depth of 560 feet in glacial deposits almost three miles below the axis of the anticline on the south bank of Sage creek. Neither oil nor gas was encountered here, nor were they to be expected, as the location is absolutely impossible from a geologic and structural position.

A well, known as the Butte, was put down to an unknown depth (probably about 1,100 feet, from the best information) near the east end of lower Kintla lake, and gas was reported to have been struck, but at the time of the writer's visit nothing was observed about the well to verify this report. This well is located fully two miles west of the seepage on Kintla creek between the two lakes, and is also believed to be drilled in a very poor location.

Gloyn's two wells, or those of the Columbia Oil Company on the headwaters of Kishinena creek, sixteen miles above its mouth, are started in a syncline in beds overlying the red Grinnell formation, well up in the Cambrian series. Notwithstanding certain favourable reports, the writer is inclined to the belief that these wells have obtained little or no oil, nor does their position lead to favourable conclusions as to the outcome of drilling in this locality.

* Probably should be two, but is reproduced as in copy received.

† Probably intended for carbonaceous.

CONCLUSIONS CONCERNING POSSIBILITIES.

A consideration of the evidence leads the writer to draw the following conclusions concerning the possibilities of the Flathead District:—

(1.) The oil originates in the Cretaceous shales underlying the great horizontal thrust fault-plane, has in part migrated up, across this fault-plane, and has collected in the joint cracks and porous portions of the overlying Cambrian beds in structurally advantageous positions in the arch of the Sage Creek-Kishinena Creek anticline.

(2.) The character of the oil obtained in drilling is of paraffin base and of light gravity—viz., about 48° to 50° Beaumé (0.7865 to 0.7777 sp. gr.)—and should contain a high percentage of gasolene, kerosene, and lubricants, the most valuable constituents of crude oils.

(3.) It is believed that commercial quantities of oil—say, two to ten barrels for shallow wells of from 200 to 1,000 feet in depth, and from ten to fifty barrels (or possibly more) for the deeper holes, down to 2,500 feet—will be obtained by drilling along or near the crest of the anticline.

(4.) The width of the productive zone can only be proved by drilling, but it is the writer's opinion that the productive area will extend for half a mile to one mile, or possibly a little farther, on each side of the axis of the anticline in the creek-valleys. The areas which can be developed along the anticline between the creek-valleys will be very limited indeed, owing to the great height and precipitous character of the intervening ridges. It is evident, therefore, that the only territory offering inducements for developments at the present time lies in the creek-valleys adjacent to the anticline. This is from 2,000 to 3,000 acres of first-choice land, with possibly some highly speculative land near the axis in the minor canyons or farther away from the axis in the major valleys.

NORTH-WEST KOOTENAY DISTRICT.

REPORT OF ROBERT GORDON, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report on the progress of mining within the Revelstoke and Lardeau Mining Divisions for the year ending December 31st, 1914:—

In the Big Bend country placer-mining has been in progress throughout the working season, and some new ground has been opened up on French creek by underground diggings; about thirty men being employed. This has brought out some rich dirt, but not enough, apparently, to cover working expenses. Several placer claims are being worked in this vicinity, with good results.

At Illecillewaet, on the main line of the Canadian Pacific Railway, work has been prosecuted on the old *Lanark* mine with a few men, good ore being encountered and a trial shipment made, the results of which are not yet to hand.

In the Lardeau country several mineral claims have been developed during the year, but no shipments of ore were made. This locality is still awaiting some enterprising capital in order to put the whole district on a shipping basis.

REVELSTOKE MINING DIVISION.

REPORT OF R. S. SQUAREBRIGGS, MINING RECORDER.

I have the honour to submit herewith the annual mining report and office statistics of the Revelstoke Mining Division for the year ending December 31st, 1914.

The mining conditions in this Division are about the same as the preceding year, very little being done except assessment-work, which has been kept up on most claims. Along the Columbia River in the Big Bend several new mineral claims have been located near Goldstream, Downie, and Canyon creeks, and a few to the south between Revelstoke and Arrowhead, which look promising for the prospector.

Along the Illecillewaet river two claims have been located near Laurie. On the *Lanark* mine, near Laurie, some development-work has been done, and an assay shipment has been made to the smelter at Trail, but it is difficult to obtain the results.

The *Lanark* mine was an important producer prior to 1898 and was described in Reports of 1896 and 1897.

At French creek, in the Big Bend, the Pioneer Placer Mines, Limited, has been operating all summer with about thirty men at work. At the same place Kitson, Remillard, Fullmore, and Williams have been working the *Black Bear*, *Blue Jay*, and *Snowshoe* placer leases, but the results of their labours have not been communicated to this office. French creek is looked upon as being rich in placer gold, and if expenses in connection with the transportation of machinery and supplies could be considerably reduced, no doubt much capital would be invested in this Division.

Two new placer claims have been located on Eleven-mile creek, Big Bend, known as the *Savana* and *Gold Cap*, which will be tested at the earliest opportunity.

OFFICE STATISTICS—REVELSTOKE MINING DIVISION.

Free miners' certificates (individual)	114
" " (company)	2
" " (special)	2
Claims recorded (mineral)	14
" (placer)	2
Certificates of work recorded	18
Payments in lieu of work	2
Placer leases granted	2
Agreements and transfers recorded	6

LARDEAU MINING DIVISION.*

REPORT OF WM. A. STRUTT, MINING RECORDER.

I have the honour to submit herewith my report of the progress of the mining industry in the Lardeau Mining Division for the year 1914.

The mining operations in this district show a slight increase over last year; there has been more free miners' certificates issued, double the amount of agreements and transfers, also an increase in work, but a falling-off in locations. Only one company operated in here last summer.

The only work now in progress is on the *Excise and Duty*, and the men are working all winter driving a lower level.

OFFICE STATISTICS—LARDEAU MINING DIVISION.

Free miners' certificates (ordinary)	43
" " (company)	1
Certificates of work	56
Payments in lieu of work	1
Locations recorded	17
Agreements and transfers recorded	28

* *See also* Report by N. W. Emmens, page 245.

LARDEAU MINING DIVISION.

REPORT BY NEWTON W. EMMENS, M.E.

The area covered by the Lardeau Mining Division embraces the territory bounded on the north by a line following the summit of the ridge dividing the watersheds of the Illecillewaet and the Incomappleux rivers; on the south by a line following the summits of the ridges forming the divide between the watersheds of Pingston and Bannock creeks and the Upper Arrow and Trout lakes; on the east by a line following the summits of the ridges dividing the watersheds of the Incomappleux river from that of Lardeau creek and the upper portion of the Duncan river and Beaver creek; while on the west it follows along the summits of the ridges forming the divide between the watersheds of the Shuswap and the Columbia rivers.

That portion of the area bordering the Upper Arrow lake north of Albert point, the North-east arm and the valley of the Columbia river as far north as Mile-post 23, on the Arrowhead branch of the Canadian Pacific Railway, has already been dealt with in the geological report on the Arrowhead section, and will not therefore be repeated here.

All bearings mentioned in this report are astronomic and all elevations are above sea-level.

ACCESSIBILITY.

The greater portion of the Lardeau Mining Division is comparatively easy of access, being, as it is, practically bisected by the wide, flat valley of the Incomappleux river.

The Canadian Pacific Railway operates trains as far as Arrowhead, at the junction of the Columbia river and the North-east arm with the Upper Arrow lake. From Arrowhead a steamer connects with the town of Beaton, at the head of the North-east arm, from which place there is an excellent wagon-road for a distance of twelve miles up the valley of the Incomappleux river. From this wagon-road excellent trunk trails have been built up most of the larger tributary creeks, and, from these trunk trails and other parts of the wagon-road, pack-trails have been built to a number of individual mines and prospects. Most of these trails are in fair condition, and a comparatively small amount of work will put the others in good shape.

At present it is possible, in the majority of cases, to ride on horseback to the several mines and prospects that exist in the district.

Above Twelve-mile, on the Incomappleux river, at which point the stream is crossed by an excellent wagon-road bridge, a trail exists along the east bank which at one time extended over the divide at Flat Creek pass, following the latter creek to its junction with the Illecillewaet river, near the main line of the Canadian Pacific Railway. This trail has been little used for a number of years beyond the mouth of Boyd creek, and is therefore in a bad state of repair and much overgrown with weeds and brush, but it would not be an expensive matter to clear it and make the necessary repairs.

TOPOGRAPHY.

The Lardeau Mining Division includes one of the most rugged and picturesque areas in the Selkirk mountains, the higher peaks of which rise to altitudes of 7,000 to 9,000 feet, and are crowned by glaciers and fields of perpetual snow.

The mountain-sides are steep, in many places precipitous, with deep narrow valleys between, and are densely timbered with cedar, spruce, hemlock, fir, and balsam to elevations of from 5,500 to 6,000 feet. The underbrush to elevations of 5,000 feet is dense, making transportation and travelling, away from the roads and trails, arduous. Above timber-line the mountains are clothed with grasses and alpine varieties of flowers, some of which are very beautiful. The summits of the higher peaks are either covered with glaciers and snow-fields or consist entirely of bare rock.

Along the valleys flow streams of water which, owing to the steep gradient of their beds, afford splended water-powers. Many of the creeks and rivers are a succession of cascades and rapids for miles, often running through narrow rocky canyons, forming splended sites for the construction of dams.

Flowing through the district, from close to its north-east corner, in a southerly direction to the head of the North-east arm of Upper Arrow lake is the Incomappleux river, which occupies a wide steep-walled U-shaped valley, the floor of which has a gentle slope towards the south through which the stream meanders.

This valley cuts across the strike of the rocks, and tributary to it are a number of streams occupying deep, narrow, V-shaped valleys having their sources in the glaciers and snow-fields which crown the summits of the divide to the north-west and south-east.

These valleys dissect the district into a number of mountain ridges having a general north-west and south-east trend, with offsetting ridges at right angles.

The mountains are large, blocky masses, usually terminating in rough, narrow, serrated ridges, the skyline of which is fairly even, but relieved in detail by a number of pinnacles and spire-like rock-masses.

Speaking of the mountains in this portion of the Selkirks, R. W. Brock * says: "This even skyline, suggestive of dissected peneplane which is a striking feature in a panoramic view from almost any peak, is remarkable in so mountainous a district. It seems to be due to the sameness in physical and structural conditions of the rocks over a wide area, with, perhaps, planation by the Cordilleran ice-sheet. Where the country-rock is granite or limestone the mountains are loftier and the skyline becomes uneven."

At the northern end of the district is a belt of limestone which forms the most conspicuous feature in the topography. Here the ridges are wedged-shaped, rising precipitously above the surrounding country, weathering into castellated and fantastic forms.

The topographical features are undoubtedly due to the erosion by river-action in a region of uplift, but there is much evidence to show that these features have been modified by ice, the summits of the ridges having been bevelled off and basins and cirques scooped out. Many of these latter are still occupied by residual glaciers.

The shape of the larger valleys has been changed from a V-shape to that of a steep-walled U, while the ends of the ridges projecting into these valleys have been truncated, giving them the appearance of enormous cut-banks. The floors of the main valleys have been deepened to a greater extent than those of the tributary, so that the latter often lie above as hanging valleys.

On the mountain-sides and on the summits of the ridges are numerous boulders of rock, foreign to anything in the vicinity, indicating clearly that they have been transported to their present position by ice.

Numerous glaciers and snow-fields, some of which are several miles in extent, occupy the summits of the higher peaks and ridges. These glaciers are rapidly retreating, and there is considerable evidence that the lower parts of many of the valleys were occupied by ice at no remote period.

In Poole creek as far down as Camp creek (called Hillman on the map) the valley must have been occupied by ice not very long ago (geologically speaking). This portion of the valley is of the steep-walled U-shaped type, and, although a number of tributaries enter it and snow-slides are both large and numerous, little rock debris has as yet accumulated.

* Brock, R. W. Summ. Rep. Geo. Sur. Can., 1903, pp. 44, 45.

From the field evidence it is seen that the existing glaciers are the remnants of the large valley glaciers, which, in turn, were the remains of the great Cordilleran ice-sheet at one time covering the whole of southern British Columbia.

The present glaciers, while comparatively small as regards area, are of considerable thickness, often exceeding 200 feet. Their movement is comparatively rapid, as is shown by the turbid condition of the streams issuing from them, produced by the powdered rock, with which they are charged, from the grinding action of the glaciers on their ground moraines.

GEOLOGY.

The rocks forming the Arrowhead section have already been dealt with in the geological report previously spoken of. It is not necessary, therefore, to say anything further about them here, especially as they do not contain any known ore-bodies of commercial importance.

During the examination of the Arrowhead section, a zone of mineralization having a width of 5 feet and occurring between a quartzite and a green schist was noted on the south side of the North-east arm, and had evidently, at one time, been staked as a mineral claim, as, a short distance above the lake-level, there is an open-cut some 15 feet in length, in which may be seen some small bunches of galena and iron pyrites in a quartz gangue. The metallic contents, however, of this material is not sufficient to warrant further work. A sample taken from this point, of the more highly mineralized portion, assayed only a trace in gold and 1.8 oz. in silver to the ton.

Between the head of the North-east arm of the Upper Arrow lake at Beaton and the town of Camborne the rocks consist of dark carbonaceous phyllites, grey siliceous schists, green schists, and a green rusty-weathering schistose rock which is generally considered to be an altered eruptive, and has been classified as a diabase-schist.

These rocks have a general north-west and south-east strike, with a north-easterly dip at angles from 50 to 60 degrees, cut by a series of joint planes having a north-easterly strike and a dip of from 40 to 80 degrees north-westerly.

North of Camborne to Twelve-mile the formation consists mainly of altered sedimentary rocks which are now represented by phyllites, talcose schists, calc-schists, and quartzites, interbanded with the rusty-weathering diabase-schists and bands of a green chloritic schist. These latter are considered to be altered eruptives. These rocks have the characteristic north-westerly strike and north-easterly dip, and are cut by master joints striking at right angles and dipping steeply to the north-west.

Two important bands of quartzite, locally called "quartzite dykes," cross the valley of the Incomappleux river—one a short distance below the mouth of Menhinick creek, and the other below that of Sable creek. This is an exceedingly hard, close-grained, dark-blue rock, cut and seamed in all directions by quartz stringers, and has the appearance of an indurated sandstone.

Above Twelve-mile to within a short distance of McDougal creek the formation consists of crystalline limestones, interbanded with slates and phyllites. Many of the limestone-bands are highly carbonaceous, some of them containing a considerable amount of graphite, while others contain a sufficient amount of chlorite to impart a decided green colour to the rock. This green chlorite has, in some instances, been mistaken for the green carbonate of copper (malachite).

North of this last series of rocks is a coarse-grained porphyritic granite near which occur numerous dykes of aplite and a coarse-grained quartzose pegmatite. It is in connection with the latter rocks that the tin occurs north of McDougal creek.

Owing to the highly altered and metamorphosed condition of the rocks, there is a complete absence of recognizable fossils, but from their general appearance, sequence, and position, they are regarded as a continuation southward of the formation which is exposed along the main line of the Canadian Pacific Railway between the stations of Twin Butte and Glacier, which has been classified as belonging to the Beltian system* (the Nisconlith and Selkirk series of Dawson) and as being of the Pre-Cambrian age.

The granite which occurs along the north-east portion of the district is generally regarded as being much younger than the sedimentary rocks, and from its resemblance to the Nelson granite is considered to belong to the same intrusion as the Nelson batholith of the West Kootenay sheet, which is tentatively referred to the Jurassic or Post-Jurassic period,† and differing both in structure and composition from the granite occupying the south-western portion of the area examined, and which is regarded as being of Pre-Cambrian age.

Mineral Zones.

In the Lardeau Division there are two recognized mineral belts, known respectively as the Central and Lime Dyke series.

The former extends from the head of Sable creek and the Akolkolex river in a general south-easterly direction, crossing the valley of the Incomappleux river just north of the town of Camborne, and continuing across Mount Poole into the Trout Lake Mining Division. This belt is somewhat irregular in width and consists of slates and phyllites cut by the green rusty-weathering diabase-schist, lying between broad bands of the green schist. It is within this belt that the more important mineral deposits occur.

The second mineral belt, locally spoken of as the "Lime Dyke," extends along the divide between Sable and McDougal creeks south-easterly across the Incomappleux river, along the divides between Lexington and Boyd, and Boyd and Kellie creeks, across the head of Poole creek over into the Trout Lake District.

Central Belt.

Mines and Prospects.

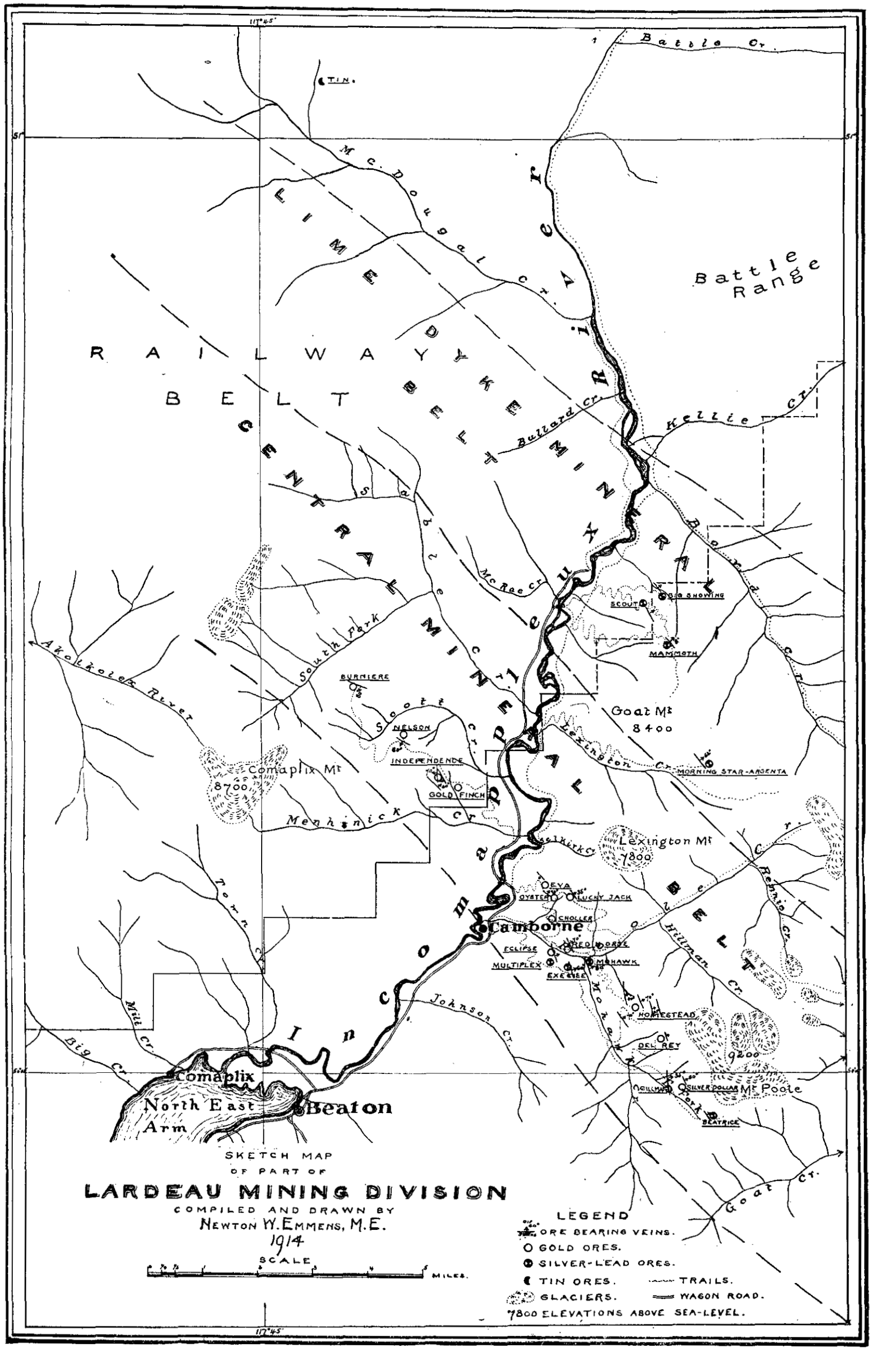
Burniere Group. This property consists of three claims, the *Bodmin*, *St. Mabyn*, and *Burniere*, situated on the north-east slope of Comaplix mountain, at the head of Scott creek, and at an elevation of 6,000 to 6,800 feet. On this property there is a well-defined quartz vein having a strike of N. 65° W., with a dip of 80 degrees south-westerly, lying at the contact between a rusty-weathering diabase-schist and a narrow belt of crystalline limestone containing a large amount of chlorite.

The vein varies in width from a few inches to 2.5 feet, and is particularly well exposed along the gently sloping hillside above the timber-line on the ridge dividing the watersheds of Scott creek and the West fork of Sable creek; here it shows as a white line through the green grass and alpine flora with which this slope is clothed.

A number of open-cuts and shallow prospect-pits have been made along this outcrop for a distance of 350 feet, and in many places free gold can be seen in the quartz with the naked eye. A sample taken along this outcrop, after rejecting the pieces in which free gold could be seen, assayed: Gold, 0.3 oz.; silver, 0.2 oz.

From a flat below the outcrop a crosscut has been driven to intersect the vein, which it does at a vertical depth of 19 feet. Here the vein is 12 inches wide, and a general sample, taken as nearly as possible at right angles to its strike assayed: Gold, 1.2 oz.; silver, 0.5 oz.

* Daly, R. A. Summ. Rep. Geo. Surv. Can., 1912, p. 159.
† Le Roy, O. E. Summ. Rep. Geo. Surv. Can., 1911, pp. 143, 144.



SKETCH MAP
OF PART OF

LARDEAU MINING DIVISION

COMPILED AND DRAWN BY
NEWTON W. EMMENS, M.E.
1914

SCALE
0 1 2 3 4 5 MILES.

LEGEND
- ORE BEARING VEINS.
- GOLD ORES.
- SILVER-LEAD ORES.
- TIN ORES.
- TRAILS.
- GLACIERS.
- WAGON ROAD.
- 7800 ELEVATIONS ABOVE SEA-LEVEL.

Here was noticed some galena scattered through the quartz, which was stated to be very rich in gold, although only on very rare occasions is native gold visible in the galena itself. To confirm this, a sample of the quartz containing a considerable amount of galena was assayed, and found to contain: Gold, 12.32 oz.; silver, 4.7 oz. No assay was made for lead.

A peculiar characteristic of this vein is the presence in the quartz of a bright light-green chlorite, which weathers to a rusty yellow. This chlorite is considered an indicator for gold in this formation, as it has been found that those portions of the vein containing the greatest amount of chlorite are also the richest in gold, outside of the galena, which is the heaviest gold-carrier.

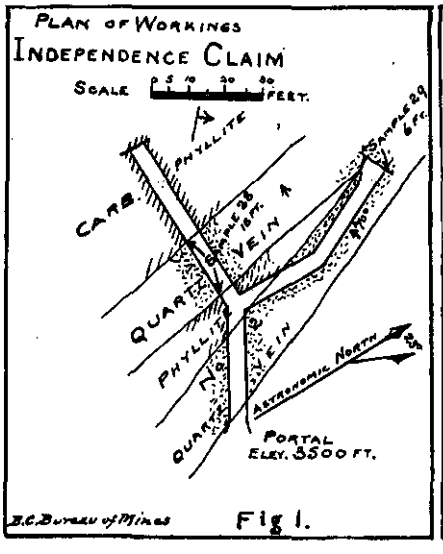
Nelson Group.

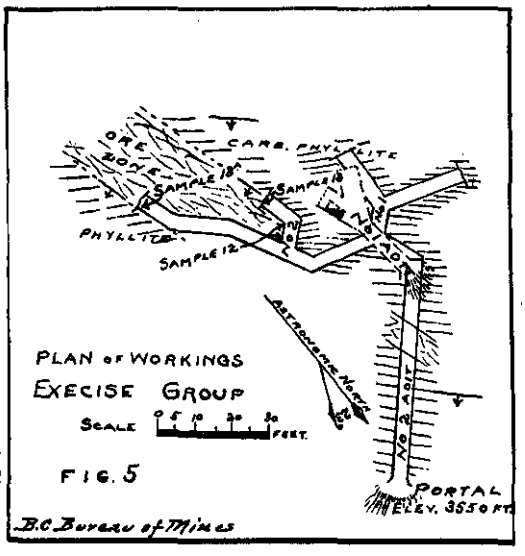
This group is situated on a ridge between Menhinick and Scott creeks, at an elevation of 4,600 feet, on the west side of the Incomappleux river. On this property there is a quartz vein having a strike of N. 60° W., with a dip to the south-west at an angle of 50 degrees. A number of open-cuts have been made at various places along the vein-outcrop, which shows a width of from 10 to 18 feet. A short crosscut tunnel has also been driven into the vein, which it intersects at a depth of 40 feet. The vein contains many schist inclusions and is divided into two sections by a well-defined seam. In an open-cut above this crosscut the hanging-wall section has a width of 8 feet, a sample taken across which assayed: Gold, 0.2 oz.; silver, 0.1 oz. A sample of the foot-wall section, taken across 7 feet, assayed: Gold, 0.08 oz.; silver, 0.1 oz.

In the crosscut an assay of the foot-wall section showed it to contain: Gold, 0.02 oz.; silver, 0.6 oz.; and the hanging-wall part: Gold, 0.15 oz.; silver, 0.3 oz.; while a third sample taken across 6 feet of the centre of the vein assayed: Gold, a trace; silver, 0.1 oz.

In a second open-cut, about 150 feet south of the crosscut, a general sample taken across the vein assayed: Gold 0.1 oz.; silver, 1.16 oz.

These assays from the open-cut samples are not as high as one is led to expect by the manner in which the ore pans, as a very nice "tail" of gold can nearly always be obtained





from a panful of the decomposed ore from the cuts. The explanation probably is that the gold occurs in very thin flakes which, while making a big showing, do not weigh much. The writer had a similar experience in California, where the ore obtained from an open-cut "panned big," it being quite a common thing to get a "tail" of gold an inch long from a pan

of dirt; but on running this material through the mill it was found to contain only between $2 and $3 a ton, the explanation being that the gold was very thin and light.

The formation in which the *Nelson* vein occurs is a carbonaceous phyllite having a strike of N. 45° W., and is therefore cut by the vein at a slight angle.

Independence Group.

This group consists of two claims and a fraction, situated on the north side of Menhinick creek and west side of Incomappleux river, at an elevation of 3,600 feet. The country-rock is a phyllite cut by a dyke of rusty-weathering diabase-schist. There are two veins on the property. One of these has a strike of N. 45° W. and a north-easterly dip of 60 degrees; it has a width of 4 feet and is known as the No. 1 vein. The second vein has a strike of N. 25° W., with a dip of 70 degrees south-westerly, and is known as the No. 2 vein.

The outcrops occur along a flat where the vegetation is so dense that it is difficult to trace them and so form an opinion as to their relationship.

The No. 1 vein has been opened by a series of surface trenches which show it to be continuous for a distance of between 300 and 400 feet. A sample taken across 3 feet of the quartz in No. 1 cut assayed: Gold, 0.06 oz.; silver, 0.1 oz.

The No. 2 vein has been opened by an adit (Fig. 1) run in from the flat. The first 30 feet of this adit passes diagonally through the vein, then turns to the west, and, 10 feet farther on, encounters a quartz vein having a strike of N. 10° W., and a westerly dip of 70 degrees. It continues through this vein for a distance of 16 feet and into the hanging-wall phyllites for a further distance of 34 feet. From the turn in the adit a drift was run north 27 feet into the No. 2 vein, then turned to a course of N. 25° W. and continued for a further distance of 27 feet. At the face of this drift a few shots were put into the west side, and apparently broke through into the No. 3 vein (?). A sample taken across 6 feet of the quartz exposed in the face of this drift assayed: Gold, 0.02 oz.; silver, a trace; while a sample taken across 16 feet of the No. 3 vein in the main adit showed it to contain 0.5 oz. gold and 0.3 oz. silver.

Sufficient work has not been done in connection with the No. 2 and No. 3 veins to determine whether they are separate and distinct, or whether they are one and the same, the ore-body being split by a horse of country-rock through which the main adit penetrates. Owing to the heavy covering of soil and rocky debris, no outcrops are visible where these veins should come to the surface.

There is a large amount of quartz float scattered about on the surface in both large and small masses, some of the former weighing several tons, a good many of which, upon being broken, show free gold. It is supposed, by the owners of the property, that this float comes from the No. 3 or "big vein," as they call it, but no systematic attempt has been made to prove the correctness of this supposition.

Some 500 feet north-westerly from the adit is a dyke of diabase-schist containing considerable quartz and having a strike of N. 25° W., with a south-westerly dip of 60 degrees. An open-cut has been made across the quartz portion of this dyke, from which a sample obtained over 5 feet of the more highly mineralized part assayed: Gold, 0.1 oz.; silver, 0.28 oz.

One hundred feet farther east from this cut, on the side of a low, narrow ridge, some open-cuts have been made across a series of quartz stringers which occur here in a carbonaceous phyllite. These stringers follow the bedding-planes of the rock and have a strike of N. 45° W., with a dip of 70 degrees to the north-east. A sample taken across 6 feet of the most promising portion of the No. 4 cut assayed: Gold, 0.06 oz.; silver, 1.13 oz. It is quite possible, and in fact probable, that these stringers represent the continuation of the No. 1 vein in this direction.

Goldfinch Group.

This group adjoins the *Independence* on the south-east and extends to the valley of the Incomappleux river. The ore occurs in a diabase-schist, having the characteristic north-west strike and north-easterly dip. This schist is cut by a series of faults having a strike of N. 25° west, and a dip of 80 degrees to the south-west. There are also a series of flat joint planes having a strike of N. 45° W. and a southerly dip of 20 degrees.

The dyke apparently has been subjected to a considerable amount of movement, which has cracked and faulted the rock in different directions. Many of the fault-planes and cracks subsequently became filled with quartz, more or less mineralized with pyrite, galena, and zinc-blende, with, occasionally, a little free gold.

Some of the flat seams, or joint planes, are now occupied by quartz "veins" from 0.5 to 12 inches wide. These are apparently much richer in the precious metals than the other veins and stringers.

So far as development-work shows and can be seen, there is nothing on this property in the nature of a well-defined quartz vein, such as exist in other portions of the district.

A large amount of development-work has been done on the property, consisting of numerous open-cuts, adits, drifts, and crosscuts, aggregating a good many hundred feet.

The property was at one time equipped with a 10-stamp mill, situated near the mouth of Menhinick creek, in the valley of the Incomappleux river, which was connected with the mine-workings by a wire-rope aerial tram. A forest fire destroyed the tram-line some years ago and it was never rebuilt. The mill building and machinery are still on the ground and in a fairly good state of repair.

The writer was informed that a considerable tonnage of ore from the open-cuts was put through the mill, and that the yield in bullion was satisfactory; but no figures as to tonnage or actual recoveries are available, and, from the general appearance of the material which was put through the mill, it would be surprising if in the unsorted ore the yield was in excess of $3 or $4 a ton, and it was probably considerably less, inasmuch as the proportion of quartz to country-rock is exceedingly small.

An upper adit at an elevation of 3,400 feet, was driven on one of the flat veins previously spoken of; this vein is exposed in the sides of the workings, and has a width of from 4 to 12 inches. In places this ore shows free gold, together with some galena and pyrite; a selected sample assayed: Gold, 1.8 oz.; silver, 0.6 oz. This class of ore, however, occurs in comparatively small patches, and for every ton of material extracted a good many tons of waste would have to be handled.

Two hundred feet vertically below the upper adit a second adit has been driven for a considerable distance. For the first 50 feet it has a course of N. 15° W.; it then turns and follows the formation in a general N. 45° W. direction for some 300 feet, crossing, in its course, two well-defined fault-planes, the farthest one (in from the portal of the adit) of which contained some quartz. A drift was run along this quartz in a N. 25° W. direction for a distance of about 75 feet, and in one place a raise was put up 20 feet. In both directions the quartz terminated in a wedge, and it shows very little mineralization; no samples were taken.

From what can be seen, there is no verification of the existence of a commercial ore-body in this portion of the ground, but the face of the lower adit is very close to the line of the *Independence*, and if it was continued until it cut the "big vein" in that property might uncover an ore-body of considerable value.

Eva Mine.

This mine is situated on Lexington mountain, on the east side of the Incomappleux river and on the north side of Poole creek, close to the mouth of the latter. The property extends from the river-valley up the mountain-side to an elevation of 3,800 feet. It was upon this property that the first discovery of gold was made in the district. In the year 1900 an inexperienced prospector was searching for silver-lead ores, and found upon what is now known as the *Eva* property a vein containing a few specks of galena, which he staked as a silver-lead claim. On having his samples assayed, however, they were found to contain high values in gold, whereupon he and his partners staked a group of gold claims, and, the news getting abroad, started a little excitement.

A syndicate was formed in Nelson, under the management of A. H. Gracey, for the acquisition and development of this property, since which time a large amount of work has been done and a considerable tonnage of ore put through the 10-stamp mill with which the property is equipped.

The mine has been idle now for several years owing to the fact that the ore is of too low a grade to be profitably handled with a small reduction plant and at the same time keep development-work ahead. However, the mine has made a good showing considering the conditions under which it was worked.

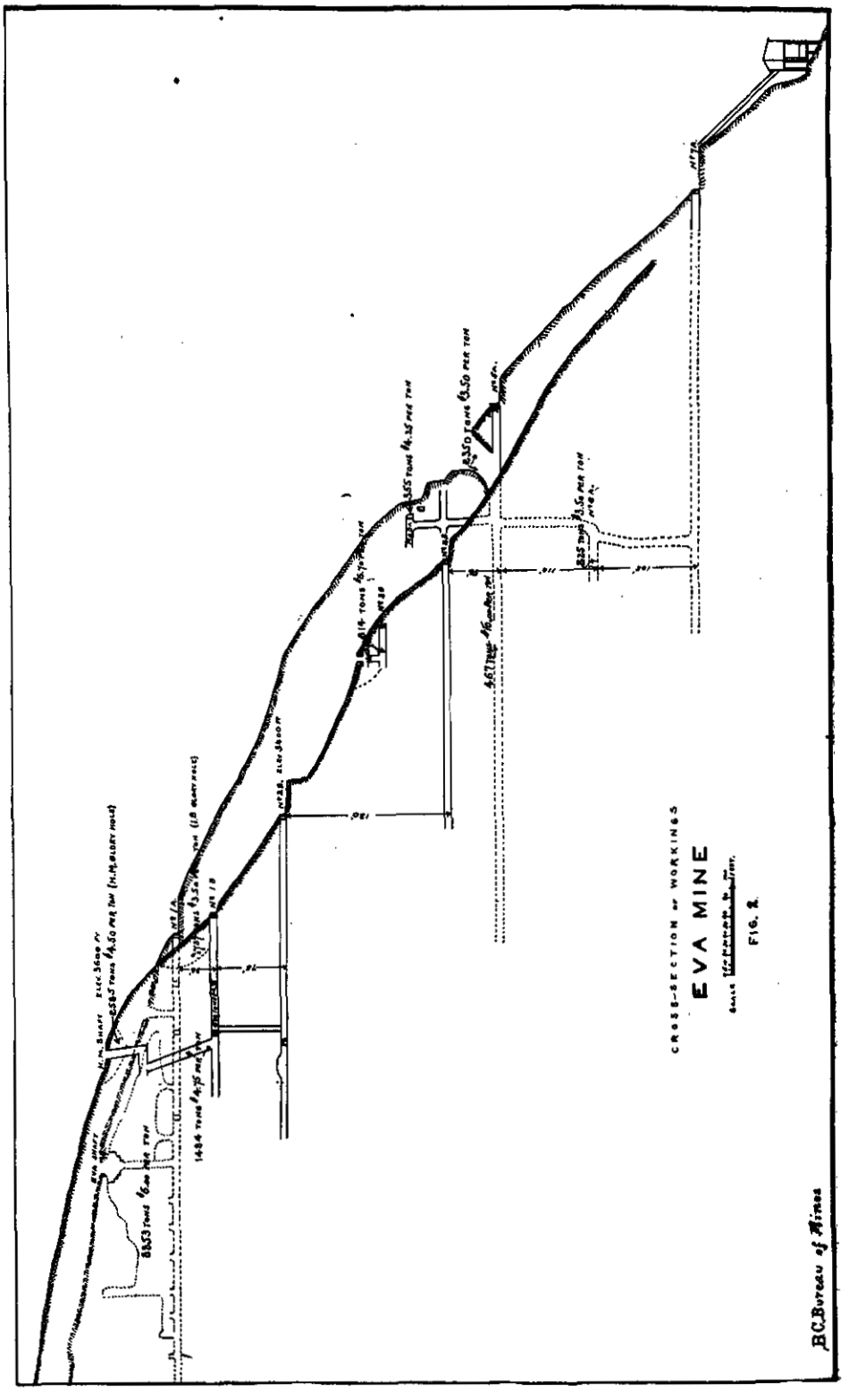
Referring to the local geology, I cannot do better than quote from the report of R. W. Brock* on the Lardeau District, in which he says :—

"The lead consists of two veins, lying in and along two fault-planes connected by numerous cross-veins and stringers. The direction of the lead is about 120 degrees (S. 40° E.), cutting the formation at a low angle. At the camp level (that is to say, at the level of No. 5A level and No. 6B level) the confining faults are 175 feet apart and dip 80 degrees away from each other. Since they are converging upwards, at the No. 2 tunnel, 500 feet above, they are closer together, being only 90 feet apart.

"The country-rocks are a spotted phyllite cut by the yellow-weathering diabase-schist. The veins are of quartz carrying siderite and sulphides, the latter usually in small quantities only, together with free gold. The sulphides consist of pyrite sometimes crystallized in the form of cubes, and pyritohedra, a little galena, and zinc-blende. The veins vary in width from a few inches to many feet. Gouge along the faults has usually confined the ore-bearing solutions within these planes and the crushed country-rock between them, so that the veins occur along these lines and in the country-rock between them.

"The southern vein is called 'A' and the northerly 'B.' Large masses of quartz may be developed especially where the cross-veins join the 'A' and 'B' veins. The cross-veins have not been observed to extend through the 'A' and 'B' veins out into the country-rock. In many places the lead is of solid vein-matter, sometimes banded, and with divisional planes parallel to the walls or to the stratification of the country-rock. Sometimes the veins hold inclusions of the country-rock more or less mineralized by vein-matter. In other places the quartz is deposited in bands between the lines of stratification. The rock between the 'A' and 'B' veins and the cross-veins is itself often mineralized with quartz and pyrite assaying perhaps $2.50 a ton in gold. Gold may be panned from the quartz almost everywhere, but the values are not evenly distributed. Gold occurs, visible to the naked eye, both in the solid quartz, in seams in the quartz, and along the selvedge of a vein. It is often concentrated along the walls of the vein or around the inclusions. As the walls and inclusions are often highly carbonaceous, the carbon may be responsible for the enrichment."

*Summ. Rep. Geo. Surv. Can., 1903, p. 59.


CROSS-SECTION OF WORKINGS
EVA MINE
FIG. 2.
B.C. Bureau of Mines

In reference to the foregoing statement with regard to the gold visible to the naked eye, it must not be assumed that this applies to the ore-body as a whole. Free gold is only visible in spots here and there in the veins.

The vein has been traced along its outcrop from the top of the ridge to the level of the river-valley, a vertical difference of elevation of some 2,000 feet.

A total of 5,570 feet of development-work has been done on this property, consisting of 3,130 feet of drifts, 2,000 feet of crosscuts, 375 feet of raises, and 75 feet of shaft, in addition to which there are two glory-holes and many open-cuts.

I am indebted to A. H. Gracey, M.E., of Nelson, formerly manager of the property, for the following information regarding the production and recovery from ore produced from the mine during thirty-three working months:—

There was treated a total of 30,595 tons, from which was recovered $147,553.92, an average of $4.86 a ton. The average tailing loss during this period was 83 cents a ton, so that the gross value of the ore milled amounted to $5.69 a ton, showing an extraction of 85.3 per cent. of the valuable metals in the ore.

In order to ascertain the recovery from the treatment of the ore from different portions and levels of the mine (Fig 2), a series of mill-runs were made, the details of which are as follows: 8,853 tons from the No. 1A level having an assay value of $6 a ton, mine-car sampling; 467 tons from the cross-vein on No. 5A level assayed $10 a ton; 355 tons from 3A drift assayed $4.25 a ton; 2,350 tons from the big stope on No. 5A level assayed $3.50 a ton; 825 tons from the drift on No. 6A level assayed $3.50 a ton; 2,163 tons from drift, crosscuts, and raise on the No. 1B level assayed $4.75 a ton; 737 tons from 1B glory-hole assayed $3.50 a ton; 2,585 tons from *Highland Mary* glory-hole assayed $4.50 a ton; 614 tons from drift and glory-hole on 3B level assayed $6.70 a ton; making a total of 18,889 tons having an average assay value of $5.22 a ton. The total recovery from the treatment of this amounted to $83,445.94, an average of $4.41 a ton, with a tailing loss of 65 cents a ton, showing a gross value of $5.06 a ton for the ore milled, which checks within 16 cents a ton of the average value according to the mine-car sampling.

On the No. 7 level, which is along the "A" vein, the ore-shoot that shows on the No. 6 level is just being entered. An assay taken across 6 feet of quartz gave $2.89 a ton in gold. There is a considerable tonnage of ore blocked out in the mine; this has been estimated at 200,000 tons according to a report made upon the property by Chester F. Lee, of Seattle, and which he further states can be counted to yield, on the average, between $5 and $6 a ton.

In addition to the ore-bodies above mentioned, there exist other vein-outcrops, but, aside from the fact that they are gold-bearing as shown by assays and panning tests, nothing is known of their commercial value, as no work has been done upon them.

The property is equipped with a 10-stamp mill (1,050-lb. stamps), ore-feeders, rock-crushers, classifiers, and vanners, also a 250-light dynamo and an air-compressor, the whole of which is housed in a substantial building. The plant is operated by water-power derived from Poole creek, the water being conveyed from the dam to the mill through a flume 4,000 feet long and an 18-inch steel pipe-line 1,030 feet long, developing, under the head of 400 feet, 400 horse-power, which can easily be increased by enlarging the flume and pipe-line, as only a small portion of the water flowing in Poole creek is utilized.

The ore is conveyed from the mine to the mill by means of a Riblet automatic aerial tram 4,200 feet long, having a capacity of 10 tons an hour.

Oyster-Criterion.

This property immediately adjoins the *Eva* on the south-east. The principal work has been done upon what is called the *Criterion* vein, which has a strike of S. 60° E. and a dip of 70 degrees north-easterly. This is almost parallel to the "A" vein of the *Eva*, although converging towards it. There has been a total of 2,550 feet of underground development-work done upon this property, in addition to a number of surface cuts. The bulk of the work has, however, been done on the *Criterion* vein on two levels. No. 1 level cuts the vein at a depth of 100 feet below its outcrop, and approximately 1,000 feet of drifting has been done here upon what proved to be a practically continuous ore-shoot averaging in width approximately 5 feet. Between this level and the surface some 14,000 tons of ore was extracted, yielding bullion to the value of $52,469.42, or within a fraction of $3.75 a ton. The figures of the tailing loss are not available, but I think it is safe to say that they were pretty close to $1 a ton.

The *Criterion* vein is well defined and persistent, and is apparently the result, partly of the filling of an open fissure with quartz, and partly the replacement of the brecciated country-rock by the ore. The country-rock is a dark-coloured carbonaceous phyllite (the colour evidently being due to the presence of carbon in the form of graphite) and can be seen in all stages of replacement.

The quartz not only is developed between the laminæ of the phyllites, but has in many places completely replaced that material, though often with remaining included fragments of phyllite. In places the vein consists of, practically, solid quartz from wall to wall, and in others a mass of reticulating veinlets of quartz with phyllite between. The carbon in the phyllite has undoubtedly played an important part as a precipitating agent for the gold contained in the mineral-bearing solutions, as it is not an uncommon thing, in certain portions of the vein, to find gold concentrated around these inclusions, consequently the mottled portions of the vein often yield the highest grade of ore, but it is evident from the gold recovered in the mill that these high-grade spots are of limited extent.

The *Criterion* vein is cut by a fault having a strike of N. 43° E., which is occupied by what is known as the "galena vein," having a width of from 1 to 5 feet, with well-defined and slickensided walls. The galena vein is younger than the *Criterion*, as the latter is not only cut, but is faulted a distance of 15 feet by it. Where the galena vein passes through the *Criterion* it narrows down to a width of 1 foot, but both it and its accompanying gouge continue unbroken through the quartz.

A drift has been run along this galena vein on the No. 1 level, and, 350 feet in from the *Criterion* vein, the galena vein intersects an east-and-west fault having a dip of 8 degrees to the south, which cuts it off completely. A little farther on a second fault is met with. At 525 feet, in a quartz vein about 8 feet wide was encountered, similar to that on the "A" vein in the *Eva* (of which it is supposed to be the continuation), the nearest working on which from this point lies 700 feet to the west. This drift has not yet been continued through to the "B" vein.

One hundred and seventy-five feet vertically below this upper level a No. 2 adit crosscut has been driven to intersect the *Criterion* vein, which it does in a distance of 450 feet. Only a small amount of drifting has been done on this level, and the downward continuation of the ore-shoot which was mined out in No. 1 level has not yet been entered.

About 300 feet north of the *Criterion* vein is the outcrop of what is known as the *Oyster* vein, which has a strike of S. 35° E. and a dip of 65 degrees to the north-east. This vein has been opened by a series of surface trenches and cuts, and has been traced into the *Lucky Jack* property, which adjoins the *Oyster-Criterion* on the south-east. Several other veins exist on

the property, but practically no development has been done on any of them, although it is possible to find free gold, visible to the unaided eye, in some of the outcrops.

The property is equipped with a 10-stamp mill, rock-breakers, air-compressor, and vanners, similar to that of the *Eva*. The mill is operated by water-power taken from Poole creek below the intake of the *Eva* flume. The ore is transported from the mine to the mill by a Riblet aerial wire tram 3,500 feet long.

Choller.

This property is situated on Lexington mountain, west of and below the *Eva* and *Oyster-Criterion* groups, and extending from their west side lines to the opposite side of Poole creek. There are several quartz veins on this property, all of which are gold-bearing, but, as the property is under the same ownership as the *Eva*, it has not been developed to any extent, the resources of the owners having been devoted to the development of the *Eva*.

On the *Choller* claim there is a well-defined quartz vein having a north-south strike, with a vertical dip cutting across the enclosing phyllites, which at this point have a strike of N. 70° W. and a northerly dip of 85 degrees. A number of open-cuts have been made along the outcrop for a length of about 100 feet, and showing it to have a width of from 2 to 6 feet. Assays of samples taken from these open-cuts are stated to give values ranging from $4 to $15 a ton.

At an elevation of 2,725 feet an adit has been driven on the *Choller* vein for a distance of approximately 100 feet, showing it to have a width of 5 feet. A sample taken across the full width of 5 feet assayed: Gold, 0.54 oz., silver, 0.4 oz. A few feet back from the face a winze has been sunk to a depth of 40 feet in the vein, which has the same appearance as in the drift. In driving this adit some ore was encountered which showed iron pyrites and manganese. It has been found that the manganese is a good indicator of gold, and a selected sample of quartz showing considerable of that mineral assayed: Gold, 1.2 oz.; silver, a trace.

One hundred and twenty-five feet lower down the hill a second adit has been run in on the vein, which is here about 3 feet wide, of quartz containing many fragments of phyllite; this material is said to assay 0.4 oz. gold.

On the *Thelma* claim of this group is another large quartz vein with the same general characteristics as the *Choller*. No work has been done on this vein except near its lower exposure at Poole creek, where an open-cut shows it to have a width of 6 feet of solid quartz, giving small assays in gold.

Lucky Jack Group.

This property is situated on Lexington mountain, and adjoins the *Oyster-Criterion* and *Choller* groups on the south-east. There are several veins upon this property upon which a little prospecting-work has been done, but the only development of any importance has been confined to the vein upon the *Sleve Namon* claim, which is a continuation of the *Oyster* vein. This vein is of quartz having a banded structure containing inclusions of carbonaceous phyllite is well mineralized with pyrite, and here has a strike of N. 35° W., with a dip of 35 degrees to the north-east at the surface, with a width, as shown by surface cuts on this claim and on the *Oyster-Criterion* ground (into which it has been proved to extend for a distance of 700 feet), of from 4 to 15 feet.

The gold in this vein appears to be chiefly associated with iron pyrites, although occasionally it is found native in the quartz and around the phyllite inclusions. At surface, however, where the iron pyrites has been leached, the cavities remaining in the quartz often contain loose specks of gold. In depth the ore becomes more base, only about 25 per cent. of the gold content being amenable to amalgamation, the balance being contained in the sulphides.

In an open-cut made on this vein, not far from the *Oyster-Criterion* line, the vein shows a width of 15 feet, is of a banded structure, and contains phyllite inclusions between walls of carbonaceous phyllites. The bulk of this ore consists of quartz honeycombed from the decomposition of the iron pyrites, and contains considerable free gold. This ore all pans well.

From the floor of this cut, at an elevation of 4,650 feet, a crosscut has been driven through the vein from foot-wall to hanging, showing it to have a width of 14 feet at right angles to its strike and dip. The vein is here divided into three distinct bands by narrow seams of phyllite, the foot-wall band being more heavily mineralized with iron pyrites than either of the others. Three separate average samples taken from this crosscut, representing the three separate bands in the vein and assayed separately, gave the following results: Hanging-wall band, 5 feet wide, assayed: Gold, 0.2 oz.; silver, 1.0 oz. Central band, over a width of 6 feet, assayed: Gold, 0.3 oz.; silver, 0.5 oz.; while the more heavily mineralized foot-wall band, 3 feet wide, assayed: Gold, 0.8 oz.; silver, 1.0 oz.

One hundred feet vertically below and about 125 feet south-east of this crosscut is the No. 2 adit. This is a crosscut through the foot-wall phyllites for about 200 feet, when the vein was cut. A drift was then driven in a north-westerly direction along the foot-wall of the vein for about 40 feet. From this place a crosscut was driven into the vein for 15 feet, when a well-defined wall was encountered which was considered to be the hanging-wall, but there is a question as to the correctness of this supposition, inasmuch as a shot put in this wall showed it to contain a considerable amount of mineralized quartz. In this crosscut the vein is divided into two distinct portions by a narrow band of phyllite, the foot-wall portion being 4 feet wide and the hanging-wall portion 5 feet.

Average samples taken from each portion, separately, assayed as follows: Foot-wall portion, taken across 3 feet of the more heavily mineralized part, assayed: Gold, 0.8 oz.; silver, 0.4 oz. A second sample taken over 4 feet assayed: Gold, 0.34 oz.; silver, 0.4 oz. A sample taken across 5 feet of the hanging-wall portion assayed: Gold, 0.2 oz., with a trace of silver; and a second sample taken from the same place, but a little higher up, gave only traces of either gold or silver.

So far as the eye can detect, there is no difference in the appearance of the ore in either the hanging-wall or foot-wall portions of the vein at this place, but there is a very decided difference in the gold contents of the iron pyrites with which it is mineralized. Samples of the iron pyrites practically free from quartz taken from the hanging-wall section assayed: Gold, 0.6 oz.; no silver. Samples of the same mineral from the foot-wall taken from three separate places assayed, respectively, 1.4 oz., 1.47 oz., and 1.61 oz. in gold and no silver.

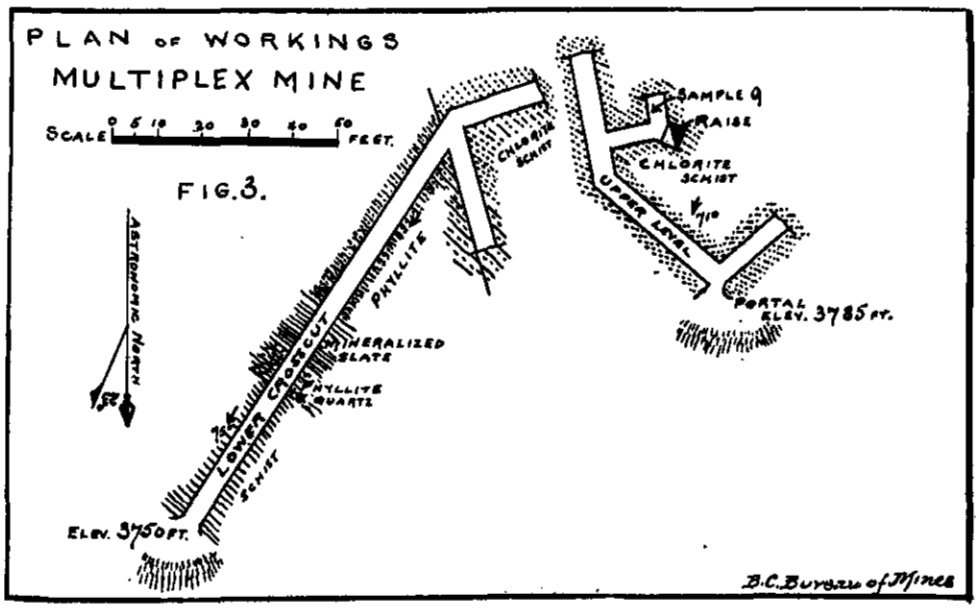
At the place where this lower crosscut intersects the vein the latter is cut by a fault having a strike of N. 65° W., with a dip of 70 degrees to the south-east. The extension on the south side of this fault has not been found, but there is reason to believe that the continuation will be found lower down the hill, and it is probable that the vein which outcrops on the *San Joaquin* claim is such continuation, but no work has been done to verify this supposition.

On the *St. Joe* claim, 2,400 feet south of the workings on the *Oyster* vein, is a quartz vein 5 feet wide between walls, carrying galena and having a north-westerly strike. This is a continuation of the vein which has been opened just above the Poole Creek trail on what is known as the *Red Horse* claim. On the *Lucky Jack* properties very little development-work has been done on this vein, and no samples were taken therefrom, it being considered that the results obtained from the sampling of it on the *Red Horse* claim would be sufficient.

Red Horse Claim. This is a relocation of the old *Sir Wilfred* claim, and is situated on Poole creek, about a mile and a half from the town of Camborne, at an elevation of 2,700 feet. The vein has been traced for a distance of 200

feet up the mountain-side by a series of open-cuts and trenches. Just above the trail the vein has been "faced up" and an adit started thereon. Here it is 14 feet wide, with a strike of N. 25° W. and dip of 70 degrees north-easterly, divided by a well-defined seam in the centre into two portions, the foot-wall section having a width of 8 feet and the hanging-wall section 6 feet. In character and mineralization it is similar to the *Oyster* vein in the *Lucky Jack* tunnel; its value, however, is very much lower. A sample taken across 6 feet of the hanging-wall section assayed: Gold, a trace; silver, 0.6 oz.; while a sample taken across 8 feet of the foot-wall section assayed: Gold, 0.02 oz.; silver, 2.4 oz. The formation at this place is a phyllite having a strike of N. 45° W., with an almost vertical dip, cut by two series of joint planes, one series having a strike of N. 45° E., with a dip of 80 degrees westerly, and the other having a north-easterly strike, with a dip of 15 degrees north-westerly.

Multiplex Group. This group consists of fourteen claims extending from the valley of Poole creek in a south-easterly direction to the summit of the ridge. Included in this group is the *Spider* claim, upon which all the underground work has been done. So far as can be seen, there is not, with perhaps one exception, a well-



defined vein on the property. The ore occurs in a chloritic schist which has been subjected to a great deal of pressure, and is consequently fractured and faulted to a considerable extent.

The ore occurs along the seams and fracture-planes, also as bunches at their intersection; it consists of quartz carrying galena, iron pyrites, and zinc-blende. The strike of the formation is N. 45° to 55° W., with a dip of 65 to 75 degrees to the north-east; this is cut by a series of joint planes having a strike of N. 40° E., with a dip of 70 degrees to the north-west. There is also another series of minor joints having a north-and-south strike and a dip of 15 degrees to the east.

Some years ago, a short distance above the *Beatrice* trail, which follows this side of Poole creek, at an elevation of 3,786 feet, some galena was found in an out-crop. A short crosscut was driven in from the hillside, a little lower down, with the intention of opening up what was supposed to be a vein carrying this material. The crosscut is only about 5 feet long (Fig. 3), when a wall was cut with a little ore on it. A drift was then driven in a direction of S. 50°

W. for 17 feet, but the ore playing out, work in that direction was discontinued. A drift was then made from the crosscut in a direction of S. 50° E. for 27 feet, then turned to a direction of S. 10° E. for another 27 feet. In this last drift several patches of ore were found, but nothing in the shape of a defined vein. Midway in this drift a crosscut 12.5 feet was driven in a direction of S. 80° W., and, from the face, drifts were made S. 3° E. for 7 feet and N. 55° W. for 5 feet. From the face of the latter a raise was put up, coming out immediately under the galena showing at surface. In the course of this work there was extracted a quantity of ore, from which a shipment was made in October, 1912, which contained, according to the analysis furnished by the Trail smelter: Gold, 0.1 oz.; silver, 68.6 oz.; lead, 17.2 per cent.; zinc, 15.4 per cent.; iron, 23 per cent.; lime, 8 per cent.; insoluble, 23 per cent.; sulphur, (approximately), 16 per cent. In the blacksmith-shop at the mouth of this adit there are several tons of sacked ore, from which a sample taken by the writer assayed: Gold, 0.09 oz.; silver, 66.4 oz.; lead, 22.8 per cent.; zinc, 11.3 per cent.

In the workings above described there still remain some patches of ore. A sample from the richer portions assayed: Gold, 0.24 oz.; silver, 68.9 oz.; lead, 22.8 per cent.; zinc, 14.9 per cent.

Thirty-five feet vertically below this upper crosscut a lower adit has been driven with the intention of cutting on its dip what was considered to be an ore-shoot, and from which the bulk of the ore produced on the upper level was extracted. This adit has a course of S. 33° W. for 115.5 feet; it then turns to a direction of S. 72° W. for an additional 20 feet, and was still being continued at the time of my visit. From the turn in this adit, a drift had been driven along a fracture plane in a direction of N. 15° W. for a distance of 29 feet. The formation cut by the adit consists of bands of schists, slates, and phyllites, all of which have a strike of N. 45° W. and a dip of 75 degrees to the north-east.

At 35 feet in from the portal a band of phyllite mixed with quartz stringers 8 feet wide was passed through, followed by 12.5 feet of a dark-coloured slaty rock much contorted and seamed with quartz containing iron pyrites.

Beyond this there is very little mineralization showing until the chlorite-schist is reached at 115 feet in. In this formation the ore occurs along the joint planes, seams, and cracks in the rock, and consists of quartz sparingly mineralized with pyrite, galena, and zinc-blende. There is, however, no continuity to this ore, it occurring in small lens-shaped patches, rarely exceeding a few inches in thickness and wedging out rapidly in all directions.

On the hillside at an elevation of 4,500 feet is an old adit driven along a quartz vein, having a course of N. 15° W. and a width of 15 feet; this quartz is fairly well mineralized with iron pyrites.

Fifty feet higher up the hill a rock-slide has exposed a large quartz-outcrop containing fragments of schist and a little iron oxide and pyrites. This material is said to assay $2.50 a ton in gold.

In other places on the property there are numerous quartz stringers and veinlets, but, as previously stated, nowhere was anything observed in the nature of a well-defined vein such as can be seen in other parts of the district.

Eclipse.

Adjoining the *Multiplex* group on the north-east, extending from Poole creek up the hill to the south-east, is the *Eclipse* claim. On this property there are three quartz veins having a strike of N 10° to 25° W. and a width of 6 to 8 feet. They are well defined, cutting the formation at a slight angle, and are almost vertical in dip. Aside from a little surface prospecting, work has been confined entirely to what is known as the *Eclipse* vein. Here at an altitude of 3,100 feet (100 feet above Poole

creek) an adit (Fig. 4) has been driven on the vein for a distance of 208 feet. This adit follows along in the foot-wall of the vein for the entire distance. At the face of this adit is a fault having a north-east and south-west strike which cuts off the vein. A drift was started in a S. 20° W. direction along this fault-plane with the intention of picking up the continuation of the vein on the other side. The drift, however, has not been driven far enough to accomplish this, although near the face, on the floor at the south side, there is some quartz coming in which appears to be its continuation. A sample of this material assayed: Gold, 0.02 oz.; silver, 7.4 oz.

At a distance of 100 feet from the portal of the adit a crosscut was driven through the vein in a westerly direction to the hanging-wall, showing 9 feet of quartz mineralized with iron pyrites. Eighty-seven feet farther on, a second crosscut was made through the vein which proved to have a width of 15 feet, and consisted of quartz sparingly mineralized with iron pyrites and galena. An average sample taken along the south side of this crosscut, representing the cross-section of the vein at this place, assayed: Gold, 0.12 oz.; silver, 2.1 oz.; no assay being made for lead.

The other two veins were not sampled, but are said to pan gold. The formation through which these veins pass is a carbonaceous phyllite. There is a question as to the relationship of these three veins, and it is possible that they belong to the same lode formation, and that further development will show them to contain commercial ore.

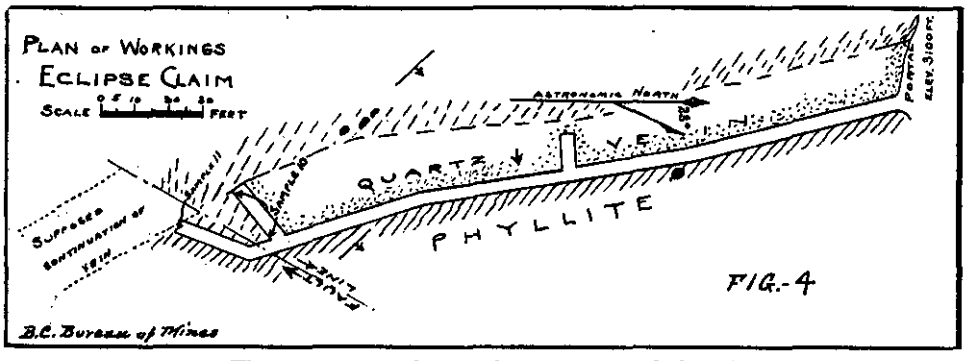


FIG.-4

Execise Group.

This property adjoins the *Eclipse* and *Multiplex* groups on the east, and is situated at the junction of Mohawk and Poole creeks, on the west side of the former. Some years ago an outcrop of galena was discovered on the hillside about 200 feet above Mohawk creek on what is now the *Execise* claim.

A little prospecting showed that the ore occurred along a fault having a course of S. 30° W., with a dip of 50 degrees to the south-west. An adit (Fig. 5) was started 13 feet below this outcrop, following along the line of the fault; 10 feet in, a vein was encountered having a strike of S. 15° E. and a dip of 50 degrees to the east. Drifting was continued along this vein for a distance of 15 feet, and along the fault-line for a distance of 14 feet, but the ground being badly broken up, and the ore somewhat scattered, driving was discontinued. A winze was then sunk on the vein to a depth of 12 feet, and some very nice solid galena ore extracted. The owners of the property considered that these workings were on the top of an ore-shoot, so decided to go farther down the hill and drive a level to cut the continuation of the ore at depth.

A second adit (Fig. 5) was therefore commenced at a point 57 feet vertically below, and 40 feet (horizontal measurement) N. 35° E. from the upper tunnel. For the first 59 feet this No. 2 adit is a crosscut and has a course of S. 43° W., from which point it turns to the east of south and continues in a south-easterly direction for a distance of 70 feet, following the

formation. The first part of this drift is in a badly crushed and contorted zone of carbonaceous phyllite; the latter part follows a well-defined wall along which occurs more or less ore. In the face of the drift, galena was showing at the time of my visit. This galena is of a fine grain, locally called "steel galena," a sample of which assayed: Gold, 0.02 oz.; silver, 24.2 oz.; lead, 37.3 per cent.

Two crosscuts had been made from this south-east drift looking for the continuation of the ore-shoot exposed in the upper workings, and from these crosscuts drifts have been made at different angles. As will be seen from the plan, the No. 1 crosscut and drift were too far west to have any hope of encountering the downward continuation of the ore found in the upper workings. The No. 2 crosscut and drift, however, are in a very much better position and appear to be fairly close to the downward continuation of the ore-shoot; here a considerable amount of galena is in evidence. An assay of the solid galena from this place showed it to contain: Gold, 0.05 oz.; silver, 40 oz.; lead, 48.5 per cent; zinc, 5.5 per cent. The No. 2 crosscut passed through 11 feet of quartz and phyllite mixed, mineralized with pyrite and a little galena. An average sample taken across this 11 feet assayed: Gold, 0.08 oz.; silver, 2.0 oz.; lead, 0.8 per cent.

Thirty feet in from the portal of the No. 2 adit a band of carbonaceous phyllite, cut and seamed with quartz, mineralized with iron pyrites, was passed through, and probably represents the extension of the ore-bearing zone in a north-westerly direction.

Mohawk Group. This group is situated at the junction of Mohawk and Poole creeks, on the east side of the latter, and extending from Poole creek up the hillside in a southerly direction for a distance of 4,000 feet. On this property there are two veins, known respectively as the *Mohawk* and *Fresno*.

The *Mohawk* vein has been opened by a short adit commencing within a few feet of Poole creek, driven for a distance of some 20 feet. The vein has a strike of N. 25° W., with an easterly dip at an angle of 72 degrees. It has a well-defined hanging-wall and carries considerable galena, zinc-blende, and iron pyrites in a quartz gangue, with small phyllite inclusions. The country-rock is a phyllite having a strike of N. 45° W. with a north-easterly dip, and is fractured by two series of joint planes, one having a strike of N. 15° to 25° W. and an easterly dip at a high angle, and the other an east-west strike and a southerly dip. Where opened by the adit the *Mohawk* vein has a width of 4 feet and contains a considerable amount of galena and zinc-blende, in addition to iron pyrites. An assay of the clean galena gave: Gold, 0.1 oz.; silver, 50.7 oz.; lead, 65.3 per cent.; while a sample of the clean zinc-blende gave only traces in gold and silver, and zinc 62.8 per cent. The elevation of this adit is 3,100 feet.

The *Fresno* vein has been opened by an adit 40 feet long, driven on its course, which is N. 20° W., with an easterly dip of 80 degrees. The vein is well defined, with a gouge of crushed rock between it and the hanging-wall, and is mineralized with iron pyrites and a little galena. Aside from the galena, however, it does not appear to contain much of value, as a sample taken across the vein at the face of the adit over a width of 5 feet assayed only traces in gold and silver. The country-rock here is a grey phyllite.

Homestead Group. This is a group of claims adjoining the *Mohawk* on the south-east, and is situated on the east side of Mohawk creek at an altitude of 4,500 to 6,000 feet. On this property there is a series of well-defined and clean-cut quartz veins ranging from 3 to 8 feet in with.

The No. 1 vein is 6 feet wide where it outcrops on the hill at an elevation of 5,150 feet, and stands up above the enclosing rocks like a stone wall. It has been opened by a series of surface cuts. A sample taken from the face along the wall gave only traces in gold and silver,

and a sample taken across a cut through the vein, 50 feet to the south, gave: Gold, 0.1 oz.; no silver. About 100 feet north-east of this vein is the No. 2 vein, which has been opened by a series of cuts at elevations ranging from 5,200 to 5,225 feet. It is of quartz, 8 feet wide, with a strike of N. 15° W. and a dip of 80 degrees to the north-east. A sample taken across the vein in the deepest cut, over a width of 8 feet, assayed: Gold, 0.02 oz.; silver, 1.5 oz.

The No. 4 vein is still farther up the hill, and has been opened by a cut at an elevation of 5,500 feet. It is of iron-stained quartz, is well defined, and has a strike of N. 20° W., with a dip of 70 degrees to the east. An average sample taken across 15 feet assayed only traces in gold and silver. A selected sample containing iron pyrites and a little galena assayed: Gold, 0.5 oz.; silver, 8.3 oz.

One hundred feet higher up the hill is another quartz vein 10 feet wide, having a strike of 10° W. and an easterly dip of 65 degrees. This is known as the No. 5 vein. Two hundred feet above this is the No. 6 vein, which has been prospected by two or three cuts along its outcrop. It has a strike of N. 15° W. and an easterly dip, but at this place is much broken over and therefore could not be measured accurately.

Both the Nos. 5 and 6 veins were stated by the owners of the property to carry from $2 to $6 a ton gold, but the samples taken by the writer only assayed traces in the precious metals.

Del Rey.

This property adjoins the *Homestead* group on the south-east, and extends from the forks of Mohawk creek up the hillside to an elevation of 6,000 feet. On this property there is a quartz vein 6 feet wide, with a north-westerly strike. It has been prospected by a series of open-cuts along its strike, but at surface is so badly broken over that its dip could not be accurately ascertained. At an elevation of 5,900 feet an open-cut has been made across the vein for a distance of some 20 feet, but is in the broken-over portion. A sample obtained from this cut assayed: Gold, 0.14 oz.; silver, 2.3 oz. The quartz is of a banded structure containing a little iron pyrites and included fragments of phyllite, which here forms the country-rock.

Below this cut, one hundred feet farther down the hill, an adit has been driven to intersect the vein. The mouth of this adit is caved in, so it was impossible to make an examination of the vein on this level. There is, however, a great deal of quartz on the dump, so it is evident that the vein was cut by this crosscut, but as to its size and the work done thereon no information could be obtained. The ore on the dump has the same appearance as that in the open-cut above mentioned, but was not assayed.

Parties interested in the property state that there is some good ore in these workings, and that there are some parallel veins which also contain good ore, but details are lacking.

The mill, air-compressor, and tram-line originally built for the *Silver Dollar* mine has been acquired for the *Del Rey* mine, across whose property the tram-line passes. It was intended to reopen the mine this season, but owing to the European war, active operations have been postponed until financial conditions improve, only the necessary repair-work being done this year.

Gillman.

This property is situated on the north side of the East fork of Mohawk creek, on the southern slope of Mount Poole, at an elevation of 6,000 feet. There is a well-defined quartz vein traversing the property which has a width of 6 feet and a course of N. 15° W., with a dip of 35 degrees to the north-east. The formation is a carbonaceous phyllite having a strike of N. 45° W. and a north-easterly dip. The vein is opened by a few shallow surface cuts, a prospect shaft 6 feet deep, immediately above where the *Beatrice* trail crosses the vein, and a short crosscut driven in from close to the level of the East fork of Mohawk creek. The vein is well mineralized with

iron pyrites, a little galena and zinc-blende, and is seamed with phyllite. It is separated from the walls by a narrow gouge, and in a number of places the quartz against the wall is slickensided. An average sample taken from the shaft above the trail, from the crosscut at the creek, and along the outcrop between these two places, a distance of about 100 feet, assayed: Gold, 3.9 oz.; silver, 6.1 oz.

In view of the promising appearance of this vein and its precious metal content, it is to be regretted that more work has not been done upon it.

Silver Dollar.

This property is situated near the head of the East fork of Mohawk creek, immediately above the *Gillman*, at an elevation of 6,100 to 7,000 feet. On the property there are two veins, one, the *Silver Dollar*, which has been traced by surface cuts for a distance of 1,400 feet, and having a strike of N. 25° W., with a dip of 60 degrees north-easterly. This vein consists of quartz mineralized with iron pyrites, galena, and zinc-blende, with occasional patches of grey-copper. The mineralization is not uniform, but is more or less confined to streaks along the walls of the vein, and to shoots, the rock between the shoots consisting of a white quartz of small value.

The second vein appears to be a parallel one. It has been opened by surface trenching and a few shallow cuts, in which it appears to have the same general course and structure as the *Silver Dollar*. At this place the rocks are much disturbed and crushed, so that it is possible this second vein is in reality the continuation of the *Silver Dollar*, although it is apparently too far to the north-east, unless it has been so displaced by a fault.

Most of the development-work has been done on the *Silver Dollar* vein, and consists of a number of open-cuts along its outcrop, and two crosscuts from which some drifting has been done. In an old prospect-shaft on the outcrop near the north-west end of the property the vein is 4 feet wide; on its foot-wall a seam of galena 4 inches wide assays: Silver, 59.2 oz.; lead, 68.27 per cent.; while an average sample taken across 2 feet of the hanging-wall portion of the vein assayed: Gold, 0.1 oz.; silver, 0.15 oz.

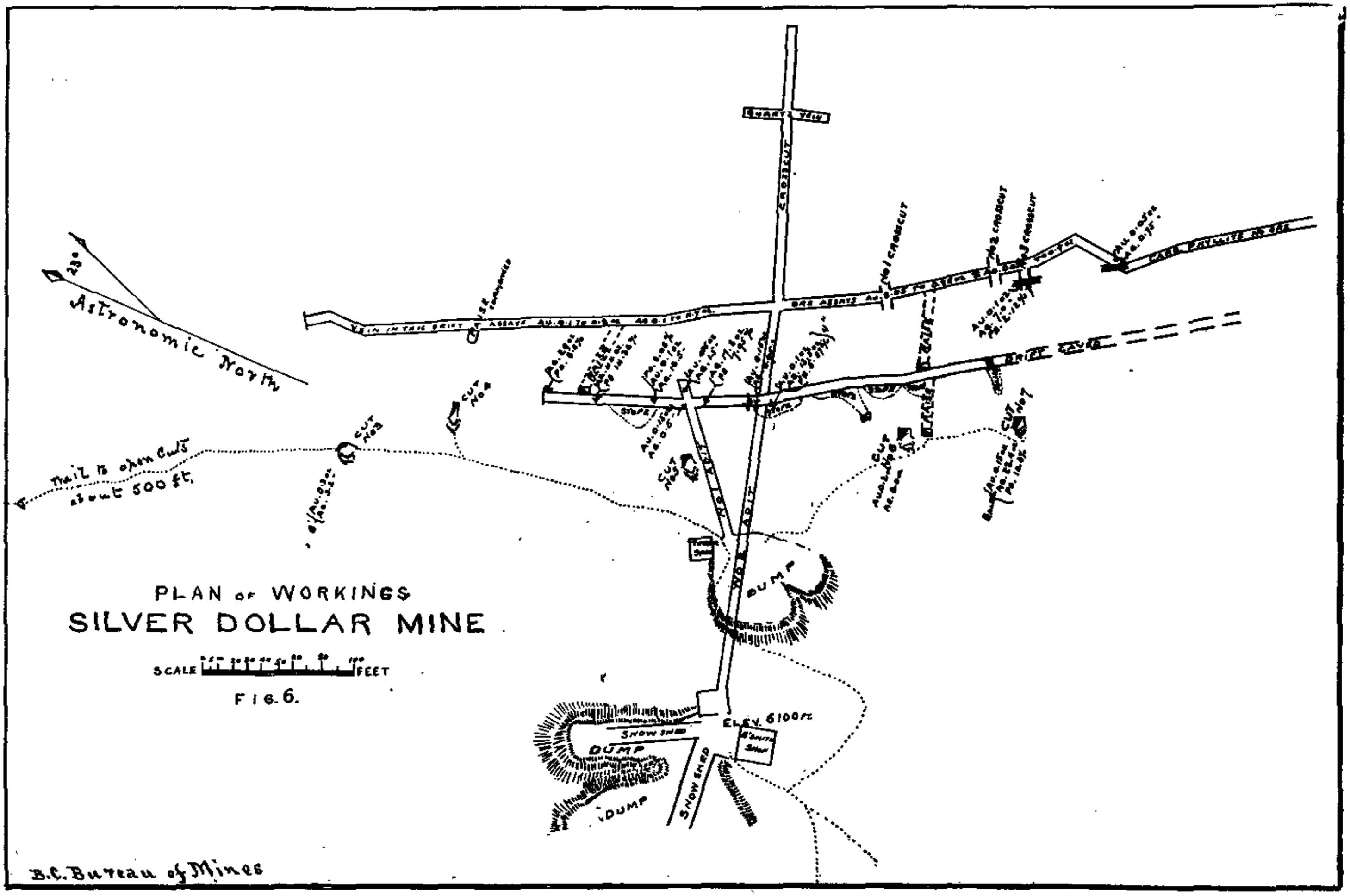
Fifty feet south-east of this shaft, in an open-cut, at an elevation of 6,240 feet, the vein is 4 feet wide, with a streak of galena ore on the hanging-wall side 1 foot thick. A selected sample of the galena assayed: Silver, 66 oz.; lead, 66.37 per cent.; while the quartz assayed: Gold, 0.05 oz.; silver, 1 oz.

About 650 feet south-east of the old prospect-shaft a cut has been made in the vein, showing it to have a width of 6 feet. An average sample taken at this point assayed: Gold, 0.3 oz.; silver, 3.2 oz. There are four other cuts along the outcrop in which the vein is exposed for a width of from 2 to 10 feet, and assays from 0.2 to 0.3 oz. in gold and 0.3 to 7.75 oz. in silver to the ton.

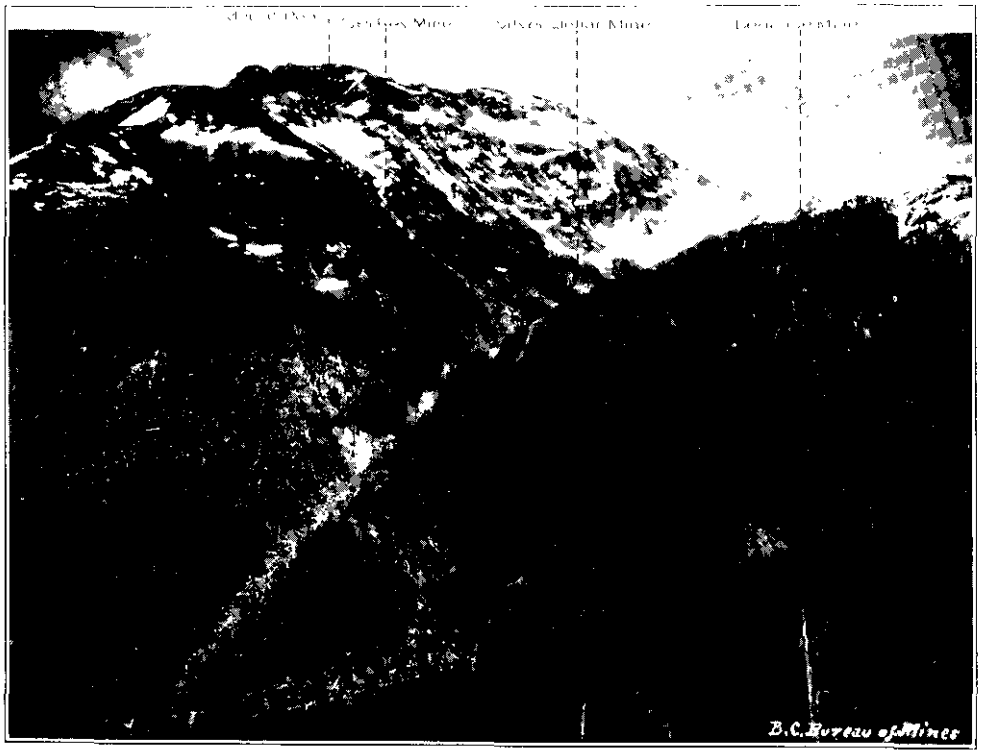
In the most south-easterly of these cuts there is some solid sulphide ore consisting of a fine-grained mixture of iron pyrites, galena, and zinc-blende. Assays of this material taken from the open-cuts showed it to contain 0.15 to 0.2 oz. in gold, 22.4 to 32.25 oz. in silver, and 10.6 to 15.16 per cent. in lead; no assays being made for the zinc.

Twenty-five feet vertically below the vein-outcrop a crosscut has been driven (Fig. 6), cutting the vein in a distance of 92 feet. From this point drifts were made north-westerly along the vein for a distance of 100 feet and south-easterly for 375 feet. Where this crosscut intersects the vein it has a width of 9 feet, from which a sample representing 5.5 feet of the hanging-wall portion assayed: Gold, 0.05 oz.; silver, 1.5 oz.; while 2 feet of the foot-wall portion assayed: Gold, 0.15 oz.; silver, 0.5 oz.

Twenty-five feet north-west of the crosscut the vein narrows down to 2 feet, from which a sample was taken, representing an 8-inch streak of ore along the foot-wall side; this assayed: Gold, 0.1 oz.; silver, 16.5 oz.; lead, 8.05 per cent. Forty feet farther on, the foot-wall section



PLAN OF WORKINGS
SILVER DOLLAR MINE
SCALE FEET
FIG. 6.



Del Rey and Silver Dollar Mines—Lardeau M.D.

McDougal Creek from Goat Mountain—Lardeau M.D.

widens to 10 inches, and assays: Silver, 44.0 oz.; lead, 14.36 per cent. A short distance farther along this drift the vein narrows down again and becomes mixed with the country-rock for a distance of 15 feet, when it again widens out, and in the face of the drift, 100 feet from the crosscut, there is a streak of ore against the hanging-wall, 8 inches wide, which assayed: Silver, 29 oz.; lead, 8.6 per cent.

In the south-east drift, 10 feet south of the crosscut, there is a 12-inch streak of ore against the hanging-wall which assayed: Gold, 0.1 oz.; silver, 17.8 oz.; lead, 7.95 per cent.; while an average sample taken across the full width of the vein, which is here 3 feet, assayed: Gold, 0.25 oz.; silver, 1.05 oz. Forty feet south-east of the crosscut is a stope 35 feet long and 15 feet high at the highest point above the level. Here the vein is 30 inches wide, and a sample taken across the ore showing in the north-west end of the stope assayed: Gold, 0.15 oz.; silver, 0.95 oz. Between the vein and the foot-wall in this stope is a streak of fine-grained sulphide ore 4 inches wide which assayed: Gold, 0.1 oz.; silver, 13.5 oz.; lead, 5.87 per cent. From this stope the drift continues along the vein for a further distance of 330 feet, but is inaccessible beyond the 200-foot mark owing to a "cave." In this part of the level the vein varies in width from 2 to 4 feet, and assays from 0.1 to 0.16 oz. in gold and 0.6 to 2.5 oz. in silver, with here and there patches of ore containing galena which assayed: Gold, 0.1 oz.; silver, 13 oz.; lead, 5.5 per cent.

Sixty-five feet vertically below the No. 1 adit a second adit has been driven at nearly right angles to the strike of the formation, intersecting the vein in a distance of 259 feet passing through the vein, which is here 26 feet between walls, and continuing on for a further distance of 180 feet, with the idea of cutting another vein which is supposed to parallel the *Silver Dollar*. In this crosscut, at a distance of 129 feet beyond the *Silver Dollar* vein, is a well-defined wall against which lies a quartz vein 8 to 12 inches wide, slightly mineralized with iron pyrites; it does not, however, show any ore of commercial value.

On the *Silver Dollar* vein drifts have been made in a north-westerly direction for a distance of 325 feet, and in a south-easterly direction for a distance of 375 feet from the crosscut. In the north-west drift the vein varies in width from 3 to 5 feet, and average samples taken in various places range in assay from: Gold, 0.1 to 0.2 oz.; silver, 0.1 to 11.7 oz. Along this level, 106 feet from the crosscut intersection, a raise was put through to the No. 1 level. This raise is 90 feet long on the slope of the vein, but comes out 10 feet inside the hanging-wall of the vein on the upper level. The quartz on which this raise was started extends only 25 feet above the lower level, where it becomes broken up and mixed with the country-rock.

In the south-easterly drift the vein varies in width from 8 to 48 inches in the workings, but, as the level is carried along the hanging-wall portion of the vein, this does not represent its full width. Assays of samples taken from various places along this level gave values ranging from 0.05 to 0.25 oz. in gold and 0.05 to 0.9 oz. in silver. Three crosscuts have been made in the foot-wall portion of the vein at different places along the level, showing its contents to range from 0.2 to 0.4 oz. in gold and 0.3 to 0.5 oz. in silver. One hundred feet south-east of the main crosscut a raise was made connecting with the No. 1 level above, but, like the raise put up from the north-west drift, it also came out inside the hanging-wall of the upper level. At a point 20 feet above the No. 2 level the quartz upon which the raise was being driven is cut off by a slip, and no more ore shows until within a few feet of the level above; what was carried as a foot-wall of this raise forms the hanging-wall to the No. 1 level. This leads to the suggestion that the two ore-bodies along which the respective levels have been driven are separate and distinct, the one lying a few feet north-east of the other. This supposition is further strengthened by the No. 3 crosscut in the south-east drift on the No. 2 level, in which a vein 26 inches wide was found inside the foot-wall of the *Silver Dollar* vein, a sample of which assayed: Gold, 0.1 oz.; silver, 7 oz.; lead, 2.12 per cent.

At 600 feet south-east from the main crosscut the vein is cut off by a slip having a very flat dip to the south-east. Thinking that the vein had been faulted here, the drift was turned to the south and continued for a distance of 40 feet, where it intersected a small quartz vein 8 inches wide, a sample of which assayed: Gold, 0.05 oz.; silver, 0.75 oz. This is probably the same vein as that which was encountered in the No. 3 crosscut. From this point the main drift was again turned to the south-east, following this small vein, which pinches down to a seam a few feet farther on. The drift, however, was continued for 100 feet farther without encountering any ore-body.

This property was equipped with a mill situated on Mohawk creek, and connected with the mine by means of a wire-rope aerial tramway a little over 7,000 feet long. In the mill are two 3-stamp batteries of the Merrill type, in which each stamp works in an individual mortar and has a quadruple discharge, together with rock-breakers, ore-feeders, concentrating-tables, etc., driven by water-power obtained from Mohawk creek. This plant has now been purchased by the *Del Rey* company. The mill was operated for a short time, but was not successful in saving the values. An examination of the ore at present lying in the mill-bins and the ore-bins at both the upper and lower terminals of the tram-line show it to contain an indiscrimate mixture of phyllite, quartz, solid iron pyrites intermittently mixed galena and zinc-blende, and some galena containing grey-copper. It is obvious that the putting through the mill of solid sulphide ore is a useless waste of good material, especially where such ore contains grey-copper, which under the action of the stamps would be crushed to a fine powder and carried away with the tailings. In the mill is some 75 tons of concentrates which assayed: Gold, 0.3 oz.; silver, 18.8 oz.; the lead was not determined. This material contains a large proportion of sand, due to poor milling. A sample of the tailings obtained from the "tailings launder," through which the waste material was allowed to flow to the creek, assayed: Gold, 0.1 oz.; silver, 6.3 oz. This probably does not represent the average tailings, as they actually ran to waste while the mill was in operation, as this material has been lying there for some years and has perhaps become somewhat concentrated through the action of the rain and melting snow. It is certain, however, that the tailing losses were a great deal higher than they ought to have been, owing to poor milling methods, and it is certain that a low-grade ore-body such as that of the *Silver Dollar* requires the most up-to-date and careful milling in order to make it pay a profit.

Beatrice Mine.

This property is situated at the head of the East fork of Mohawk creek, covering the summit of the divide between it and the North fork of Goat creek, which flows into Lardeau creek, in the Trout Lake Mining Division. On this property there are two veins, one from 2 to 5 feet wide carrying a fine-grained solid sulphide ore, consisting of an intimate mixture of galena, zinc-blende, iron pyrites, and grey-copper, assaying: Gold, 0.25 oz.; silver, 120.72 oz.; lead, 17.42 per cent.; zinc, from 10 to 23 per cent.

A considerable amount of work has been done on this property at different times, and a considerable tonnage of ore has been shipped to Trail, but owing to the distance the ore has to be rawhided (seven miles before reaching the wagon-road), and its high zinc content, which is penalized by the smelter, it has not been a paying proposition. The vein also is badly contorted, and the phyllite formation in which it occurs is badly broken, and therefore requires considerable timbering. The mine is opened by means of two adits, the lowest one of which is at an elevation of 7,000 feet and is above timber-line; the upper adit is some 300 feet in length and connects with an old prospect-shaft by means of a raise. In doing this work there was some 300 tons of ore sorted and sent to the smelter. This particular lot formed a part of the ore-body comparatively free from zinc, so that it was possible to keep that metal down to

within the limit allowed by the smelters, but when the property was operated three or four years ago the zinc content of the shipments was in excess of 15 per cent.

The second vein, called the "Gold lode," lies to the west of that carrying the galena; it has a strike of N. 25° W. and dips at a steep angle to the north-east. It has been opened by a number of surface cuts, in which it shows a width of from 4 to 6 feet, mineralized with iron pyrites and a sprinkling of galena. Assays show it to contain: Gold, 0.15 oz.; silver, 0.95 oz. Sufficient work has not been done on this vein to fully determine either its extent or economic value. There are a number of other quartz-outcrops on this property, one of which shows at the edge of the ice of the Poole glacier, north-east of the *Beatrice* workings, and at an elevation of 8,000 feet. Others occur to the south-west of the *Gold Lode* on the *Beatrice*, but have not been prospected.

LIME DYKE BELT.

Mines and Prospects.

As previously stated, this mineral belt extends from the head of Sable creek in a general south-easterly direction across the Incomappleux river and the heads of Lexington and Poole creeks over the divide into the Trout Lake District.

The rocks comprising this belt consist of bands of limestone, slate, and phyllites, with a few intrusive dykes of diabase and porphyry. So far as development has gone, the mineral deposits appear to be largely confined to the limestone-bands or to their contact with the adjacent rocks.

Owing to the mineral discoveries, thus far made, being situated high up on the divides at the headwaters of the various creeks, their long distance from transportation, and the rough steep trails which connect them with the valley of the Incomappleux river, the ore must be very rich in order to stand the heavy transportation expense. The energies of the miners and prospectors therefore have been devoted to the discovery of high-grade ore, and little attention has been paid to the large low-grade ore-bodies which are known to exist in this mineral belt. Another condition which has retarded the development and operation of these deposits is the long winter and the snowslides. At the high altitudes in this district—that is to say, from 5,500 to 7,500 feet—the first snow falls during the latter part of September and does not go off until about the middle of July.

The slopes of the mountain-sides in this belt are considerably steeper than in the Central Belt, and in consequence are subject to snowslides, some of which are of large proportions and sweep everything from their path. While these conditions add to the expense of operating, they are not by any means prohibitive, as when once the mine is equipped with the necessary plant and buildings (a safe spot for the location of which can always be found), the ore-deposits opened by underground workings, and proper transportation facilities provided which can be protected from the snowslides by means of snow-sheds or snow-fences, operations can be carried on throughout the year. There are a large number of Crown-granted claims located along this belt in the Lardeau Division, but, on the majority of them, no work has been done for a number of years owing to the fact that the ore-deposits developed are of too low a grade to admit of their being operated under existing conditions of transportation, and because their owners in most instances are not mine operators, and lack both the means and the knowledge to successfully open up and operate a low-grade ore-body. Chiefly owing to the above reasons, only a few of the prospects in this belt were visited by the writer. A brief description of these follows:—

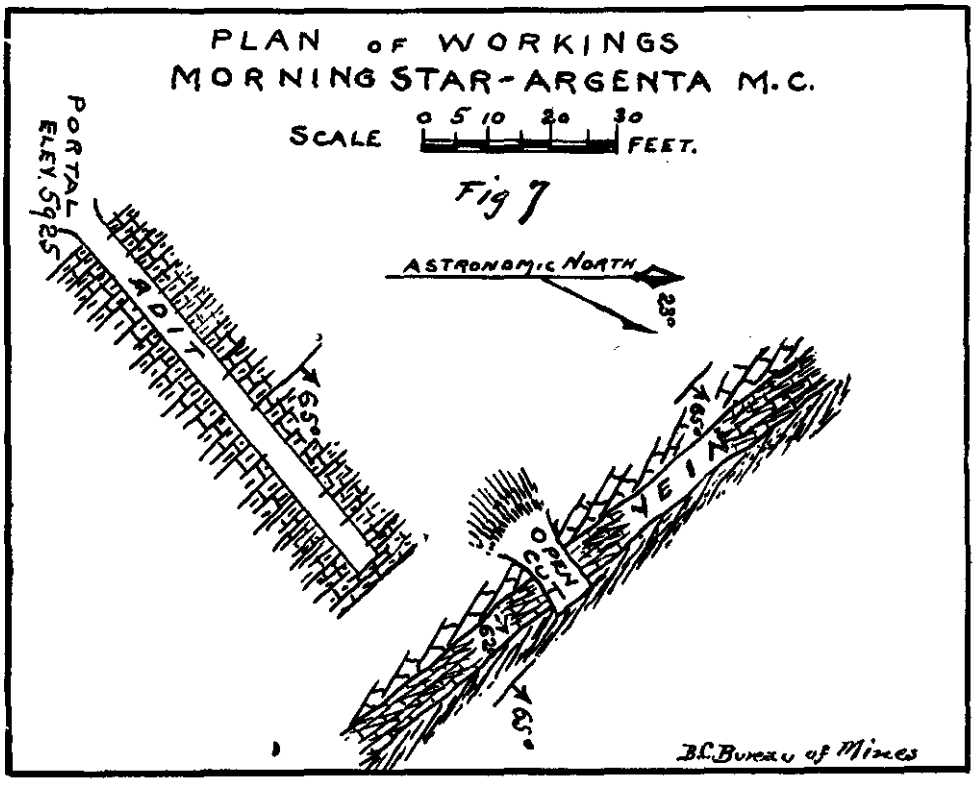
Morning Star-Argenta Group.

This property is situated near the head of Lexington creek at an elevation of 5,900 to 6,500 feet (4,000 to 4,600 feet above the level of the valley of the Incomappleux river at the mouth of the creek), and is reached by a steep, rough trail, with an average grade of 1,000 feet to the mile. At the

contact between a green chloritic schist and a band of siliceous blue limestone containing numerous quartz and calcite stringers is a vein 7 feet wide, locally known as the "Limestone lead."

This vein has a strike of N. 40° to 50° W. and a dip of 62 to 75 degrees to the eastward, conformably with that of the enclosing rocks. It has been opened by a surface cut at an elevation of 5,953 feet, made at right angles to the strike. It here shows a width of 7 feet and consists of iron pyrites, galena, and zinc-blende in a gangue of limestone and quartz. Against the hanging-wall of this vein is a streak 6 inches wide, much more heavily mineralized than elsewhere. A sample taken in this cut across the full width of 7 feet assayed: Gold, a trace; silver, 0.6 oz.; while a sample from the more heavily mineralized hanging-wall streak assayed: Gold, 0.15 oz.; silver, 49.5 oz.; lead, 49.8 per cent. At surface along the outcrop the vein is much oxidized and the iron and lead leached out, leaving behind a honeycombed shell; this zone of oxidation, however, only extends a short distance below the surface. Several other cuts have been made along the strike of the vein, and several of them show ore of a similar character, but nowhere has there been any considerable quantity of ore opened up.

One hundred feet south-west of the cut from which the sample was obtained a crosscut has been commenced (Fig. 7) to cut the vein at a vertical depth of 30 feet. The length of this crosscut, allowing for the dip of the vein, will be approximately 105 feet, of which 70 has



already been driven. The idea of the owners in driving this crosscut is to get underneath the galena showing in the cut above, with the hope that it is the apex of an ore-shoot, and that the crosscut will develop sufficient ore to enable them to make shipments to the smelter. From the limited amount of work done it is impossible to form an accurate idea as to the mineralization of this vein in depth, but on general principles it would have been far better to have sunk a prospect-shaft on the "showing" in the cut, to a depth of 25 or 30 feet, which could

easily be done with a windlass, rather than to drive a crosscut for a distance of over 100 feet through a hard siliceous lime on the chance of finding an ore-body when the vein is cut. In other words, the old adage, "follow your ore if it climbs a tree," is an excellent one in the first stages of the development of an ore-body, and if it were generally adhered to by prospectors considerably better results would be attained.

North-east of the hanging-wall chloritic schist, about 200 feet farther up the hillside, is a band of white crystalline limestone containing patches of graphite, and between this and a band of schists beyond is another vein which has been opened by a series of surface trenches and a short prospecting-drift, but no ore-body of commercial importance has been developed.

On the south side of the basin at the head of Lexington creek is a band of mineralized limestone containing galena and iron pyrites. It is stated that a considerable amount of development-work has been done on this, but owing to its being covered by snow at the time of my visit an examination was not possible. It is, however, generally considered to be a continuation of the mineralized limestone-belt which has been opened at the head of Poole creek.

Scout Group.

This property is situated on Goat mountain, on the east side of the Incomappleux river, twelve miles north of the town of Camborne, at an elevation of from 5,600 to 7,800 feet. The wagon-road along the valley of the Incomappleux river has been built as far as Twelve-mile, where the stream is spanned by an excellent bridge. From here to the lower *Scout* cabin (elevation 2,000 feet), two miles farther on, is a good trail on a wagon-road grade. From the lower *Scout* cabin to the upper the trail climbs a narrow ridge by a series of exceedingly steep switchbacks. This is considered to be one of the roughest and steepest trails in the district, second only to the *Mammoth*, it having an average grade of 1,500 feet to the mile. From the upper *Scout* cabin (which is built on a shelf cut in the hillside) to the valley of the Incomappleux river the slope angle of the mountain-side is 40 degrees. Above the cabin the mountain-side is even steeper, and in places consists of almost vertical bluffs.

The formation is a dark-coloured metamorphosed lime, seamed with calcite and quartz stringers, of a schistose structure, and containing inclusions of white crystalline lime and graphite. Between the lime-bands occur narrower bands of green chloritic schist. The whole rock-mass shows evidence of lateral pressure, the layers being badly contorted and twisted.

On the south side of the property there is a zone or band of siliceous lime from 6 to 15 feet wide, heavily impregnated with iron pyrites, which at surface have been converted into hæmetite and limonite by atmospheric agencies. At an elevation of 5,900 feet an adit has been driven on this mineralized belt in a course of S. 25° E. for a distance of 185 feet, and from this adit a crosscut has been made in a north-easterly direction across the mineralized zone, showing it to have a width of 18 feet, and to consist of lime, heavily impregnated with iron oxide and pyrites, containing galena in seams and patches. An average sample taken across the face of this adit over a width of 5 feet assayed: Gold, 0.02 oz.; silver, 2.6 oz.; and a sample of the solid galena taken near the crosscut assayed: Gold, 0.02 oz.; silver, 79.5 oz.; lead, 74.4 per cent.

Associated with and included in this mineralized zone are seams and patches of a green chlorite mineral. Six hundred feet vertically below this adit the mineralized band is exposed in a rock-slide. Here a second adit has been commenced, but has only been driven a few feet. The ore body has the same general appearance as in the upper workings, except that it contains considerably more quartz heavily mineralized with large cubical crystals of iron pyrites in various stages of alteration, and siderite, with only a little galena. Several surface cuts have been made at other places along the outcrop of this mineralized band, which can be traced for several hundred feet in either direction along its strike from the main adit.

At the upper end of the property, close to the summit of the divide between the Incomappleux river and Boyd creek, at an elevation of 7,500 feet, are some narrow quartz stringers from 2 to 12 inches wide, having a strike of N. 20° W. and a dip of 30 to 40 degrees to the north-east, sparingly mineralized with galena and grey-copper. These stringers occur in a light-coloured lime to which they are frozen. They have been opened by a number of shallow surface trenches, but no ore-shoot of commercial importance has been discovered.

Mammoth Group.

This property adjoins the *Scout* group on the south-east, and covers the summit of Goat mountain from an elevation of 7,000 to 8,400 feet. The formation here consists of a metamorphosed dark-coloured limestone tilted at a high angle, and cut by two series of fractures, one having a north-easterly course and almost vertical dip, and the other having a south-easterly strike and a dip of 5 to 10 degrees to the north-east. It is in connection with the latter that the ore-bearing seams occur.

At an elevation of 7,400 feet on the narrow mountain ridge is the outcrop of one of the flat mineralized seams above referred to. A drift has been driven along the strike of this ore for a distance of some 600 feet in a general south-easterly direction, and from this main drift shorter drifts have been made more or less at right angles along the upward and downward dip of the ore-body. Several of these lateral drifts break through to daylight on either side of the ridge, those on the east coming out on the mountain-side sloping down to the valley of Boyd creek, and those on the western to that sloping down to the Incomappleux river. The ore-seam followed in these workings varies greatly in thickness, narrowing down in some places to the width of a knife-blade, and in others opening to a width of 10 inches. The mineralization chiefly consists of grey-copper and galena, with, in a few places, argentite. That portion of the ore containing the latter mineral assays as high as 1,000 oz. of silver to the ton, but the average of the ore as sorted at the mine, several tons of which was shipped years ago, assayed approximately 400 oz. a ton in silver. From a scientific standpoint this deposit is interesting, but commercially it is of not very much importance owing to its small size, its inaccessibility, and the irregular manner in which the ore occurs. The workings are situated above timber-line, and it is stated that the wood used for heating and cooking purposes in the cabins cost $40 a cord.

The expense of packing supplies to the mine was also excessive, mainly owing to the exceedingly bad trail leading up from the valley of the Incomappleux river. In places this trail is nothing more than a narrow path across a sheer rock-slope, where a slip means a fall of 2,000 feet down the precipitous mountain-side. More than one unfortunate pack-horse has lost its life by falling from this trail.

In mining the ore, also, it was necessary to take out several tons of waste to every ton of ore, and, judging from the appearance of the vein in the workings, I think it is safe to say that not over 5 per cent. of the vein-matter broken could be sorted up to a grade high enough to ship. In addition to the vein upon which the adit is driven, there are several parallel seams farther up the mountain-side at elevations ranging from 7,700 to 8,000 feet. A considerable amount of surface work has been done on these and a few short adits driven, but while they showed galena and grey-copper in small patches, there is no ore-body of any size.

Big Showing.

This property is situated in a narrow V-shaped canyon down which flows Goldsmith creek, a tributary of the Incomappleux river, on the north-west slope of Goat mountain. The floor of this canyon is very steep, and in the winter-time is swept by snow-slides. The east side of the canyon is a sheer rock wall 1,000 feet high, having an average slope of 60 degrees. The west side rises in three benches, upon the tops of which there is a slight growth of brush and stunted trees.

The formation is a green chloritic schist and a dark crystalline limestone. The ore-body occurs in a heavily mineralized limestone-belt lying between bands of the chloritic schist. The west schist-belt is over 100 feet wide and is in turn bounded on the west by a dark-coloured schistose lime. The easterly chloritic schist is only about 20 feet wide, in places much narrower, and lies next to a great width of crystalline limestone ranging in colour from a cream to a dark blue, which forms the precipitous east wall of the canyon. The mineralized lime-belt, or *Big Showing* lead, as it is locally called, forms the lower bench on the west side of the creek above referred to. At various places along the outcrop shots have been put in and a little stripping done, showing it to have a width of from 10 to 40 feet, to be of a schistose structure, dark in colour, containing patches of chloritic schist, and irregularly mineralized with iron pyrites, galena, and zinc-blende. It has a course of N. 35° to 40° E., with a dip of 50 degrees easterly, and is cut by a series of joint planes having a strike of N. 60° E., with a steep westerly dip. The mineralization is not uniform throughout the rock, but is heavier along the joint planes. This lime-band has been subjected to a great deal of pressure and crushing. Along the joint planes and along the schist walls the rock is slickensided in many places.

At an elevation of 5,525 feet, where the outcrop has been stripped, the mineralization is very pronounced, and a good deal of galena can be seen disseminated through the rock. At an elevation of 5,025 feet an adit has been started on the *Big Showing* lead and has been driven for a distance of some 200 feet. The course of this adit is S. 10° E. and crosses the strike of the vein at an angle of 20 degrees, so that the greater part of the adit is in the foot-wall.

Two-thirds of the way in, a crosscut was made to the east in an endeavour to get back into the ore-body. In driving this crosscut a slip was encountered with a little ore on it, and, mistaking this for the "vein," crosscutting was discontinued and a drift started towards the south-east. From a rough survey it is evident that this crosscut was not continued far enough to reach the "vein," but still has to be driven 10 or 15 feet farther.

The workings are reached by a trail branching off from the *Scout* trail, and are in an exceedingly bad place for the workings of a mine, as the canyon is free from snow for only about three months of the year, and during the winter months is subject to snowslides at all times. No samples were taken for assay by the writer, as the small amount of work that has been done does not show anything definite in the shape of an ore-body.

McDOUGAL CREEK.

This creek enters the Incomappleux river about eighteen miles north of the head of the North-east arm of Upper Arrow lake, having its source in the glaciers at the summit of the Incomappleux-Illecillewaet divide, almost directly opposite the head of Albert creek. This is one of the steep-walled U-shaped valleys having a low gradient, excepting at its upper end, similar to that of the main Incomappleux valley.

McDougal creek roughly follows at its lower end the line of contact between the Lime Dyke series formation and granite, the latter crossing the Incomappleux river near the mouth of McDougal creek, across the spur of the mountain to Kellie creek, and then along the top of the divide between Kellie and Boyd creeks.

Tin.

Some two years ago a prospector discovered tin (cassiterite) in pegmatite float, and, not knowing what the mineral was, brought it out and showed it to an assayer. On being informed that it was tin ore, the prospector interested some Cranbrook gentlemen in the find, with the result that a party was sent up there and located six claims on what they called Crystal creek, a tributary of McDougal, which creek is pretty well up towards the head of the valley. For the past two seasons a consider-

able amount of prospecting has been done in this section looking for a commercial ore-body of the tin-bearing rock, but so far without success, which is partly due to the fact that those engaged in the search are not familiar with the mode of occurrence of tin ores.

While several discoveries of tin-bearing rock have been made on the North American continent, there is as yet no mine making a regular production, nor are there many localities in which tin has been discovered at all. The majority of the commercial tin-deposits of the world occur in, or associated with, granite containing lepidolite or lithia mica, a light-grey or pinkish coloured mica with a pearly lustre. The mineral tourmaline, which usually occurs in black glossy columnar crystals, also occurs in the tin-bearing granites. Pegmatite dykes, which are often found cutting the granite, or as dykes in the adjacent formation, and greisen, are also favourable formations in which to look for tin ores. Pegmatite is essentially a coarse-grained rock composed of potash feldspar and quartz, with only a little mica, and that is usually very light in colour, and the scales are often crowded together in groups. Greisen is an alteration product of granite and is composed mainly of quartz and mica, the latter usually having a red or green tint. This is not a very plentiful rock, but is the formation in which tin has been found in the Black Hills of South Dakota.

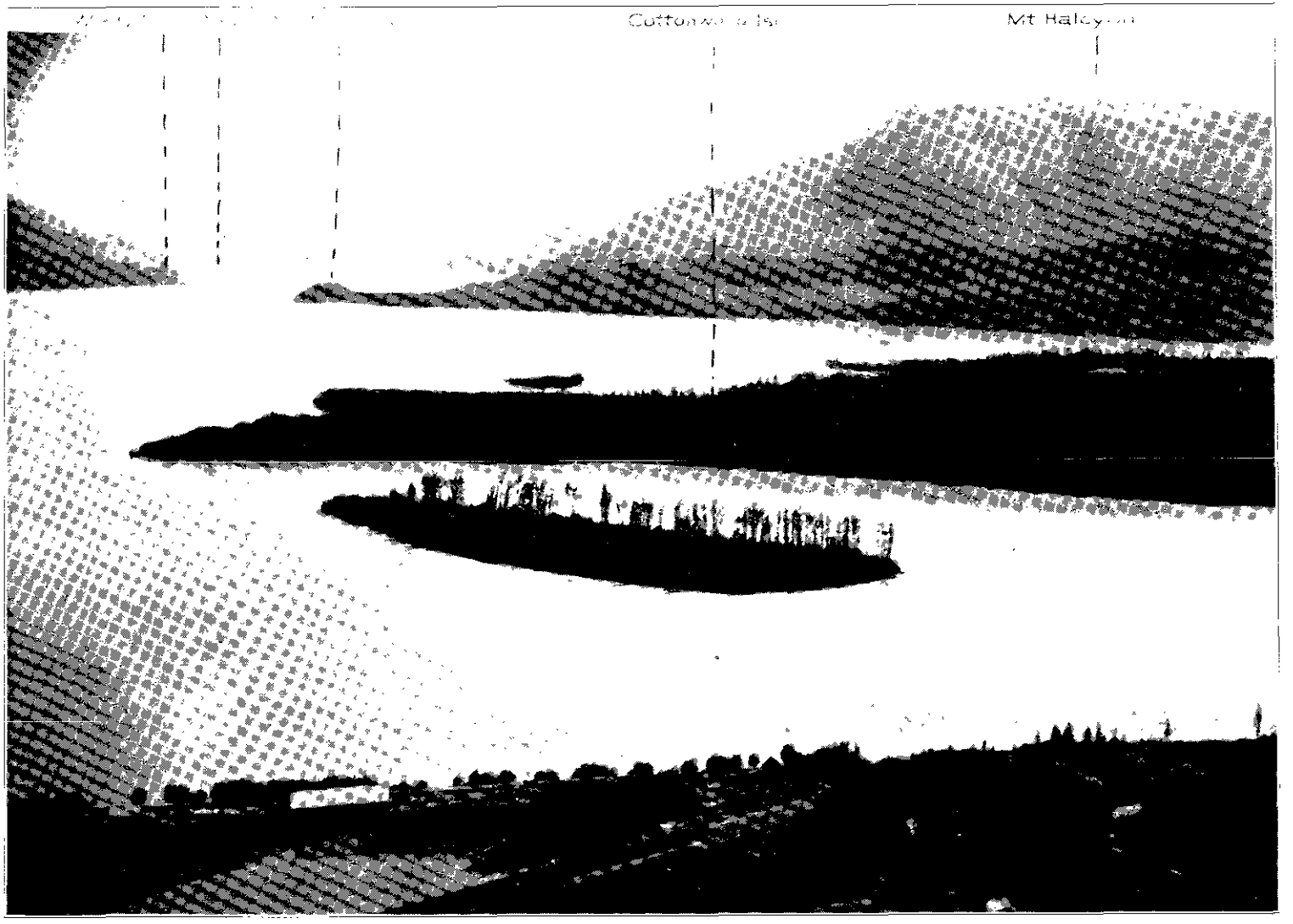
From the foregoing it will be seen that the place to search for workable bodies of tin ore is in the granite near its contact with the other rocks, because it is usually at these places that the pegmatite dykes occur.

About five or six miles up from the mouth of McDougal creek, on the north side, is a creek *having its source in a snow-field close to the summit on the east side of the* Illecillewaet-Incomappleux divide. This creek crosses the granites, and in the rocky debris brought down by it there has been found some pegmatite float containing cassiterite. Up near the head of the creek, at an elevation of close to 8,000 feet, there are some pegmatite dykes crossing the creek having an east-west strike with almost vertical dip. In width they vary from 4 to 10 feet, and the lower one, having a width of about 4.5 feet, shows a few scattered crystals of cassiterite and a little light-coloured pearly mica.

No serious work has been done on these dykes, all the energies of the prospectors being devoted to the finding of dykes containing tinstone in larger quantities. It was exceedingly difficult to obtain any information as to where they were prospecting, but apparently they have been working along the divide at the head of Albert creek, a tributary of the Illecillewaet, and Isaac creek (marked Akolkolex river on the maps), in addition to the headwaters of McDougal creek, but with poor success, as, beyond the discovery of some float and the previously mentioned dyke, no deposit of importance has yet been found.

This part of the country is an exceedingly difficult one to prospect in, the valleys and side-hills being covered with a dense growth of brush, devil's-club, and timber, with no trails, so that the question of getting from one place to another, where everything has to be carried on one's back, is a serious one; also, the formation is only exposed in the canyons and high up on the mountain-side, where for the major portion of the year it is buried under the snow. Under these circumstances prospecting becomes a difficult matter, and it is to be regretted that the prospectors engaged on this hunt for tin ore are so exceedingly mysterious, as the knowledge of geology would be of the very greatest assistance in ascertaining the most likely places in which to look for tin.

Owing to the small amount of cassiterite visible in the dyke above referred to, and to the fact that no work was being done upon it, no samples were taken for assay, as the writer had expected to make another trip up McDougal creek in company with one of the owners of the property to where it was believed a larger amount of tin-bearing rock had been discovered. Unfortunately, the prospectors in the field did not give sufficiently encouraging reports of what



Looking down Arrow Lake from Arrowhead, showing Delta Formation at Mouth of Columbia River.

they had accomplished during the months of June, July, and August to warrant the owner in making the somewhat arduous journey; therefore the second trip was never made, there being no one to act as guide to take the writer to the place where the work was done.

Beyond the fact that there is a belt of coarse-grained porphyritic granite extending in a general north-westerly direction across the Incomappleux river in the vicinity of Kellie and McDougal creeks, that associated with this granite and emanating from it are dykes of pegmatite and small areas of greisen, and that cassiterite has been found associated with the pegmatite, no further information is obtainable, but it is believed that the most promising localities in which to prospect are along the lines of contact between the coarse-grained granite, its dykes, and the adjacent rocks, also in the greisen.

ACKNOWLEDGMENTS.

In the making of the examination of the Lardeau District the writer is particularly indebted to the following gentlemen for assistance and information: Mr. A. H. Gracey, Mr. Cory Menhinick, Mr. T. V. Downing, Mr. E. B. Drew, Mr. O. T. Bibb, Mr. Geo. Goldsmith, Mr. Rowlands, and Mr. N. A. Wallinger.

LARDEAU MINING DIVISION.

GEOLOGICAL REPORT ON THE ARROWHEAD SECTION.

BY NEWTON W. EMMENS, M.E., 1914.

INTRODUCTION.

Natural gas and oil originate from the destructive distillation of organic remains (animal and vegetable) buried in marine, estuarine, or lacustrine sediments, which, when consolidated, form fossiliferous shales and limestones. These, when overlaid by sandstone or other porous rock act as a reservoir in which may be condensed and stored the gases emanating from the distillation of the organic remains contained in the shales and limestones, and the whole covered with impervious strata which acts as a seal and prevents the escape of the oil and gas, form a favourable formation in which to prospect for natural gas and petroleum.

Certain structural conditions are also necessary to the accumulation of oil and gas in a particular section of the porous strata; these are that the oil-bearing strata be bent into the form of an unbroken arch, or, as it is called, an anticline. The reason for this is that oil and gas, being much lighter than water, naturally accumulate in the upper portions of the strata, and unless prevented would flow out upon the surface and escape.

From our present knowledge of the subject, it may be stated that fossiliferous sedimentary rocks, overlain by porous and impervious strata, are necessary for the generation and storage of oil and natural gas, and that the "anticlines" are the locations in which will be found the largest reservoirs.

The more important of the world's petroleum and natural-gas fields occur in the marine sediments of the Ordovician and Devonian systems of the Palæozoic era; in the Cretaceous system of the Mesozoic era and in the Miocene sytem of the Cenozoic era. Oil-shales, from which oil is obtained by distillation, occur in the Carboniferous and Permo-Carboniferous rocks of the Palæozoic era and in the Miocene strata of the Cenozoic.

SUMMARY AND CONCLUSIONS.

The existence of inflammable gas in the vicinity of Arrowhead, on the Upper Arrow lake, twenty-seven miles south of Revelstoke, a division point on the main line of the Canadian Pacific Railroad, and in the delta formation of the Columbia River valley, north of Arrowhead,

has been known for several years, but no attempt has hitherto been made to definitely determine its source.

The recent discovery of petroleum and natural gas in Western Canada has caused attention to be directed to the Arrowhead section as a possible natural oil and gas field, and it was with a view to definitely ascertaining the possibilities in this connection that the present investigation was undertaken.

It is a fact that by analysis *alone* it is not possible to definitely determine the origin of a hydrocarbon gas coming from the ground; that is to say, as to whether it is being formed by the decomposition of modern organic matter (ordinary marsh-gas) or whether it comes from some ancient, underlying rock formation (natural gas). Analysis is, however, a guide, because oxygen occurs in very small quantities in natural gas* and is always present in quantity in marsh-gas. To emphasize this point the following analyses of samples of natural gas from two widely separated fields and one of marsh-gas are given :—

	Natural Gas.		Marsh-gas.
	Ontario.	Ohio.	
	Per Cent.	Per Cent.	Per Cent.
Carbon dioxide	2.34	0.26	2.77
Carbon monoxide	None	0.50	None
Hydrogen	None	2.18	None
Methane	95.00	92.61	92.30
Ethane (olefines)	None	0.31	None
Nitrogen	2.56	3.61	2.43
Oxygen	None	0.34	3.50

These analyses are virtually the same, except for the difference in the percentage of contained oxygen. In order, therefore, to definitely determine the source and origin of such gas, the geological conditions existing in the field in which it occurs must be studied.

The rocks occurring in the Arrowhead area are a series of metamorphosed volcanics and sediments, belonging to the Pre-Cambrian era, underlaid, cut, and intruded by igneous batholiths, dykes, and sills of Pre-Cambrian age. Overlying these are another series of metamorphosed sediments also of Pre-Cambrian age, but younger than the intrusives. Of these formations, the Archæan and igneous rocks occupy the greater area.

Extensive deposits of fluvatile and lacustrine sediments (unconsolidated) occupy the Columbia River valley and the valleys of Cranberry and Little Cranberry creeks. These deposits contain much organic matter in the form of wood, twigs, leaves, seeds, etc., by the decomposition of which much gas would be formed.

Numerous "showings" of gas occur in the district, but only where there are deposits of sand and silt or where marshy land exists. No evidence of oil or "oil-seepages" exist in the district. The irridescent scum which forms upon the surfaces of some of the marshy pools and sloughs, and which has been taken for oil, is a thin film of iron oxide and has not the remotest connection with petroleum.

The gas samples taken from three separate places in the Arrowhead area show by analysis that they contain from 3.2 to 6 per cent. of oxygen, which suggests a *marsh-gas;* this suggestion is strengthened by the fact that the sediments from which the gas comes contain much decaying vegetable matter and are constantly saturated with water, most of the valley-fill being at all times below the water-level of the river and lake.

* Bulletin No. 19, United States Geological Survey, p. 46.

There are no fossiliferous rocks in the district from which petroleum or natural gas might emanate, nor are there any porous rocks to act as a reservoir for the storage of oil or gas. The strata are all badly crushed, plicated, and folded, and dip mostly at steep angles.

In view of these facts the following conclusions have been arrived at:—

(1.) The gas which occurs on the Hall ranch and other places in the Arrowhead area is *marsh-gas.*

(2.) Neither petroleum nor natural gas exist in the district.

AREA.

The area covered by this report embraces the territory bordering the Upper Arrow lake north from Albert point, the North-east arm, and the valley of the Columbia river as far north as the 23-mile post on the Arrowhead branch of the Canadian Pacific Railroad. Excursions were made from a number of points along the shore of the lake and river, back into the hills, for the purpose of tracing out the formations, in order to secure the data necessary for the construction of a geological map of the district.

TOPOGRAPHY.

The Upper Arrow lake and its North-east arm occupy a deep narrow valley, bordered by high, steep-sided mountains, the higher peaks of which attain elevations of 6,000 to 7,000 feet above sea-level, and are crowned by glaciers and fields of perpetual snow. Their slopes are well timbered with cedar, spruce, and hemlock to elevations of 5,000 feet, and with hemlock and balsam for an additional 1,000 feet. Their summits, except where occupied by glaciers or snow-fields, or consisting of bare rock, are clothed with heather and alpine varieties of grasses and flowers, with a few scattered, stunted balsam trees.

The region has been subjected to intense glacial action, the mountain spurs which project into the valley being truncated, cirques carved in the sides of the higher mountains, and the lower ridges rounded and planed off; glacial erratics are met with not only along the shores of the lake and in the valleys, but also on the summits of the peaks. Snowslides are of frequent occurrence in winter down the steep slopes, from which they have swept the timber, leaving long "scars" to mark their course.

The Upper Arrow lake and its north-east arm are long, narrow, fiord-like bodies of water, with steep rocky shores. Soundings taken at different places along the centre line of the lake show it to be very deep, ranging from 300 feet off the town of Arrowhead to 550 feet east of Whiskey point, on the North-east arm, and even greater depths are obtained along the main lake.

The Columbia river, flowing southward from Revelstoke, on the main line of the Canadian Pacific Railroad, enters the head of the lake at Arrowhead, where it is forming a delta and gradually filling up the lake. A sand-bank extends south-east from Cottonwood island and north-west from Sawmill point, formed by the sediment brought down by the river, a large part of which is dry land during the period of low water. In a similar manner the head of the North-east arm, where there also exists a considerable area of delta land, is being silted up by the sediments brought down by the Incomappleux river.

GENERAL GEOLOGY.

The oldest rocks in the region examined belong to the Archæan era, and consist of thoroughly metamorphosed volcanic and sedimentary rocks comprising mica-schists, hornblende-schists, hornblende-mica schists, coarsely crystalline limestones, and quartzites, under-

laid by granite, cut and intruded by granitic dykes and sills of Pre-Cambrian age. The entire complex is classified as belonging to the Shuswap series.*

Overlying these is a series of calcareous schists, phyllites, quartzites, and limestones belonging to the Nisconlith or Selkirk series, also classified as being of Pre-Cambrian age.†

Superficial deposits consist of glacial drift and erratics, gravel and sand of the river deposits, and lacustrine gravels, sand, clay, and silt.

DETAILED DESCRIPTION.

The rocks of the Shuswap series are most extensively developed in the Arrowhead area; they form the escarpment back of the town of Arrowhead up to an elevation of 4,400 feet above sea-level, extend up both sides of the North-east arm of Upper Arrow lake for a distance of six miles, and form both sides of the main lake as far south as Halcyon, and probably farther. Northward the series forms both sides of the Columbia River valley to Revelstoke, as well as forming the ridge, which extends in a north-westerly direction from Bannock point, which in this report is spoken of as Bannock ridge.

The granite underlying the series is a fine-grained, light-coloured rock ranging from a hornblende-biotite granite on Sawmill point and at Arrowhead to a two-mica granite at Bannock point. The prevailing strike of this granite intrusive is N. 60° W., with a dip of 30 degrees to the north-east. The intrusive sills and dykes occurring in the schists are very numerous, and consist of a fine-grained granite gneiss, biotite granite, and aplite, the latter also forming dykes of some size which cut the granite on Bannock point and the schists on the west side of the North-east arm, north of Whiskey point.

Arrowhead.—At the base of the Shuswap series where that formation makes contact with the main granite-mass, detached schist fragments completely engulfed in the granitic magma occur. An example of this is to be seen above the road near the Arrowhead mill.

The escarpment back of the town (Sec. E-F), up to an elevation of 3,750 feet above sea-level, consists of mica (mainly quartz-biotite) schists, cut and interleaved by granitic dykes and sills, the latter varying from a thickness of less than an inch to that of several feet. Blocks of the mica-schist are sometimes entirely surrounded by the intrusive granite, especially towards the base of the escarpment. The schists are also much faulted and twisted by the intrusive. A number of readings were taken of the strike and dips of these schists, the average of which was a strike N. 70° E., dip 20 degrees to the north-west. A series of master joints cut both the schists and the granite; they have a strike of N. 35° E. and a dip of 70 degrees to the south-east.

Towards the top of the second bluff of the escarpment the schists are quite calcareous, and in the upper part of the third bluff, above the 3,720-foot level, quartz-biotite schists predominate. These schists contain a few crystals of garnet and have a strike of N. 80° E., with a dip of 20 degrees to the north; they are cut by two series of joints, the master series having a strike of N. 20° W. and a dip of 70 degrees to the south-west, and the other having a strike of N. 20° E. and a dip of 60 degrees to the south-east.

Along the railroad north of Arrowhead the rocks are exposed in a number of cuts. From the station to the 26-mile post the rock consists of a fine-grained hornblende-biotite granite containing schist inclusions and cut by a series of joints having a strike of N. 30° E. and a dip of 75 degrees to the south-east.

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* Dawson, G. M. Ann. Rep., 1888-89, Geol. Surv. Can., p. 9 *et seq.* Daly, R. A. Sum. Rep., 1912, Geol. Surv. Can., p. 157. Brock, R. W. Sum. Rep., 1903-4, Geol. Surv. Can., p. 53.

† Daly, R. A. Sum. Rep., 1912, Geol. Surv. Can., p. 159. Dawson, G. M. Ann. Rep., Vol. 4, Geol. Surv. Can., p. 9.

In a cut near the 26-mile post the rock exposed is a mica-schist cut and intruded by granite. This is close to the base of the schists and the intrusive rock predominates. Eleven hundred feet to the north the schists predominate, and the intrusive occurs mainly as narrow sills between the bedding-planes of the schists. The strike of the formation here is N. 60° W. with a dip of 55 degrees to the north-east.

Continuing to the north, the angle of dip rapidly becomes steeper till it becomes vertical 1,500 feet south of the 25-mile post, and in a cut just beyond the dip is in the other direction. Here the formation is a quartz-biotite schist seamed with quartz stringers and containing garnet crystals, and having a strike of N. 60° W., with a dip of 55 degrees to the south-west.

Near the 24-mile post, a short distance east of the railroad-track, is an exposure of crystalline limestone, in comparatively thin beds, varying in colour from a dark grey to almost white and containing mica, which is particularly prevalent along the bedding-planes and joints. The strike of the beds is N. 60° W., with a dip of 35 degrees to the south-west, which are cut by a series of joints having a strike of N. 25° E. and a dip of 60 degrees to the north-west. South of this limestone is a belt of hornblende-biotite schist having a similar strike and dip.

North-east Arm.—The formation is well exposed along both shores of this part of the lake, forming in many places precipitous bluffs rising from the water's edge. The contact between the main body of the granite (with schist inclusions) and the overlying quartz-biotite schist crosses the arm, about a quarter of a mile east of the Arrowhead mill, in a south-easterly direction, and shows on the opposite shore two miles north-easterly from Sawmill point. The quartz-biotite schist, on the north side of the lake, forms a precipitous bluff rising over 1,500 feet from the water's edge. It is a bronze weathering, coarsely crystalline, glistening rock, containing subordinate muscovite and calcite. It is intruded by sills of a pink-tinted muscovite granite which have a strike of N. 45° W. and a dip of 45 degrees to the north-east. The strike of the schists is N. 65° W., with a dip of 50 degrees to the south-west; they are cut by a series of joints having a strike of N. 40° W., with a dip of 50 degrees to the south-west. This formation outcrops on the south side of the lake, where it exhibits the same general characteristics with regard to composition, but is here much plicated and is evidently close to the axis of a synclinal fold.

Near Whiskey point is a band of quartz-muscovite schist containing crystals of hornblende. This is a glistening, coarsely crystalline rock having a strike of N. 50° W. and a dip of 55 degrees to the south-west, and cut by a series of joints having a strike of N. 45° W. and a dip of 32 degrees to the north-east. At Whiskey point these schists have a strike of N. 80° W. and a dip of 60 degrees to the south-east, with joints which strike N. 10° E. and dip 63 degrees to the east. A quartz vein 15 inches wide, having a strike of N. 70° E. and a vertical dip, cuts across the schists near the extremity of the point; this vein is mineralized with pyrite and pyrrhotite and has had a prospect-shaft sunk on it to a depth of some 20 feet; it does not appear to be of any commercial value. On the opposite side of the lake, on the south side of Blind bay, this formation contains some lime and more biotite, giving it a darker colour. It is also in a close anticlinal fold, the axis of which has a strike of N. 45° W., and the limbs of which dip 50 degrees to the north-east and 60 degrees to the south-west respectively. Here the formation is cut by a series of joints having a north-south strike and a dip of 60 degrees to the west.

North of Whiskey point is a belt of finely crystalline hornblende-mica schist. This rock has a dark, almost black, colour and a slaty structure; in fact, when viewed from a distance, might easily be mistaken for a slate. It has a strike of N. 60° W., with a dip of 45 degrees to the south-west, and is cut by a series of joints having a strike of N. 10° W. and a dip of 84 degrees to the south-east. This formation appears to be represented on the south side of the

lake, near the head of Blind bay, by a narrow, much-plicated band of dark, greenish-coloured calcareous schists (not shown on the map) which have a general north-south strike and westerly dip; they are too much contorted to get accurate courses.

Adjoining the finely crystalline hornblende-mica schist on the north-east, north of Whiskey point, is a broad belt of coarsely crystalline, shining biotite-schists, quartzose, and cut by a number of granite dykes near their south-west boundary, and merging into a calcareous biotite-schist to the north-east, with a slight development of graphite along the bedding-planes.

The granitic (aplite) dykes have a strike of N. 60° W., with a dip of 55 degrees to the south-west; they are sparingly mineralized with pyrite and a little galena, and are cut by small quartz veins having an east-west strike and dip of 55 degrees to the south. The schists have a strike of N. 80° E. and a dip of 60 degrees to the south-east, cut by joints having a strike of N. 10° W. and a dip of 45 degrees to the north-east.

On the opposite side of the lake this formation is represented by a plicated series of calcareous biotite-schists which show in a bluff forming the eastern shore of Blind bay. Near the base of the bluff the schists are intruded by granitic sills and dykes having a course of N. 60° E. and a dip of 30 degrees to the south-east. The schists have a general strike of N. 10° W. and a dip of 30 degrees to the east, cut by joint planes having a strike of N. 70° W. and a dip of 60 degrees to the north. These calcareous biotite-schists are believed to represent the top of the Shuswap series in this district, as they are directly overlain by a greenish-grey calcareous schist (phyllite) charged with films of sericite mica, which in turn is overlaid by a crystalline limestone followed by a dark carbonaceous phyllite. These are taken to represent the basal members of the Nisconlith or Selkirk series.*

The grey-green phyllites on the north side of the lake have a strike of N. 65° W. and a dip of 55 degrees to the north-east. This formation contains bunches of siliceous limestone in which occasionally occur clear calcite crystals, and is cut by an aplite dyke having a strike of N. 75° W. and a dip of 55 degrees to the south-west. On the opposite side of the lake this phyllite contains scattered crystals of pyrite, and has a strike of N. 45° W., with a dip of 35 degrees to the north-east, cut by a series of joint planes having a strike of N. 30° E. and a dip of 65 degrees to the north-west.

The belt of limestone consists, on the north side of the lake, of a light-coloured, finely crystalline, siliceous rock merging into a dark, coarsely crystalline, micaceous, calcareous schist having a strike of N. 65° W. and a dip of 55 degrees to the south-west, cut by a series of joint planes having a strike of N. 45° W. and a dip of 55 degrees to the north-east. This limestone near its northern border is cut by narrow quartz veins having a strike of N. 60° E. and a dip of 56 degrees to the south-east. Near this quartz is a little pyrite and galena in the minute cracks in the rock. On the south side of the lake this limestone is micaceous and coarsely crystalline. It has a strike of N. 45° W. and a dip of 80 degrees to the south-west; it is cut by two series of joints, one having an east-west strike and dip of 60 degrees to the north, along which occur quartz stringers, and the other having a strike of N. 30° W. and a dip of 70 degrees to the north-east. Immediately adjoining the lime on the north-east is a narrow band of green schist containing pyrite, followed by a belt of calcareous quartzite and another narrow band of green schist. The quartzite has a strike of N. 45° W., with a vertical dip. It contains pyrite with a development of mica along the joint planes, of which there are two sets, one having a strike of N. 50° E. and a dip of 20 degrees to the north-west, and the other having a north-south strike and a dip of 80 degrees to the west. Near the contact between the quartzite and green schist, on the south, is a zone of mineralization, 5 feet wide, following a fracture-plane having

*Daly, R. A. Sum. Rep., 1912, Geol, Surv. Can., p. 159.

a strike of N. 60° W. and a dip of 75 degrees to the south-west. An open-cut has been made along this mineralized streak for a distance of 15 feet, showing bunches of ore consisting of galena and pyrite in a quartz gangue.

The green schist which adjoins the quartzite on the north-east is cut by an aplite dyke 10 feet wide, having a strike of N. 45° and a dip of 70 degrees to the south-west. This dyke is mineralized to a slight extent with pyrite.

The dark carbonaceous phyllite which adjoins the limestone on the north side of the lake is apparently of sedimentary origin, as near its base (the limestone) it contains a band of conglomerate, consisting of quartzose pebbles, much flattened and squeezed, in an argillaceous cementing material which has been metamorphosed into a phyllite. This rock becomes finer in texture to the north-east, merging into a sandy calcareous phyllite. It has a strike of N. 70° E., with a dip of 50 degrees to the south-east, with a series of joint planes having a strike of N. 25° W. and a dip of 65 degrees to the north-east. On the opposite side of the lake this formation is represented by a sandy carbonaceous phyllite, markedly calcareous in places, having a strike of N. 60° W. and a dip of 75 degrees to the south-west. Here the band of conglomerate is absent.

Bannock Ridge.—This is a comparatively low, rounded ridge extending in a north-westerly direction from Bannock point for a distance of four miles and a half (Sec. C-D), separating the valley of Little Cranberry creek from Arrow lake. Up to an elevation of 1,920 feet above sea-level the rock is a fine-grained granite which in places has a gneissic structure. Near the southern end of the ridge an aplite dyke, having a strike of N. 45° E. and a south-easterly dip, cuts the granite. The granite is also cut by two sets of joint planes, one of which has a strike of N. 65° E., with a dip of 40 degrees to the north-west, and the other having a strike of N. 20° E., with a dip of 35 degrees to the south-east. Above the 1,920-foot level, to the summit of the ridge at an elevation of 2,220 feet above the sea-level, the granite contains many inclusions of hornblende-mica schist. In some instances the bordering line between the schist fragment and the granite is very distinct; in others it is not visible, the one rock merging into the other owing to the partial absorbing of the schist fragment in the engulfing magma. The schist fragments vary in strike from N. to N. 20° W. and in dip from 17 to 40 degrees to the west.

West Side of Upper Arrow Lake.—On the west side of Upper Arrow lake for a distance of three miles south of Bannock point the rocks exposed along the shore consist of muscovite-biotite schist, hornblend-mica schist, and a calcareous hornblende-schist, all having a north-south strike and dips varying from 10 to 35 degrees to the west. They are cut by joint planes having an east-west strike and dip of 80 to 85 degrees to the south. These schists are cut and intruded by narrow granitic dykes and sills.

On the opposite side of the lake, from Albert point north to Sawmill point, the formation consists of fine- to medium-grained granite, containing mica-schist and hornblende-mica schist inclusions.

Superficial Deposits.—These consist of glacial, fluvatile, and lacustrine deposits.

The valley of the Columbia river for a distance of several miles north-west of Arrowhead was originally occupied by a northerly extension of the Upper Arrow lake, when its level was a great deal higher than it is at the present time, and was gradually silted up by the enormous quantities of sediment annually brought down by the river until the valley was reclaimed as far south as Arrowhead. This silting-up of the lake-bed is still going on, as is shown by the gradual extension of the sand-banks formed and forming south of the present point at which the river enters the lake. The wearing-down of the barrier at the exit of the lake gradually lowered its level, so that the reclaimed portion of the lake-bed was raised above the level of

the water. During this period the river cut for itself a channel through the sediments it had previously laid down. In this manner were formed the extensive alluvial flats which constitute a large portion of the Columbia River valley north of Arrowhead and which are now being brought under cultivation.

In the sediments deposited by the river were quantities of wood, twigs, leaves, and other vegetable matter, with probably the remains of fish and animals.

The valleys of Cranberry and Little Cranberry creeks were filled in a like manner, assisted by modified glacial materials, probably laid down by the streams issuing from valley glaciers contemporaneous with their retreat. Such deposits are well shown in the valley of Little Cranberry creek, where the present stream has cut a deep channel in the valley-fill, exposing the well-stratified bedded sands, gravel and silt characteristic of such deposits.

How deep the alluvial deposits filling the Columbia valley in the Arrowhead section are is unknown, but judging from the slopes of the bounding mountains they are undoubtedly hundreds of feet thick.

Structural Geology.

The formations bordering upon the North-east arm, the Upper Arrow lake, and the Columbia river, within the area covered by this report, have been much disturbed by the granitic intrusions and consequent minor faulting and folding.

Along the Columbia river, as shown in the railroad-cuts between the 24- and 25-mile posts, is a compressed synclinal fold the axis of which has a north-west and south-east strike.

Along both sides of the North-east arm the rocks show every evidence of intense folding and consequent local crumbling and plication of the strata, accompanied by minor faulting. The axes of all the folds have a north-west and south-east strike.

In the high bluff on the north side of the lower part of the North-east arm, west of Whiskey point, the strata show a compressed anticlinal fold overthrown in a south-westerly direction.

Other portions of the area are occupied by the granite intrusive, with its schist inclusions, and by the alluvial deposits.

Gas Phenomena.

Arrowhead.—In the slough in front of the town, shown in the lower left-hand corner of Fig. 1, gas-bubbles can frequently be seen rising through the water, and when the silt forming its bottom is probed with a rod the flow is momentarily increased.

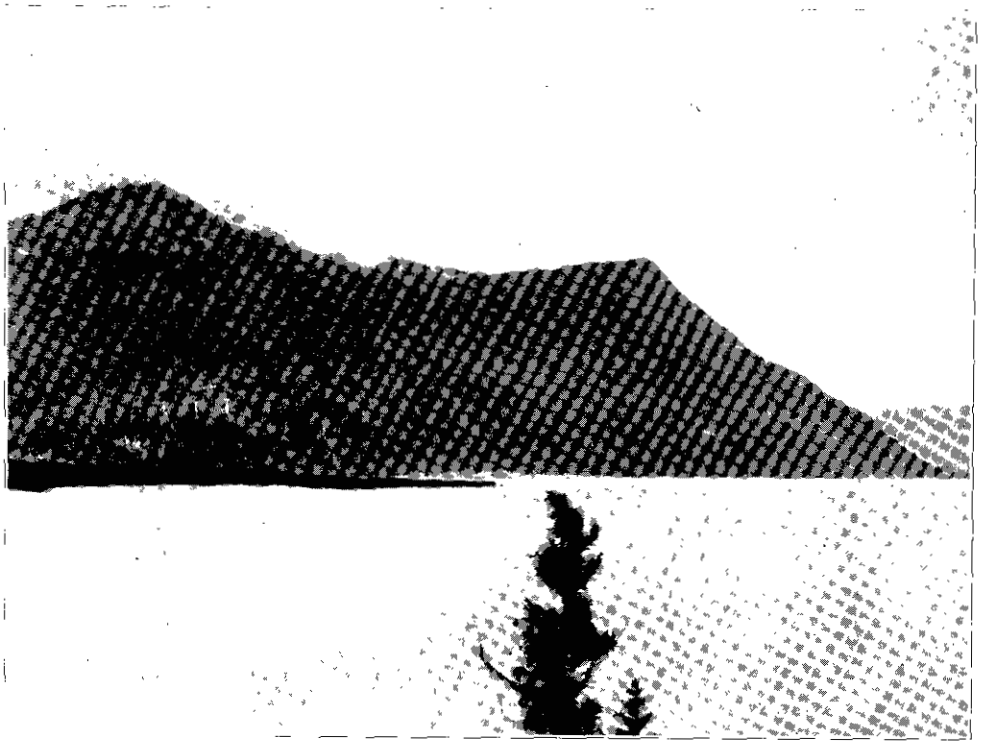
Gas-bubbles can often be seen rising along the edge of a swampy place immediately above the railroad-track, a short distance east of the station, where a row of piles has been driven to prevent the earth and rocks from sliding on to the road-bed, which here crosses the base of an old earth and rock slide.

In a marshy place back of the school-house up on the hill, gas-bubbles were noted rising through the water in a stagnant pool.

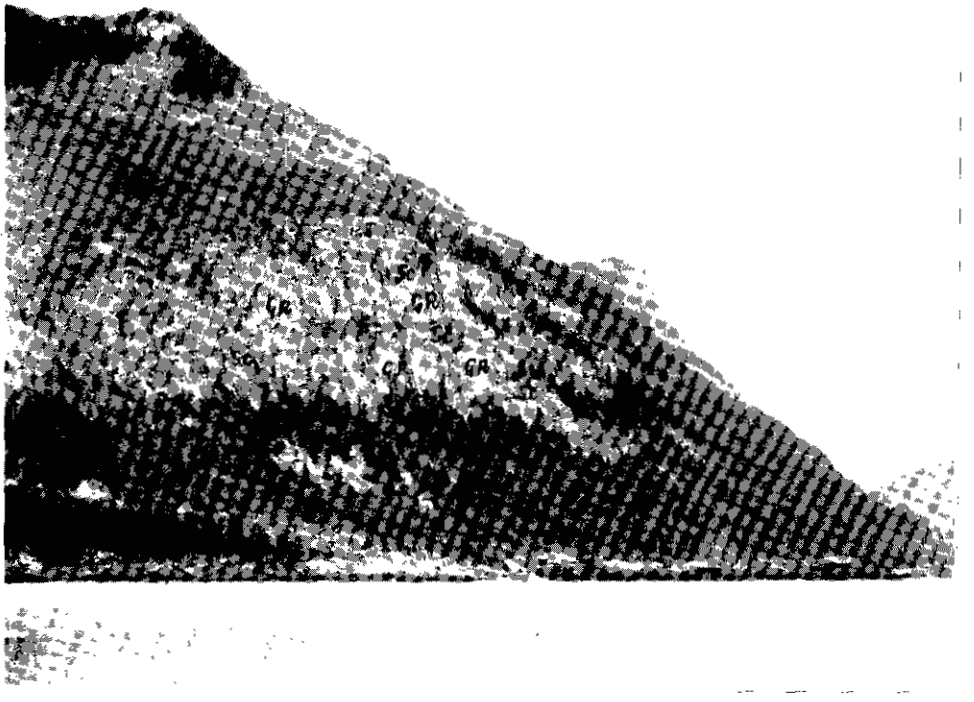
Lake.—It is not an uncommon thing to see streams of bubbles rising through the water, out in the lake, around Sawmill point, south-west of Cottonwood island, and off the entrance to the North-west arm.

Bannock Point.—In a number of places, in the shallow water of the beach, along the north-west shore of bannock ridge, gas-bubbles can be seen rising through the water.

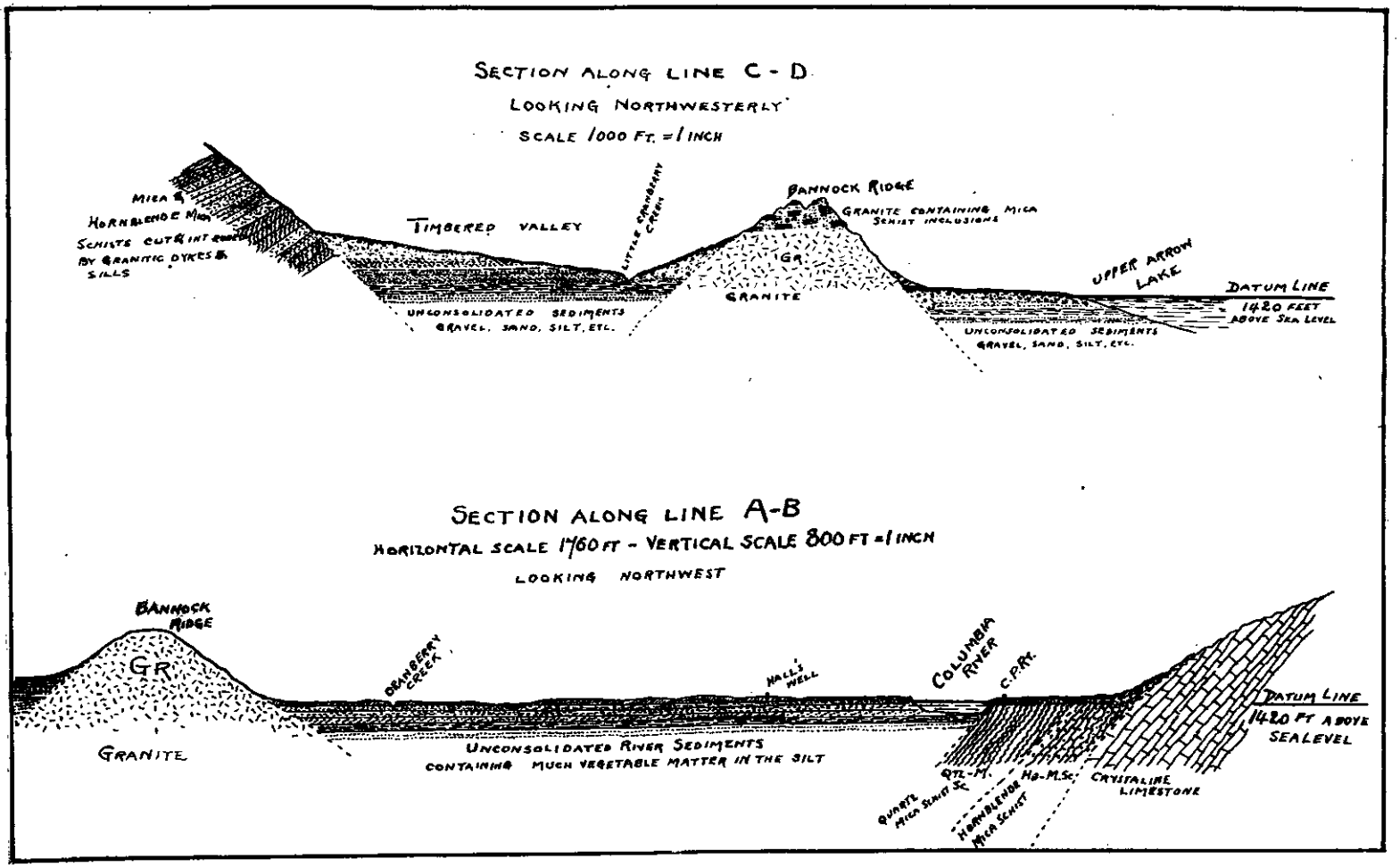
North-west Arm and Cranberry Creek.—Streams of gas-bubbles are often seen rising not only close to the shore-line, but also out in the lake. In a number of places along the margin of the arm and lower portion of the creek gas-bubbles can be seen rising through the shallow water.

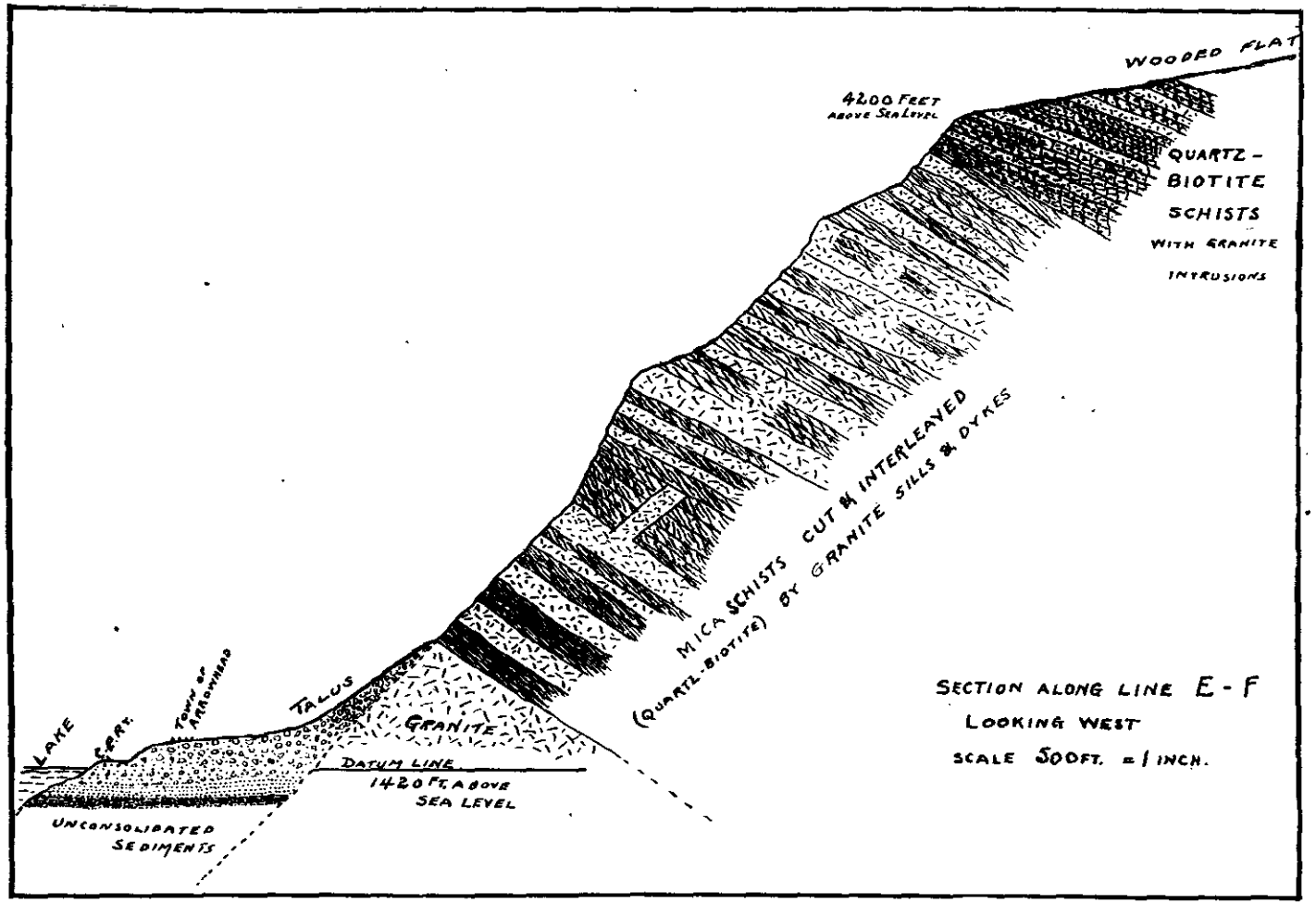


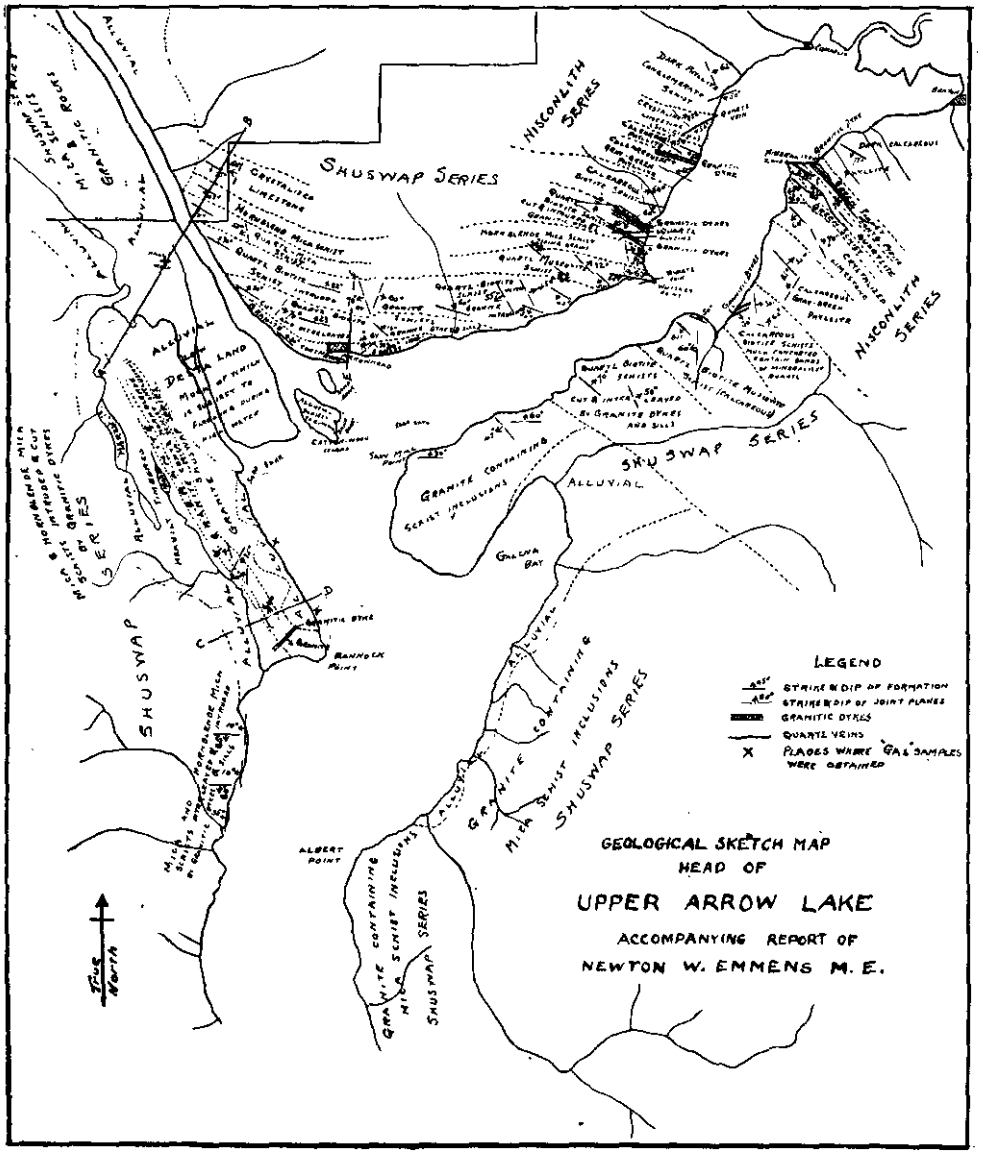
Sprout Mountain and Arrowhead from Bannock Ridge—Lardeau M.D.



Escarpment behind Arrowhead, showing Granite Intrusions in Schists—Lardeau M.D.

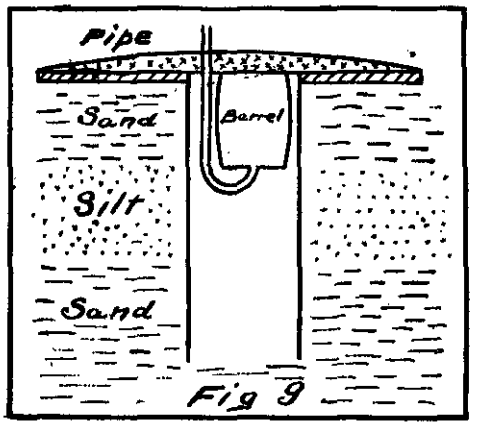

SECTION ALONG LINE C - D
LOOKING NORTHWESTERLY
SCALE 1000 FT. = 1 INCH
MICA & HORNBLENDE MICA SCHISTS CUT & INTRUDED BY GRANITIC DYKES & SILLS
TIMBERED VALLEY
LITTLE CARMENAY CREEK
BANNOCK RIDGE
GRANITE CONTAINING MICA SCHIST INCLUSIONS
GR
GRANITE
UNCONSOLIDATED SEDIMENTS GRAVEL, SAND, SILT, ETC.
UPPER ARROW LAKE
DATUM LINE
1420 FEET ABOVE SEA LEVEL
UNCONSOLIDATED SEDIMENTS GRAVEL, SAND, SILT, ETC.
SECTION ALONG LINE A-B
HORIZONTAL SCALE 1760 FT - VERTICAL SCALE 800 FT = 1 INCH
LOOKING NORTHWEST
BANNOCK RIDGE
GR
GRANITE
BRANBERRY CREEK
HALL'S WELL
COLUMBIA RIVER
C.P.R.
UNCONSOLIDATED RIVER SEDIMENTS CONTAINING MUCH VEGETABLE MATTER IN THE SILT
QUARTZ MICA SCHIST Sc.
QTZ-M.
HORNBLENDE MICA SCHIST
Hb-M.Sc.
CRYSTALINE LIMESTONE
DATUM LINE
1420 FT ABOVE SEALEVEL


WOODED FLAT
4200 FEET
ABOVE SEA LEVEL
QUARTZ-
BIOTITE
SCHISTS
WITH GRANITE
INTRUSIONS
MICA SCHISTS CUT & INTERLEAVED
(QUARTZ-BIOTITE) BY GRANITE SILLS & DYKES
TALUS
GRANITE
LAKE
TOWN OF
ARROWHEAD
DATUM LINE
1420 FT. ABOVE
SEA LEVEL
UNCONSOLIDATED
SEDIMENTS
SECTION ALONG LINE E-F
LOOKING WEST
SCALE 500 FT. = 1 INCH.

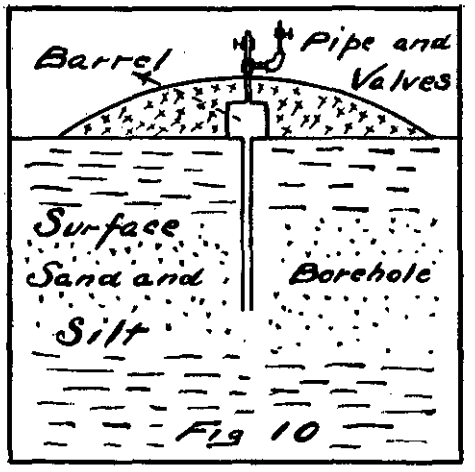

SHUSWAP SERIES
NISCONLITH SERIES
ALLUVIAL
GRANITIC ROCKS
SHUSWAP
GALENA BAY
BANNOCK POINT
ALBERT POINT
TRUE NORTH
LEGEND
STRIKE & DIP OF FORMATION
STRIKE & DIP OF JOINT PLANES
GRANITIC DYKES
QUARTZ VEINS
PLACES WHERE GAL SAMPLES WERE OBTAINED
GEOLOGICAL SKETCH MAP
HEAD OF
UPPER ARROW LAKE
ACCOMPANYING REPORT OF
NEWTON W. EMMENS M. E.

Hall's Ranch.—On this ranch, which comprises Lot 440, on the ancient flood-plain of the Columbia river, three miles north-west of Arrowhead, gas had been frequently seen rising in the sloughs. Some miniature mounds were noted near one of these sloughs, which were taken to be "gas-mounds," and were supposed to indicate the presence of a considerable body of natural gas beneath the ground. This belief was strengthened by an irridescent scum seen upon the surface of the water at the edges of the sloughs and apparently issuing from the ground; this was taken for a film of oil and was assumed to indicate the existence of mineral oil in the rocky strata underlying the alluvium. This scum is not oil, however, but is formed by an extremely thin film of iron oxide floating on the water, so frequently seen in marsh lands, and which ultimately settles to the bottom, forming the rusty-coloured mud (the brown hydrous peroxide of iron) which is found covering the bottom of the sloughs at those places.

Acting on the belief that underlying this section was a reservoir of natural gas and petroleum, N. F. and J. L. Hall started to dig a well, but only succeeded in reaching a depth of 14 feet when the inflow of water prevented further progress. As there was much gas bubbling up through the water covering the bottom of the hole, the well was boarded over; a barrel, from one end of which the end had been removed, was inverted immediately below the cover to act as a collecting-tank, and into this barrel a $\frac{1}{4}$-inch pipe introduced, the other end being allowed to project above the surface of the ground; the dirt excavated from the well was then piled up around the pipe and over the cover of the well, so as to prevent the escape of gas as much as possible, except what passed out through the pipe (Fig. 9.) The gas issuing from this pipe is of sufficient volume to maintain a flame 8 inches high, but is under no pressure, it being necessary to shield the pipe from the wind, as the flame is easily blown out.



Thinking to get a greater depth, a second well was sunk 25 feet south of the first. This second well was bored with a post-hole auger, but it was found impossible to carry it any deeper than the first without casing, because the sand came in with the water and filled it up as fast as it was dug below the water-level. All attempts to sink it below water-level for the time being were abandoned, and the hole was covered with an inverted half-barrel, into the end of which had been screwed a 1-inch pipe. In this pipe was screwed a valve and below it was placed a tee, into the side opening of which a $\frac{3}{8}$-inch nipple, L, pipe, and stop-cock was screwed. The object of the valve and stop-cock was that by closing them the escape of gas would be prevented and it would be allowed to accumulate in the well under pressure. The dirt excavated in making the hole was piled up around the barrel and pipe to prevent the gas escaping between the barrel and the collar of the hole (Fig. 10).



The closing of the valves in the pipes was successful in preventing the escape of gas, but it did not attain any pressure in the borehole. On opening the valve and lighting the issuing gas, a flame 8 or 10 inches high can be obtained, but the gas is under no pressure and the flame is easily blown out.

GAS SAMPLES.

In order to have some guide as to the nature of the gas from the Arrowhead area, three sets of samples were taken from three different places.

The first sample was taken from the "Hall" well, marked "Sample H." An attempt was made to take this by placing a rubber tube over the pipe projecting above the ground, leading the free end into a pail of water and beneath the submerged neck of a bottle, previously filled with water. It was found impossible to secure a sample in this manner, as the gas was not under sufficient pressure to overcome the resistance of the water. The bottle was then emptied of water and placed directly over the pipe and the gas allowed to flow into it until the air was completely replaced by gas. This was ascertained by applying a match to the gas issuing from the neck of the bottle, between it and the pipe, and when this was sufficiently free from air to burn freely it was considered that the air in the bottle had been completely replaced by the gas.

This method proved successful, and the sample was analysed by G. S. Eldridge & Co., assayers and chemists, Vancouver, who reported it to contain:—

	Per Cent.
Paraffin (methane)	90.7
Olefines (ethane, etc.)	1.0
Carbon dioxide	1.1
Oxygen	3.2
Nitrogen, etc	4.0

The second sample marked "C," was obtained from the lake-shore, about a mile above Bannock point, where a stream of gas-bubbles was noted rising through the water. This sample was obtained by placing a tin funnel over the place where the gas was rising through the gravel forming the shore below the surface of the water, filling a bottle with water, inverting it over the neck of the funnel (under water), and allowing the rising gas to displace the water in the bottle. When filled with gas, the stopper was put in the bottle while still submerged, and it was then lifted from the water, the stopper and neck carefully wiped dry and dipped in melted paraffin-wax, thus sealing the bottle and preventing any escape of its contents.

An analysis of this sample was made by G. S. Eldridge & Co., who reported as follows:—

	Per Cent.
Paraffin (methane)	84.6
Olefines (ethane, etc.)	2.0
Carbon dioxide	1.6
Oxygen	6.0
Nitrogen, etc	5.8

The third sample, marked "D," was obtained a few feet off-shore on the west side of Bannock point, about a quarter of a mile above the point. Here a stream of gas-bubbles was seen rising through the water, which was here 3 feet deep. In taking this sample a modified method of that used in obtaining sample "C" was adopted.

This sample was sent to Falkenburg & Laucks, chemists, of Vancouver and Seattle, Washington, U.S.A., for analysis. They reported that it contained:—

	Per Cent.
Saturated hydrocarbons (benzene, etc.)	None.
Olefines (unsaturated hydrocarbons)	None.
Carbon monoxide (CO)	None.
Carbon dioxide (CO_2)	1.3
Methane (CH_4)	30.2
Hydrogen (H)	61.3
Oxygen (O)	5.9
Nitrogen (N) by difference	2.2

The instructions to the chemists, accompanying the samples, were to analyse and determine by any method known to them whether the gas submitted was a *marsh-gas*, given off by the decomposition of modern vegetable matter, or whether it was what is commonly known as *natural gas* coming from an old formation.

In commenting on this point, G. S. Eldridge & Co., of Vancouver, say :—

"Sample 'C' is presumably natural gas, the low percentage of nitrogen and presence of olefines suggesting this."

And in connection with sample "H" the same firm says :—

"It is impossible to form an opinion as to the origin of this gas from the analysis."

Falkenburg & Laucks, of Seattle, Wash., say in connection with the sample "D" submitted to them for analysis :—

"Based upon the above results (the analysis), it is our opinion that the sample represents gas commonly known as 'marsh' gas, given off by the decomposition of modern vegetable matter. We base this opinion upon the absence of both saturated and unsaturated hydrocarbons."

ORIGIN OF THE GAS.

From the above it is evident that analyses alone are not sufficient to definitely determine the origin of a gas of this kind. The solution of the problem must, therefore, rest upon the geological conditions under which the gas occurs and the source from which it comes.

The greatest observed flow of gas in the Arrowhead area occurs on Hall's ranch; this, therefore, was selected as the best place to investigate the question of its origin. Sufficient geological data was gathered to enable a geological section of the Columbia River valley to be made on a line passing through the Hall well, section A-B on the map. As will be seen from an inspection of the map and section A-B, the solid formation in this section consists wholly of igneous and crystalline, highly metamorphosed rocks of the Archæan era, and it is obvious from their structure and composition that they are not the sources of the gas.

The two "wells" sunk by Messrs. Hall on their ranch pass through layers of fine micaceous sand and silt, the latter so finely divided that when wet it has the appearance of a clay. An examination of the sand excavated in digging these wells shows it to contain much vegetable matter in the shape of little bits of wood, twigs, portions of leaves, seeds, etc., while the finer "silt" was found to contain rotting leaves in bunches and layers. From the nature of the formation of this part of the Columbia River valley-fill there is no reason to suppose that the vegetable matter is confined to the upper layers; on the contrary, it is to be expected that all the beds of gravel, sand, and silt contain vegetable matter, and probably here and there some animal remains. These deposits are of great thickness (hundreds of feet), and if the lower layers contain no more organic matter than is present in the upper, there is still ample to account for the gas which is being given off, and which is a marsh-gas, and has its source in the decomposition of the organic matter contained in the underlying sands, silts, etc., in the presence of water, with which this material is constantly saturated to within a few feet of the surface of the ground. This is further borne out by the fact that gas is only found in the swampy places along the shore-line where there are accumulations of sand and silt, or out in the lake over the sand-bars formed by the detritus brought down by the entering streams.

It may therefore be stated that natural gas and oil do not exist in the Arrowhead district, as not only is there no indication of their presence, but the geological conditions are most unfavourable to their formation.

That marsh-gas is being generated in quantity in the valley-fill of the Columbia river is a fact, but owing to the porous nature of the sediment in which it is being formed it probably escapes as rapidly as it is being made. It is impossible, therefore, that even by drilling deeper a flow of gas can be secured under sufficient pressure to be of any commercial utility.

SLOCAN DISTRICT.

AINSWORTH, SLOCAN, SLOCAN CITY, AND TROUT LAKE MINING DIVISIONS.

REPORT BY R. J. STENSON, GOLD COMMISSIONER.

I beg to submit the annual report for the Ainsworth, Slocan, Slocan City, and Trout Lake Mining Divisions for the year 1914 :—

The result of the year's work in the mining industry has not been normal, owing to the unsettled state of affairs during the latter part of the year arising through war conditions.

During the first six months of the year there was a noticeable improvement as compared with the same period of the previous year, and confidence was increased in the profitable exploitation of the numerous ore-bodies throughout the district. This was largely due to the successful operations of the Consolidated Mining and Smelting Company's properties in Ainsworth camp, and to renewed regular transportation facilities over the Kaslo & Slocan Railway.

Early in August the metal market was so unsettled that the local smelter found it impossible to continue purchasing ore, which caused the closing-down of several shipping mines. Towards the end of September arrangements were made whereby the smelter again accepted ore shipments, but the price and conditions offered, as might be expected under the circumstances, were unfavourable to the shipper and failed to revive the industry to what it was before the European war.

AINSWORTH MINING DIVISION.

The biggest shippers from Ainsworth Division in 1914 were the *Bluebell*, *No. 1*, and *Highland* mines, each with a comparatively large output. Next in importance, as regards quantity of ore shipped, were the *Maestro*, *Utica*, and Retallack & Co.'s *Whitewater* group. Eight or ten others shipped ore during the year, but in each case less than 100 tons.

Bluebell.

The New Canadian Metal Company operated the *Bluebell* mine and concentrating-mill until August, when the metal-market conditions necessitated a suspension of production. During the seven months the mine was worked about 50,000 tons of ore was mined and concentrated, and the product, nearly 4,400 tons of lead-silver concentrate, shipped to Trail. Development-work done in 1914 consisted chiefly of sinking to and opening the C level, which is 200 feet below the level of Kootenay lake. Mining was done on all three levels, A, B, and C, and ore stoped on each of them.

Consolidated Company's Mines.—The Consolidated Mining and Smelting Company operated the *Highland* mine and concentrating-mill, and the *No. 1*, *Banker*, and *Maestro* mines, all near the town of Ainsworth.

No. 1.

At the *No. 1* mine an average of fifty men has been employed, thirty-five being underground. About 4,750 tons of silver ore was shipped, and 1,272 feet of development-work was done. Installation of the Cedar Creek power plant was completed, and an electrically driven air-compressor installed at the mine.

Highland. At the *Highland* mine the average number of men employed was seventy-eight, forty-seven of whom were underground. Eleven thousand four hundred and forty-one tons of silver-lead ore was mined, of which 10,338 tons was milled, and 2,842 tons of crude ore and concentrates were shipped. About 2,142 feet of development-work was done. Some new machinery was installed at the *Highland* mill and the drive changed so that power was taken from the Cedar Creek plant.

Maestro and Banker. At the *Maestro* and *Banker* an average of twenty-five men was employed, eighteen of whom were underground. Two hundred and sixty-two tons of ore was shipped and 746 feet of development-work was done. Annual assessment-work was done on several of the company's un-Crown-granted claims. Operations at all the company's Ainsworth properties were suspended early in August.

Silver Hoard. This property which is owned by a company, the Silver Hoard Mines, was worked throughout the year, giving employment to ten men. During the summer an Ingersoll-Rand compressor was installed, which is operated by electricity supplied through a 3,000-foot power-line connected with the *No. 1* mine. Forty-four tons of ore was shipped, and during the last few months 100 tons was extracted. It is expected vigorous development will be resumed on the return of satisfactory metal values.

Gallagher. This property was worked by A. D. Wheeler, who extended the cross-cut tunnel 100 feet, and it was later bonded to the Olive A. Silver Lead Company; this company in turn further extended the tunnel 175 feet. The same company has developed the *Ida C.* group by 266 feet of drifts, 239 feet of cross-cuts, and 50 feet of upraise, besides erecting two buildings and 2,250 feet of flume and ditch construction.

Ayesha. This property was further developed by Mr. Wheeler to the extent of driving 100 feet, and erecting two buildings; three men were employed.

Early Bird. A satisfactory showing of low-grade ore has been developed on this property, which is now under lease to A. Baglow *et al.*, who has made a trial shipment of 25 tons; the result is said to have been satisfactory.

Florence Mine. A Spokane company is working this property under the management of Mr. Wolfle, and has shown up large bodies of clean and milling ore. It is the intention of the company to erect a concentrator near Princess creek.

Cork-Province Group. This is the chief property on the South fork of Kaslo creek; it is controlled by a district company, and consists of thirteen claims. Operations were commenced in September and continued to the end of November, when it became necessary to close down owing to the failure of water which furnishes the mill power. One thousand nine hundred and fifty feet of iron pipe was laid for power purposes. During the three months of operations twenty-five men were employed and 65 tons of concentrates was shipped.

Revenue and Martin Claims. Work was continued on these claims during the greater part of the year.

The Eureka. This property was further developed in the early part of the year, but owing to prevailing conditions it was closed down in July.

The Whitewater. This property, operated by J. L. Retallack & Co., shipped 160 tons zinc ore carrying 160,000 lb. zinc, and 196 tons lead ore carrying 15 oz. gold, 22,698 oz. of silver, and 109,114 lb. lead; development consisted of 800 feet of raises, crosscuts, and tunnels. An average of fifteen men was employed throughout the year.

Charleston. On this property, which is under lease to A. J. Harris, a shoot of high-grade ore was uncovered, from which 20 tons was shipped.

The *U.S.*, on Jackson creek, a zinc property, continued development.

The *Panama*, owned by H. Giegerich and J. P. Miller, was worked all year with a small force, driving 250 feet of drifts, and shipped two cars of silver ore.

The *Utica*, under the management of C. F. Caldwell, was worked continuously, giving employment to fifteen men, and 285 tons silver-lead ore was shipped.

Payne. On this property one-third of the 750-foot upraise to connect the lower tunnel with the old workings was accomplished; twenty men being continuously employed.

Placer leases on Poplar creek and Lardeau river were worked on a small scale, with no important results.

OFFICE STATISTICS—AINSWORTH MINING DIVISION.

Free miners' certificates	402
" " (special)	1
Mineral claims located	77
Placer claims located	4
Placer leases issued	6
Certificates of work	263
Transfers, etc., recorded	43
Certificates of improvements issued	13

SLOCAN MINING DIVISION.

REPORT BY ANGUS MCINNES, MINING RECORDER.

I have the honour to submit herewith the annual report on the mining operations in the Slocan Mining Division for the year ending December 31st, 1914.

Up to August 1st, when the disastrous European war broke out, all the mines in the Slocan were working full time, with forces varying from five to 250 men. About August 5th the metal market went to pieces, and the smelters refused to take any more ore. Consequently the properties that did not have a large surplus of cash to work on had to close down until such time as conditions became more favourable and the silver and lead markets again became normal. However, I am pleased to say that all the mining men in the Slocan are confident that in a short time all the mines will again be working full swing.

However, in spite of all the troubles and drawbacks during the last five months, most of the properties in the Slocan are doing a great deal of development-work, so when the time comes and hostilities cease they will be in a position to employ many men and ship much ore. Further, there are a great number of miners who are taking advantage of this lay-off to develop properties which they own or are interested in. There is a good deal of this kind of work going on around the different camps in the Slocan, and quite a number of them are meeting with good success, while some of them have already struck good bodies of ore. Altogether, our people here are working with more determination and encouragement than I have seen in the twenty-one years I have spent in the Slocan. They are also doing the development in a more scientific and businesslike manner.

The extent to which the European war affected production of silver-lead ore in the Slocan is shown by the considerable decrease in the quantity of ore and concentrates received at the Trail smelter from Slocan mines during the latter part of August and the remaining months to the close of 1914. For thirty-three weeks ended August 20th the total of receipts from these mines was 13,178 tons, an average of 399 tons a week; for the remaining nineteen weeks of the year it was 1,679 tons, an average of only 88 tons a week. This does not take into account the zinc product made during the respective periods mentioned. It will be seen that receipts at Trail of Slocan ore and concentrates in 1914 totalled 14,857 tons. Of this quantity, 9,129 tons, or 61 per cent., was selected ore and concentrates from the *Standard* mine and mill, near Silverton. Next in order of quantity received was the *Rambler-Cariboo* mine and mill, with 1,934 tons, also of first-class ore and mill concentrates, and then followed the *Slocan Star*, Sandon, with 868 tons; the *Van-Roi*, near Silverton, 615 tons; and the *Surprise*, near Cody, with about 500 tons of crude ore. Notes on individual properties follow :—

Rambler-Cariboo.—Beside the crude silver-lead ore and the concentrates shipped to Trail, as stated above, there was sent out to smelting works in the United States about 970 tons of silver-zinc concentrates. The development done in the mine during the year included the extension of the 900-foot level by 300 feet, of the 1,200-foot level by 400 feet, of the 1,300-foot level by 200 feet, and some 200 feet of raising between levels.

Slocan Star.—A feature of the year was the satisfactory results of development-work done on the tenth or lowest level of this mine, where good ore was found. The total footage of development-work done was 2,403 feet, this including work on levels Nos. 6, 7, 8, and 10. A large proportion of both the higher-grade ore, shipped crude, and the milling-ore was obtained in stopes from No. 8 level, in the east drift of which there was still a fine face of ore at the end of the year. The concentrating-mill on this property was put in operation about the middle of June after having been unused for nine years. Suspension of mining in August as a result of the war necessitated closing the mill, which during the seven weeks it had been running produced 276 tons of lead concentrates and 664 tons of zinc concentrates. The year's improvements consisted of repairing and remodelling the mill, 2,000 feet of new wood pipe in the water-line, repair of tram-line and new ore-pocket at its upper terminal, etc., the whole having cost about $8,000. It is claimed that there is enough ore in sight to keep the mill supplied for a year and a half.

Surprise.—The 500 tons of ore shipped to Trail was only a small proportion of that either mined or opened ready for mining, much of the latter containing too high a percentage of zinc for shipment to Trail as crude ore. Late in the year a commencement was made to haul ore to the *Ivanhoe* concentrator, at Sandon, a contract having been entered into to supply 1,000 tons of ore a month for milling. Sufficient ore is in sight for the requirements of several months under this contract. Last summer the aerial tramway from the mine down to Cody creek was improved by putting in 13,000 feet of new wire traction-rope.

Other Mines about Sandon.—At the *Payne* driving the crosscut adit between 2,000 and 3,000 feet was completed, and raising to the old productive workings above was commenced. At the *Ruth-Hope* the lowest level, No. 5, was extended about 800 feet, with 600 feet more to be driven to get under the ore-shoots occurring in the old workings above. The *Richmond-Eureka* shipped 380 tons of ore, but nothing important resulted from continued exploration underground. Only development-work was done at the *Noble Five* group, on which a long crosscut adit is being driven to intersect five known veins; a compressor was installed to provide power for machine-drills. The discovery of a new shoot of ore on the *Reco* was reported. A quantity of silver ore was packed down from the *Mountain Con* to Sandon, for shipment when prices should be better. Small lots of ore were sent out from the *Antoine*,

Colonial, *Freddy Lee*, *Ivanhoe*, and *Lone Bachelor*. More development was done on the *Wonderful* and 100 tons of ore shipped to Trail. Ore was sacked at the *Idaho-Alamo* for shipment later. Several other properties had more or less work done on them. Altogether, activity was general up to the latter part of summer.

Silverton camp was by far the most important in the district from the point of view of production, and had it not been for adverse conditions brought about as a result of the war it would have made an even better showing. Several small properties within a few miles of New Denver were worked—namely, the *Apex*, *Hartney*, *California*, *Echo*, and others, and the *Lucky Thought*, on Four-mile creek. The larger mines in Silverton camp are the *Standard*, *Hewitt-Lorna Doone* group of the Silverton Mines, Limited, and the *Van-Roi*.

Standard.—As already mentioned, more than 9,000 tons of silver-lead ore and concentrates was received at Trail from the Standard Silver-Lead Mining Company's mine and concentrating-mill. The production of zinc concentrates, which was shipped to the United States, was continued until late in the year, when milling was stopped until prices of metals should be higher. The approximate quantities of metals produced in 1914 were: Silver, 1,050,000 oz.; lead, 10,000,000 lb.; and zinc, 5,000,000 lb. Work done in the mine included the following: No. 3 adit was extended in the expectation that an ore-shoot opened from No. 4 level at about 100 feet deeper would be found at the higher level, but only pockets of ore, up to 19 feet in length, were met with. On No. 4 the ore-shoot was mined along a distance of 235 feet, but latterly it was of a zincky nature. In one part the ore-body was fully 40 feet in width, of mixed shipping and milling ore, with some barren ledge-matter as well. Between levels Nos. 5 and 6, which are 125 feet apart, there are big shoots of ore still to be mined; several raises have been made to connect those levels, some of them in ore throughout. Stoping was in progress from No. 6 level until ore production was curtailed in August. No. 7 adit was advanced to a distance of 4,400 feet, when bunches of zincky ore were encountered. Since the close of 1914 a raise from this level was reported to have entered good silver-lead ore at 12 feet up from the level. During the year two shoots of ore were passed through, but these were not exploited, for the reason that it was regarded as more important to continue exploration ahead and determine, if practicable, whether the big ore-bodies opened on No. 6 continue downward to No. 7. A still lower adit, No. 8, was driven, and by the end of the year was well on to 1,500 feet in from the portal; it had encountered zincky ore, but it was expected that from 3,000 to 4,000 feet more would have to be driven before reaching the zone in which occur the big shoots of silver-lead ore that were so productive in and above No. 6 level. Ore-bins were built near the portal of No. 7 adit, and a tramway loader procured, but connection has not yet been made with the tramway from No. 6 to the mill.

An experimental unit of the Minerals Separation flotation plant, with the requisite tanks, etc., was added to the concentrating-mill equipment, but its use did not result in any decision being come to as to the permanent adoption of this process here. The company in 1914 distributed $475,000 in dividends among its shareholders, but after September the earnings above cost of operating mine and mill on a small scale and continuing development did not leave a sufficient margin of surplus to allow of dividends being paid for the last three months of the year.

Hewitt and Van-Roi.—At the *Hewitt* over 18,000 tons of ore was mined, the silver-lead concentrates going to Trail and the zinc concentrates to the United States. *Van-Roi* mined about 11,000 tons of ore; the silver-lead product going to Trail and the zinc concentrates to the States. No particulars of the year's operations were received from either mine, but it is known that work was suspended on the *Van-Roi* in the autumn, and that the *Hewitt-Lorna Doone* mine was still at work, though on a reduced scale, when the year closed. There has

been opened in the latter mine a large quantity of ore ready for extraction, so that when conditions shall be favourable a comparatively large output may be made.

OFFICE STATISTICS—SLOCAN MINING DIVISION.

Free miners' certificates	145
" " (company)	3
New claims located	44
" abandoned	1
Certificates of work recorded	101
Conveyances, etc.	12
Certificates of improvements	9

SLOCAN CITY MINING DIVISION.

REPORT OF HOWARD PARKER, MINING RECORDER.

I have the honour to submit my report for the Slocan City Mining Division for the year ending December 31st, 1914.

During the first six months of the year the mining industry was active, but for the latter six months it has been almost dormant.

Little of importance occurred in connection with mining in this Division during the year, save, perhaps, that some progress was made on the *Ottawa* by the Consolidated Mining and Smelting Company, which purchased this property in 1913; high-grade ore was found in the course of development-work, but the several shoots were comparatively small. Shipments of ore from mines in the Division were: *Ottawa*, 279 tons; *Eastmont*, 149 tons; *Enterprise*, 57 tons; and *Black Prince*, 10 tons. Late in the year it was reported that some men had gone to work on the *Meteor*.

The aggregate tonnage shipped to the Trail smelter from the Slocan City Mining Division does not compare favourably with the ore shipped in previous years.

The *Meteor*, the well-known high-grade silver property, has been leased to Barber & Taylor, who are now doing extensive development-work, the result of which is expected to yield several cars of silver ore. The average assay of this ore is said to be 350 oz. to the ton.

The *Westmont*, situated at Ten-mile, employed some eight or ten men chiefly at development-work. Ninety tons of silver-lead ore was shipped from this property during the year.

The *Ottawa* group employed some forty or fifty men continuously until the middle of August, since which time it has been closed down. There is a considerable quantity of ore ready for shipment, but is being held until the silver market improves.

The *Inco*, situated about a mile and a half from Slocan City, has been working a small force of men on development, and has just exposed a very satisfactory showing of ore; the owners, Wafer & Jameson, contemplate shipping early in 1915.

There has been a certain amount of activity in the gold-quartz bearing district of Lemon creek, and small shipments of a few tons were treated at the smelter. Some beautiful gold specimens from this district have been shown here.

OFFICE STATISTICS—SLOCAN CITY MINING DIVISION.

Free miners' certificates (ordinary)	85
" " (company)	1
Certificates of work recorded	108
Locations recorded	43
Conveyances recorded	6

TROUT LAKE MINING DIVISION.*

REPORT OF A. N. VARS, MINING RECORDER.

I have the honour to submit herewith my report of the progress of the mining industry in the Trout Lake Division for the year 1914.

During the early months of the year many options were taken and several properties were bonded, creating a general feeling that the former activity in mining in the district would be resumed, which only the stringency of the money market prevented.

The *Ajax*, on Nettie L. mountain, owned by the Ferguson Mines, Limited, was operated by the company until November, when it was leased. Fifty-one tons of ore was shipped and an average of four men was employed.

The *Silver Cup* mine, on Silver Cup mountain, has been worked throughout the year under lease, with an average of four men employed, 33 tons of ore being shipped.

Work on the *Ethel*, on Ethel mountain, was suspended about June 1st, but was resumed during September under lease to J. S. Lamphere. An average of three men was employed and 4½ tons of high-grade ore was shipped.

POPLAR CAMP.

On the *Calumet-Hecla* group a large amount of surface exploration-work was done; also four tunnels were driven on the property, approximating some 400 feet. The properties are under bond to J. H. Wilson and associates, of Victoria.

A force of fifteen men was employed from June 1st to December 1st, when owing to the absence of Mr. Wilson the crew was reduced to three men; operations on a larger scale are expected to be resumed about February 1st next.

The *Niagara* group, comprising five claims on Tenderfoot creek, is also under bond to Mr. Wilson, where a force of three men has been employed throughout the season; a nice showing of high-grade concentrating-ore has been found on the property, which gives promise of improvement with further development.

On the *Princeton* and *Fairhope* claims, on Poplar creek, a considerable showing of ore has been located, which with development, it is thought, should be a good shipper.

OFFICE STATISTICS—TROUT LAKE MINING DIVISION.

Free miners' certificates	59
Mineral claims located	55
Placer claims located	1
Applications for placer leases	3
Certificates of work	151
Transfers, agreements, etc	13
Notices	35
Cash paid in lieu of work	$100

* *See also* Report by N. W. Emmens, M.E., page 291.

TROUT LAKE MINING DIVISION.

REPORT BY NEWTON W. EMMENS, M.E.

The northern boundary of the Division has a north-easterly course, following the summits of the ridges dividing the watersheds of the North-east arm of Upper Arrow lake and Incomappleux river from those of Trout and Lardeau creeks; on the south it follows the summits of the transverse ridges dividing the waters of Poplar and Cascade creeks, crosses the Lardeau river, then follows the ridge immediately south of Lake creek; the eastern boundary follows the summits of the ridges dividing the watersheds of Lake creek, Trout lake, and the upper part of the Lardeau river from those of the Duncan river; while on the west it follows the summits of the divide between the Trout Lake and Upper Arrow Lake watersheds.

While this Division is one of the smallest in West Kootenay, it includes some excellent mineral "showings," and gives promise of becoming an important producer of metallic ores when thoroughly developed and provided with suitable milling plants and adequate transportation facilities.

ACCESSIBILITY.

The Division is divided near its centre by a wide, deep valley occupied by Trout lake and the Lardeau river, having a general north-west and south-east direction. The Lardeau branch of the Canadian Pacific Railway follows the river to the town of Gerrard, at the lower end of the lake; from here a steamer connects with the town of Trout Lake, where is located the Mining Recorder's office for the district. The Canadian Pacific Railway operates a tri-weekly service from the city of Nelson to Trout Lake, the route being from Nelson to Lardeau, at the upper end of Kootenay lake, by steamer; thence by rail to Gerrard and steamer to Trout Lake. The district can also be reached by way of Revelstoke, by train to Arrowhead; thence nine miles by boat to Beaton, and then by stage over a good and exceedingly picturesque road, twelve miles to Trout Lake.

From the town of Trout Lake there is a splendid road to Ferguson, a distance of four miles north-easterly, and from that town to Ten-mile on Lardeau creek (South fork), at the mouth of Gainer creek, is a wagon-road, over which it is possible to drive at the present time; but next year the improvements which were being made this summer will have been completed, and it will be possible to run an automobile over it. From the town of Trout Lake an excellent trunk trail has been constructed following the north-east shore of the lake to Six-mile creek; thence by a series of long switchbacks on an easy grade past the *Winslow* mine on to the summit of the Silver Cup ridge, which it crosses at the head of the North fork of Brown creek, following this stream to Lardeau creek (South fork), and then along its north side to the wagon-road at Ten-mile. This trail was only completed this summer, and is in every respect an excellent piece of work and a credit to the British Columbia Government, by whom it was built, and to the man who located it, as the grade is uniform throughout and there are no steep pitches. From this trunk trail a number of branch trails have been constructed leading to individual mines and prospects. From Ten-mile there is a trunk trail up Gainer creek, with branches to the several prospects tributary to that stream.

From the town of Ferguson there is a good trail up Ferguson creek (North fork of Lardeau creek) to its source on the divide between it and the headwaters of Poole and Boyd creeks, streams flowing into the Lardeau Division. From this main trail are branch trails leading to the several properties located upon Surprise creek and on the divide between Ferguson and Silver Tip creeks; there is also a first-class trail branching off the North Fork trail, a little less than a mile from the town of Ferguson, leading on to the Great Northern mountain, where are located the *Broadview*, *Great Northern*, and *True Fissure* mines.

From the wagon-road at Eight-mile a trail follows Cup creek to the *Silver Cup* mine, and from the same road near Five-mile is a wagon-road to the *Nettie L.* mine, situated on Nettie L. mountain. From the town of Trout Lake excellent trails lead to the several properties located on Trout mountain.

At the southern end of the district there are numerous trails from the valley of the Lardeau river up its main tributaries, notably those of Canyon, Tenderfoot, Rapid, Poplar, Haley and Lake creeks.

The majority of these trails are in a sufficiently good state of repair to ride a horse over, although, as some of them have not been used for several years, it is always advisable to carry an axe, so that trees which have fallen across the trail may be cut out in order to let the horse by.

TOPOGRAPHY.

In this respect the country is similar to that of the Lardeau Division, which is described in the report covering that section. The mountains are perhaps, as a whole, higher in altitude and a little more rugged and alpine in character than those in the Lardeau. The main valleys are of the steep-walled U-shape. The tributary valleys are narrow, steep, and V-shaped, the majority debouching through narrow canyons.

The most important valley is that occupied by Trout lake and the Lardeau river, which has a general south-easterly course, following closely the strike of the rocks. Trout lake is eighteen miles long and from half to one and a half miles wide. It is a narrow, fiord-like body of water whose bed, as shown by soundings, is flat transversely, and basin-shaped longitudinally. At the upper end of the lake there is a gravelly beach which continues for some distance along the west side. The shores along the other parts of the lake are steep and precipitous, except at the mouths of the entering streams, where fans project out into the lake. Soundings show a maximum depth of 736 feet off Five-mile creek, and a depth of 300 feet half a mile below the upper end of the lake. Towards its outlet the lake narrows up and gets much shallower, being only 96 feet deep just above the rock channel through which it flows as the Lardeau river.

The ridge bordering the lake on the north-east has an average height of 7,500 feet, with individual peaks exceeding 8,000 feet in elevation. It is known as the Silver Cup mountains, and its highest peak lies between the headwaters of Ottawa and Haskins creeks, attaining an altitude of 9,300 feet, and is known as Fay's peak. The ridge on the south-west side of the lake is known as the Lardeau mountains, the peaks of which, being composed of granite, are very rugged and present an uneven skyline. The altitude of these peaks ranges from 8,000 to 8,770 feet at the highest point of what is known as Trout mountain, near the town of Trout Lake.

At the northern end of the district, near the headwaters of Ferguson and Gainer creeks, is a belt of limestone, forming a range of wedge-shaped precipitous mountains reaching altitudes of 8,000 to 10,000 feet, which, from their castellated and fantastic weathering, form the most conspicuous feature in the topography. The higher peaks of this range, notably Badshot, Mohican, Templeman, and Wagner, form conspicuous landmarks which can be seen from the summits of the mountains in almost any part of the district.

The description of the topography and the effects of the erosive action of atmospheric agencies, and the Cordilleran ice-sheet thereon, as described in the report on the Lardeau Division, applies equally to the Trout Lake Division.

GEOLOGY.

The rocks included within the Trout Lake Mining Division are the south-eastward extension of those in the Lardeau, which have been fully described in the report on that section. They consist of a fine-grained, light-coloured granite at the south-western end; that of a coarse-grained porphyritic granite on the north-east, a little way beyond the district's boundary. South-west of this latter granite lies the "Lime Dyke" series of rocks, composed of crystalline limestones interbanded with slates and phyllites.

South-west of these the formation consists of chlorite-schists, conglomerate, slates, and calcareous schists. South-west of these, again, occur the carbonaceous phyllites, slates, and quartzites cut by the yellow-weathering diabase-schist, and diorite, with occasional developments of serpentine, and between these and the south-west granite-belt occur slates and siliceous lime-bands.

The whole rock complex has been subjected to intense folding, and the formation everywhere has been highly altered by metamorphic action, resulting in the development of a number of secondary minerals, such as chlorite, aragonite, asbestos, etc.

Evidence is abundant throughout the district of the presence of the Cordilleran ice-sheet, and it would appear that even the summits of the higher peaks were buried beneath this enormous glacier. The majority of the higher ridges and summits show striations caused by ice movement, and glacial erratics are common everywhere on the mountain-sides, and even on the tops of the mountains.

MINERAL ZONES.

There are three recognized mineral belts within the Trout Lake Mining Division, of which the Central is the more important, and extends from the Lardeau Division on the north-west in a south-easterly direction, crossing the Lardeau river between the towns of Gerrard and Poplar Creek, and continuing thence into the Ainsworth Division. It is within this belt that the greatest development of minerals has taken place.

The Lime Dyke Belt parallels the Central Belt as far south-easterly as Lake creek, beyond which it loses its individuality. South-west of the Central, on the south-west side of the Trout Lake-Lardeau valley, lies the South-west Mineral Belt, which consists of a series of bands of siliceous lime, slates, and a little serpentine lying against the granite forming the divide between the Trout Lake-Lardeau and Arrow Lake watersheds.

In describing the several mines and prospects situated in the Trout Lake Mining Division, they will be classified under four headings:—

(1.) Those situated within the Central Mineral Belt, extending from the summit of the Goat-Mohawk divide, on the north-west, to the head of American creek at the lower end of Trout lake, on the south-east.

(2.) Those situated within the Lime Dyke Mineral Belt, from the head of the North fork of Lardeau creek, or Ferguson creek, as it is named on the new maps of the Surveyor-General's Department, on the north-west, to Wagner mountain and the headwaters of Hall creek, on the south-east.

(3.) The prospects situated within the South-west Mineral Belt in the vicinity of the town of Trout Lake and the group of properties situated within the drainage area of Canyon creek.

(4.) The prospects situated in the neighbourhood of Poplar; that is to say, those situated on Johnson mountain, Poplar, Rapid, and Tenderfoot creeks.

By this arrangement it will be easier to trace out the sequence of the properties on the accompanying maps. All bearings mentioned in this report are astronomic, and all elevations in feet above sea-level. On the accompanying maps, where assays are given, the chemical symbols for the metals are used, in which Au, signifies gold; Ag, silver; Pb, lead; Cu, copper; and Zn, zinc. All assays quoted are in percentages of the several metals in the ore or in ounces Troy of the metals contained in a ton (of 2,000 lb.) of the ore.

CENTRAL MINERAL BELT.

The dividing line between the Lardeau and Trout Lake Mining Divisions follows the divide separating the watersheds of Mohawk and Goat creeks, a short distance south-east of the *Beatrice* mine. With the exception of a large quartz-outcrop which stands out prominently as a bluff some 60 feet high on the north-west slope of a spur from Great Northern mountain, and upon which very little work has been done, no veins occur until the property of the True Fissure Mining and Milling Company, Limited (N.P.L.), is reached.

True Fissure. This is situated on the eastern slope of Great Northern mountain, on the west side of Ferguson creek, at an altitude of 5,500 to 6,720 feet. On this property there are two series of veins, one of which has a strike of N. 50° W., and the other having a course of N. 32° W., both having a north-easterly dip of 40 to 60 degrees. The country-rock is a highly carbonaceous (graphitic) phyllite, which has a strike of N. 45° W. and a north-easterly dip of 50 degrees.

On the *St. Elmo* claim a vein belonging to the first series has been opened by an adit on its course for a distance of 175 feet. In this adit the vein varies in width from a few inches to 6 feet, and consists of galena, grey-copper, iron pyrites, and zinc-blende, with phyllite inclusions, in a quartz gangue. The average zinc content of this ore is so high that, under existing smelter regulations, only a comparatively small proportion of the ore mined can be shipped, owing to there being a penalty of 50 cents a ton for each unit of zinc contained in the ore over 8 per cent.

Fifty feet from the portal of the adit a raise 40 feet long was made on the vein to surface. For the first 6 feet this raise passed through ore consisting of zinc-blende, iron pyrites, and galena, assaying: Silver, 44.05 oz.; lead, 4.8 per cent.; zinc, 27.1 per cent. Lying immediately upon this was a body of galena ore carrying grey-copper and a little zinc-blende, extending up to the grass-roots, from which 200 tons was stoped and shipped to the smelter, yielding an average of: Gold, 0.09 oz.; silver, 79.34 oz.; lead, 26.6 per cent.; zinc, 9.07 per cent. In places in this stope were masses of practically clean grey-copper, samples of which assayed: Silver, 515.0 oz.; copper, 10.37 per cent.; but, as there was only a comparatively small amount of this material, it was mixed in with the galena ore and shipped with it. In mining this 200 tons a large amount of ore was extracted whose zinc content was too high to permit of its being shipped. This material was stored in the stopes and on the dump; average samples assayed show it to contain: Silver, 44.05 to 72 oz.; lead, 4.8 to 20.7 per cent.; zinc, 27.1 to 32.62 per cent.

A winze was sunk 20 feet below this level, in which the vein was divided into two sections by a streak of phyllite; the hanging-wall portion being of a very fine-grained galena of a dull black colour, the colour being due to the presence of a quantity of finely disseminated carbonaceous phyllite. This ore assayed: Gold, 0.06 oz.; silver, 42.64 oz.; lead, 37.7 per cent.; zinc, 10.28 per cent.

The foot-wall portion is a finely crystalline, cubical galena, assaying: Silver, 46.82 oz.; lead, 47.15 per cent.; zinc, 8.39 per cent. Owing to the heavy flow of water it was impractical to sink any deeper without a pumping plant, so work was discontinued with the intention of driving a new level from a point lower down the hill to come under this ore-shoot.

Down the mountain-side from the *St. Elmo* a vein known as the *True Fissure* lode, belonging to the second series, outcrops prominently. This has been traced for a distance of 2,500 feet along its strike. Near the southern end of the property this vein, which dips with the slope of the hill, is exposed over an area of 500 by 1,000 feet on its dip and strike, the softer overlying phyllites having been eroded away. Much of the ore here exposed consists of a fine-grained galena, samples of which assayed: Gold, 0.06 oz.; silver, 11.44 oz.; lead, 6.4 per cent.

A considerable amount of prospecting has been done along this exposure on the *True Fissure* claim, and three crosscuts have been driven into it at different levels from the hillside, with a vertical difference of elevation between the highest and lowest of 200 feet, and a maximum horizontal distance along the strike of the vein of 560 feet. The upper of these crosscuts is the only one which has been driven completely through the vein. Here it is shown to have a width of 26 feet, and to assay: Gold, 0.09 to 0.3 oz.; silver, 3.0 to 9.0 oz.; lead, 5 per cent.; zinc, 10.6 per cent.

A short distance north-west of this exposure a small creek cut through the vein, exposing an outcrop of coarsely crystalline galena. An open-cut was made here and 10 tons of ore mined, consisting of galena and iron pyrites containing grey-copper; the galena portion assaying: Silver, 68.8 oz.; lead, 68.5 per cent.; while the iron pyrites carrying grey-copper assayed: Gold, 0.1 oz.; silver, 92.0 oz.; copper, 0.07 per cent.

North-west of this cut, and at a lower elevation, a crosscut known as the *Blue Bell* adit was driven from the hillside to the vein, which it cut in a distance of 160 feet. At this place there is 19 feet of quartz, 6 feet of which assays: Gold, 0.25 oz.; silver, 7.05 oz.; the balance of the material being of a lower grade. From this crosscut drifts have been made both to the north and south along the strike of the vein for a distance of 95 and 70 feet respectively, both of which were carried along the hanging-wall. Between the vein and the hanging-wall was a streak of galena ore assaying: Gold, 0.05 oz.; silver, 32.25 oz.; lead, 38.7 per cent.; zinc, 7.3 per cent. A raise was put up on this ore in the south drift and considerable of it was stoped and shipped to the smelter, assaying: Silver, 38.0 oz.; lead, 35 per cent. In the north drift this streak was followed by an overhead stope until the material became too high in zinc contents to be shipped at a profit, and by an underhand stope until the water prevented deeper sinking. From these stopes 30 tons of ore—assaying: Gold, 0.15 oz.; silver, 48.0 oz.; lead, 39.0 per cent.; zinc, 8.7 per cent.—was shipped to the smelter. Selected samples of the galena from the underhand stope assayed: Silver, 76.25 oz.; lead, 75.5 per cent.; while a selected sample of grey-copper and iron pyrites from the same place assayed: Gold, 1.0 oz.; silver, 694.2 oz.; copper, 3.78 per cent.

The ore in the top of the north raise assayed: Gold, 0.04 oz.; silver, 30.36 oz.; lead, 7 per cent.; zinc, 28.65 per cent.; copper, 2.45 per cent. Forty feet north of this shoot a second ore-shoot was cut from which a shipment of 36 tons was made, which assayed: Gold, 0.15 oz.; silver, 45.2 oz.; lead, 22.4 per cent.; zinc, 9.1 per cent. Outside of the ore-shoots the vein assays: Gold, 0.25 oz.; silver, 20.4 oz.; lead, 5 per cent.; zinc, 3 per cent. The ore in the floor of the level, both north and south of the crosscut, is more mineralized than in the roof.

The ore shipments spoken of above were made during the winter months on the snow, the ore being sacked at the mine and rawhided to the wagon-road at Ferguson, from which place it was transported on sleighs to the Canadian Pacific Railway terminus at Trout Lake.

Great Northern.

This property adjoins the *True Fissure* on the south-east. The principal work has been confined to the *Great Northern* vein, which has a strike of N. 25° E., with a south-easterly dip at an angle of 40 degrees. Locally this has been considered to be a continuation of the *True Fissure* lode, which

outcrops on the adjoining claim, but it will be noted that they differ both in strike and dip. However, the narrow ridge upon which the *Great Northern* property is situated is badly broken and shows evidence of much local disturbance. There is a fault-line passing a short distance south-east of the *Great Northern* workings, along the valley of Broadview creek, and there has undoubtedly been a considerable amount of displacement of the rocks in this section, so that, without additional work, the continuation of the various veins through the *Great Northern* property from those adjoining cannot be positively traced, but it will probably be found that the continuation of the *Great Northern* vein on the *True Fissure* claim lies some distance above the *True Fissure* lode.

The *Great Northern* vein lies in graphitic phyllite having a north-westerly strike and a dip of 32 degrees to the north-east. The whole rock-mass as exposed by the underground workings is badly broken and twisted, requiring close timbering in places. In 1897 this vein was opened by a short adit, and some 300 tons of ore containing galena, iron pyrites, zinc-blende, and a little grey-copper was mined; out of this, 37 tons was shipped to the smelter, yielding $47 a ton. The balance of the ore was piled on the dump as being of too low a grade to ship. The property was allowed to remain idle for some years and the workings caved in. In 1906 this adit was reopened, and it was found that the vein from which the above-mentioned ore was extracted had a width of 3 feet, and an average sample of which assayed: Gold, 0.1 oz.; silver, 26.25 oz.; and a trace of copper; while a selected sample assayed: Gold, 0.1 oz.; silver, 30.5 oz.; lead, 4 per cent. A selected sample from this vein containing grey-copper assayed: Gold, 0.08 oz.; silver, 159.32 oz.; copper, 4.66 per cent. The ore as a whole was considered to be of too low a grade to mine under the existing conditions, so work was discontinued, and the property lay idle until September, 1913, when, under the management of H. McPherson, the lower adit, some 50 feet below the one above mentioned, was cleaned out, retimbered, and continued into the vein. This adit (Fig. 2) is 365 feet long and cuts the vein at 280 feet in, crossing it diagonally at a low angle for a distance of 85 feet. The vein consists of quartz, mineralized with iron pyrites, galena, zinc-blende, and grey-copper, and contains a great deal of phyllite. Owing to the graphitic nature of the wall-rocks and the flow of water the side of the workings are everywhere blackened, so that it is difficult to distinguish the vein from the country-rock, or to see the mineral in it, unless freshly broken, and, as there has been no cross-

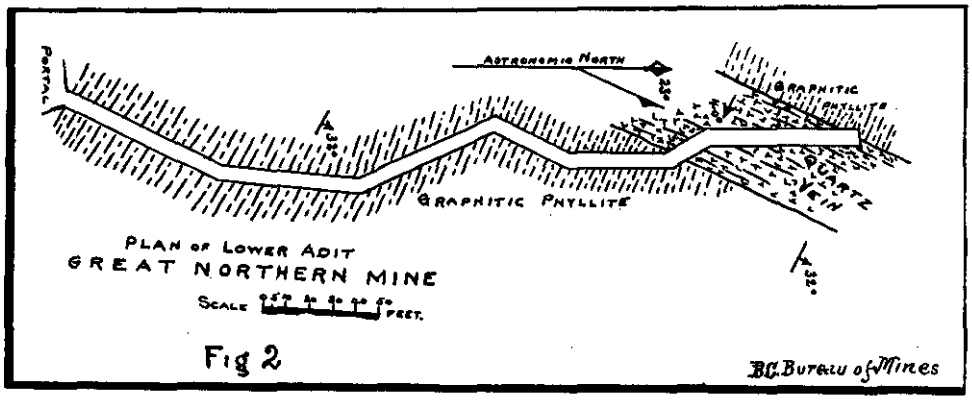


Fig 2

cutting, it is somewhat difficult to determine accurately the exact width of the ore-body. The hanging-wall is well defined, but the foot-wall has no distinct line of demarcation so far as could be seen; the foot-wall phyllites contain many quartz stringers and bunches.

The ore in the vein is not evenly disseminated through the mass, but occurs as stringers, veinlets, and lenticular masses. A sample taken across the north-east side of the drift of the more heavily mineralized portion of the vein assayed: Gold, 0.08 oz.; silver, 14.8 oz.; and lead,

Nettie L. and Broadview Mines—Trout Lake M.D.

Silver Cup Mine—Trout Lake M.D.

5.7 per cent. In doing this work a considerable amount of ore has been extracted and is now piled on the dump at the mouth of the adit. Some of this material contains a great deal of grey-copper and galena, a selected sample of which assayed: Gold, 0.13 oz.; silver, 139.2 oz.; lead, 57.9 per cent. The elevation of this adit is 5,950 feet, and that of the summit of the divide between this property and the *True Fissure* 6,100 feet. This vein is certainly worthy of additional development-work, as it evidently contains some high-grade ore, and the formation is distinctly favourable for the existence of an ore-shoot.

Broadview.

The next property to the south-east is that known as the *Broadview*, which was originally owned by the Horne-Payne Syndicate, by whom much work was done, but to poor advantage. In 1905 a syndicate composed of local people secured a lease on the property and shipped 235 tons, for which they received $39.75 a ton, the ore assaying from: Gold, 0.06 to 0.12 oz.; silver, 32.3 to 40 oz.; lead, 30.6 to 37.8 per cent. In the fall of 1906 this property was acquired by the Ohio Mines Development Company, Limited (N.P.L.), and a large amount of development-work done.

The *Broadview* vein has a strike of N. 25° W., with a dip of 60 degrees north-easterly. The hanging-wall is well defined, often showing slickensides, with more or less of a gouge between it and the country-rock. The foot-wall is not so well defined, as the enclosing phyllites on that side contain a good deal of quartz. The outcrop of the *Broadview* vein is quite prominent, and can be easily followed from the level of the No. 3 adit to the shaft near the top of the hill, a distance of 1,000 feet, with a vertical difference in elevation of 300 feet. At the top of the hill, at an elevation of 6,350 feet, there was a galena-outcrop upon which a shaft was sunk. It was from here that the ore shipped to the smelter was obtained. The shaft itself is 120 feet deep on the dip of the vein, and is in quartz practically all the way, as it passed through the galena ore-shoot a few feet below the surface. A sample of the quartz taken across the shaft about 60 feet below the collar assayed: Gold, 0.2 oz.; silver, 1.49 oz. From the 60-foot level in the shaft a drift was driven north-westerly to find the downward continuation of the galena ore showing at surface; this was found in a distance of about 60 feet. Here the galena-shoot proved to have a width of 5 feet and a length of 18 feet.

Between this level and the surface the ore was stoped and the richer portion sorted and shipped. In the winter of 1909-10 further shipments amounting to 73 tons were made of ore from this shoot, taken out below the 60-foot level. This had an average content of: Gold, 0.05 oz.; silver, 40 oz.; lead, 38 per cent. Associated with this lead ore is an appreciable amount of copper in the form of chalcopyrite. In order to ascertain the value of this material when sorted as cleanly as possible, two trial shipments were made. The first, weighing 1,524 lb., yielded: Gold, 0.26 oz.; silver, 220.9 oz.; copper, 4.48 per cent.; lead, 14.9 per cent.; zinc, 9.3 per cent. The second, consisting of 23 tons, yielded: Gold, 0.06 oz.; silver, 24.6 oz.; copper, 6.42 per cent.; zinc, 16.9 per cent. From this it is evident that the smaller shipment contained some grey-copper which would account for its high silver content. Owing to the high percentage of zinc and the fact that when an ore containing lead is shipped as a copper ore the lead is not paid for, and if the ore is shipped as a lead ore the copper contained therein is not paid for, it was deemed advisable to discontinue shipments until the mine was further developed and equipped with a separating plant.

In extracting the ore from which the shipments were made and in the sinking of the shaft, there has been accumulated on the dump some 1,200 tons of low-grade ore, a sample of the more heavily mineralized portion of which assayed: Gold, 0.12 oz.; silver, 7.0 oz.; lead, 4.7 per cent.

In order to develop the vein along its strike and at the same time open this ore-shoot at depth, the No. 3 adit was driven, at an elevation of 6,050 feet. This was originally started

by the Horne-Payne Syndicate, who drove it a total distance of 180 feet, but, for some unknown reason, swung off into the foot-wall phyllites after the first 50 feet, and the farther they continued driving, the farther they were getting away from the vein. When the present owners acquired the property the No. 3 level was turned sharply to the south-east and continued to the vein, which it cut in a distance of 95 feet. At this point a crosscut was made through the vein, which proved to have a width of 16 feet, to be of a banded structure, mineralized with iron pyrites, galena, zinc-blende, and chalcopyrite, in a gangue of quartz and feldspar with phyllite inclusions, and an occasional sprinkling of grey-copper. Between these bands occur narrow streaks of fine-grained galena and iron pyrites. A sample taken across 15 feet of this crosscut assayed: Gold, a trace; silver, 5.5 oz.; lead, 0.7 per cent.; copper, 0.5 per cent.; while samples from the heavy sulphide streaks assayed: Gold, 0.2 oz.; silver, 12 oz.; lead, 7.5 per cent.; copper, 2.4 per cent. From this crosscut the level was extended north-westerly for a distance of 550 feet along the course of the vein, and crosscuts made at intervals of 50 to 75 feet. Near the No. 7 crosscut a narrow streak of grey-copper was found between the foot-wall of the vein and the country-rock, a selected sample of which assayed: Gold, 0.25 oz.; silver, 495 oz.; copper, 7 per cent. A raise was put up on this ore, but it was only found to extend a few feet above the level. The objective point for which this level was driven, namely, the cutting of the galena ore-shoot developed in the shaft, at depth, has not been reached, there being still a short distance to drive.

Near the portal of this level some ore was found in the vein containing chalcopyrite. The ore extracted has been stored on the dump at the mouth of the adit, a sample of which, containing chalcopyrite but no galena, assayed: Gold, 0.04 oz.; silver, 17 oz.; copper, 10.4 per cent.; while a sample containing galena in addition to chalcopyrite assayed: Gold, 0.04 oz.; silver, 45.6 oz.; copper, 10.2 per cent.; lead, 3 per cent. This ore came from a shoot which apexes within a few feet of the portal of the adit (called the "Oxide shoot"), and, inasmuch as for practically the first 325 feet this level is in the foot-wall of the vein, it was deemed advisable to go down the hill and drive a new level. This adit, known as the No. 4 level, commences at a point 145 feet vertically below, and 450 feet north of the portal of the No. 3. For the first 295 feet it crosscuts the hanging-wall phyllites diagonally to the vein, which it then follows in a south-easterly direction for a distance of 100 feet. The vein here is very badly broken and the formation much disturbed. A sample taken across 2 feet on the north-east side at the face of the adit assayed: Gold, 0.08 oz.; silver, 18.8 oz.; copper, 0.8 per cent. A sample taken across 5 feet near the roof at the face assayed: Gold, 0.13 oz.; silver, 1.6 oz.; copper, 0.7 per cent. Fifty-two feet back from the face a crosscut has been made in an easterly direction for a distance of 21 feet. The whole of this crosscut is in quartz, sparingly mineralized; a sample taken across 15 feet assayed: Gold, a trace; silver, 0.2 oz.; copper, 0.1 per cent. Between the vein and the hanging-wall there is 5 feet of crushed quartz, a sample of which assayed: Gold, a trace; silver, 0.4 oz.

Eighty feet back from this crosscut a streak of galena ore was cut, two samples from which were taken; one assaying: Gold, 0.06 oz.; silver, 9.2 oz.; lead, 30 per cent.; and the other: Gold, 0.14 oz.; silver, 4.8 oz.; lead, 11 per cent. This level has not yet been driven far enough to intersect the downward extension of the copper ore-shoot from the No. 3 level previously mentioned.

In addition to this large vein, there is another, locally known as the "Copper vein," which has a strike of N. 65° W., and makes junction with the large vein a short distance north of the shaft. This vein has been developed by a series of cuts and an adit 200 feet long, known as the "A" level, at an elevation of 6,290 feet. In width it varies from a few inches to 2 feet, and has a slight northerly dip. From this vein a shipment of 20 tons of ore was

made, which yielded: Gold, 0.12 oz.; silver, 6.2 oz.; copper, 5.7 per cent. A selected sample taken of the more heavily mineralized portion assayed: Gold, 0.04 oz.; silver, 19.04 oz.; copper, 24.25 per cent. A few feet back from the face of the adit a winze was sunk to a depth of 15 feet on the vein, which at this place is 2 feet wide, and an average sample of the ore assayed: Gold, 0.04 oz.; silver, 4.13 oz.; copper, 5.86 per cent.

In a surface cut (elevation 6,310 feet) a short distance north-west of its junction with the *Broadview* vein is a streak of solid sulphide ore 6 inches wide, a sample of which assayed: Gold, 0.04 oz.; silver, 20.6 oz.; copper, 9.67 per cent. From the No. 3 level a crosscut was started in a westerly direction to ascertain if, at depth, this small copper vein was any larger and contained ore. The crosscut has been driven a distance of 55 feet, but not far enough yet to intersect the downward extension of this copper streak. The entire ground passed through by this crosscut consists of carbonaceous phyllites, containing stringers of quartz more or less mineralized with iron and copper pyrites. There is a good deal of water seeping through the rock which has in many places coated the walls with patches of malachite, showing that there is decomposing copper sulphides between this point and the surface.

Nettie L.* This mine is situated on Nettie L. mountain, on the opposite side of Ferguson creek (North fork of Lardeau creek) from the Great Northern mountain, on which the *Broadview* mine is situated. The elevation of the *Nettie L.* workings is 5,200 feet, and the mine is connected with the town of Ferguson by a wagon-road. The ore occurs in a graphitic phyllite along a zone of crushing which afforded an avenue for the circulation of the ore-forming solutions, and resulted in the cementing together of the rock fragments by mineralized quartz, and in the partial replacement of the phyllite breccia by similar material. Between the years 1900 and 1904 a large amount of work was done on the property, and over 2,200 tons of ore shipped to the smelter, which contained in the neighbourhood of: Gold, 0.17 oz.; silver, 140 oz.; lead, 20 per cent. The property was then shut down and remained idle until 1912, when it was again worked for a short time. The mine is owned by the Ferguson Mines, Limited, who also operated the *Silver Cup*, a description of which is given farther on.

In the *Nettie L.* there are two series of veins, one which parallels the strike of the formation, and the other cuts across it at varying angles; some of these latter eventually turn almost parallel to the first series, into which they merge. There has been in the neighbourhood of 7,000 feet of work done on this property in the shape of adits, drifts, crosscuts, raises, and winzes, the majority of which, however, has been confined to two veins, known respectively as the "Main Lead" and the "Cross Lead." In the latter a shoot of high-grade galena ore was discovered from which large shipments were made. This shoot dips into the Main Lead, where the solid sulphide ore becomes somewhat scattered, although it is generally thought that, in depth, another shoot will be found. In the Main Lead the ore-bodies occur as lenticular masses, which, being somewhat scattered, give the vein a very spotted character. The vein between these lenses does not contain much mineral; therefore only a small proportion of the ore mined is sufficiently rich to allow of its being sent to the smelter without previous treatment. Consequently, in extracting the ore which was shipped, a large tonnage of lower-grade material was accumulated on the dumps and in the stopes, there to await the erection of a plant which would concentrate it to a grade sufficiently high to ship, or some plant which would extract the valuable metals on the spot.

The mineralization consists of iron pyrites, zinc-blende, galena, and grey-copper, the latter being rich in silver, and some of the zinc-blende rich in gold. These sulphides are usually

* Brock, R. W. Summ. Rep. Geo. Surv. Can., 1903, p. 65. Robertson, W. F. Ann. Rep. Min. of Mines, B.C., 1903, pp. 120, 121.

intimately mixed, making it a difficult ore to treat by the ordinary wet methods, as, in the crushing, much of the grey-copper slimes and floats off with the tailings, carrying with it much of the silver. It is probable, however, that one of the flotation processes of ore-treatment which have been developed within the last few years would successfully treat this ore.

In 1912 this property was worked on a lease, and some 30 tons of ore shipped from the upper levels. The high-grade ore above the level of the lowest workings, so far as discovered, has now been all mined out, and it is a question of doing a considerable amount of development-work to find and open up new ore-bodies before shipments can be resumed and steadily maintained; to do this meant the expenditure of more capital than the lessees had at their command; work was therefore discontinued.

The property is equipped with camp buildings, an air-compressing plant, and an aerial wire tramway to Five-mile, on Lardeau creek (South fork), where is situated the *Silver Cup* mill.

Adjoining the *Nettie L.* to the south-east is the *Ajax*,* where a continuation of the *Nettie L.* ore-bodies has been opened up. This claim is one of the *Nellie L.* group and belongs to the same owners, but was not included in the lease previously mentioned.

Considerable development-work was done on this claim during the period when the *Nellie L.* was in active operation, but for six or seven years prior to 1912 it lay idle. In that year, however, a few men were put to work repairing the old adits and drifts, and a body of silver-lead ore was found above the No. 1 level. This shoot proved to have a length of 140 feet and a width of from 5 to 12 feet. From it was shipped some 550 tons, assaying: Silver, 40 oz.; lead, 60 per cent, Some very rich ore was found in the *Ajax* drift in the early days; some of the quartz, containing a chocolate-coloured zinc-blende, iron pyrites, and a sprinkling of galena, assayed $100 in gold to the ton, and occasional specimens as high as 20 oz. of that metal. Along the outcrop where the grey-copper has become weathered wire-silver was sometimes found.

In this and the other claims of the *Nettie L.* group the high-grade ore-shoots—that is to say, ore sufficiently rich to admit of its being shipped direct to the smelter—occur more or less as lenticular masses within a mineralized fracture-zone, but are of no great extent in any one direction. This necessitates the employment of a number of men in development-work, looking for new bodies of shipping-ore while the extraction of those already opened up goes on; this adds materially to the mining costs and has proved a serious detriment to the successful operation of the property. Associated with these higher-grade masses, and between them, is a large amount of second-grade ore—that is to say, ore which contains from: Gold, 0.15 to 0.4 oz.; silver, 30 to 50 oz.; lead, 3.5 to 4 per cent.; zinc, 4.5 to 20 per cent.; copper, 1 to 1.5 per cent—which, if it could be concentrated, might be counted on to keep a 50-ton mill in steady operation, and to yield sufficient to pay all operating expenses and to leave a margin of profit, in which case the higher-grade lenses would be clear gain. The difficulty in the way of treating this ore is the separation and saving of the grey-copper and the separation of the zinc from its associated minerals. This problem, however, is not insurmountable, and I believe a series of concentration tests with a combination of the flotation and electrostatic processes would successfully solve the problem.

Canadian.

On the south-east side of Lardeau creek (South fork), opposite Nettie L. mountain, is the *Canadian* mine, upon which has been discovered an outcrop of galena. The formation is a carbonaceous phyllite, having a strike of N. 60° W., with a vertical dip, cut by a quartz vein having a strike of N. 10° E., with an easterly dip of 80 degrees.

* Brock, R. W. Summ. Rep. Geo. Surv. Can., 1903, p. 65. Robertson, W. F. Ann. Rep. Min. of Mines, B.C., 1903, pp. 120, 121.

A shaft (elevation 3,825 feet) was sunk on the galena to a depth of 55 feet, where a flow of water was encountered too great to be handled by hand. Thirty feet below the collar of the shaft a drift has been driven southward on the vein for a short distance. The vein is here 4 feet wide, and on its hanging-wall side there is a streak of decomposed material containing much iron oxide, with occasional bunches of solid galena. A sample taken across the vein in the shaft at this level assayed: Gold, a trace; silver, 1.6 oz.; no assay being made for lead. A selected sample of the galena from the drift assayed: Gold, 0.04 oz.; silver, 63.6 oz.; lead, 72.6 per cent. Associated with this galena is a considerable quantity of iron pyrites, a fairly clean sample of which assayed: Gold, 0.46 oz.; silver, 6.6 oz.

Between the vein and the hanging-wall is a gouge about 6 inches wide composed largely of crushed quartz, a sample of which assayed: Gold, a trace; silver, 1 oz. One hundred and twenty-five feet vertically below and a short distance north-east of the shaft an adit has been driven on the vein with the intention of getting below the bottom of the shaft, raising to it, and thus draining the water, so as to enable the downward extension of the galena-shoot to be opened. This adit has been driven on the vein for a distance of 100 feet. The rock is very badly broken, and near the face of the level there are some open seams, from which a heavy flow of water comes; there is also a great deal of water coming in from the roof. The face of the adit seems to be about through the wettest portion of the ground, and a few feet farther should carry it beyond the heavy flow into more solid ground, where the workings will be comparatively dry. The level has not been driven far enough yet to reach a point directly underneath the shaft, nor has there been any crosscutting done, looking for the downward extension of the galena-shoot, although in the vein itself occasional bunches of galena have been found.

At surface the formation is much broken, and the vein outcropping near the bottom of a draw probably accounts for the heavy flow of water, which, owing to the open nature of the ground, flows beneath the surface in this depression and along the vein.

About 300 feet south-east of the shaft is a belt of quartzite which can be traced through the country for a long distance, and is locally known as the *Cromwell* dyke.

Silver Cup.* This property is situated on the north slope of Silver Cup mountain, south of Lardeau creek (South fork), at an elevation of 6,500 feet. The ore occurs in a belt of carbonaceous phyllite, approximately 1,000 feet wide, lying between a band of siliceous lime and one of quartzite, locally called the *Cup* and *Cromwell* dykes respectively.

There are two veins in this mineralized belt, roughly parallel with the formation, which here has a strike of N. 45 W. and a north-easterly dip at a steep angle. The ore occurs as lenticular masses, usually connected together by quartz stringers, lying parallel to the bedding-planes of the enclosing rocks. The two veins are known respectively as the *Cup* lode and the Blind lead, the latter having been found while driving a crosscut to intersect the *Cup* lode at a vertical depth of 135 feet, and does not outcrop at surface.

This mine is by far the most extensively developed in the district and has produced the largest quantity of ore. The first shipment was made in the year 1896, and from that time until the end of 1901 a total of 1,286 tons of ore had been shipped, having an average metallic content of: Gold, 0.2 oz.; silver, 150 oz.; lead, 35 per cent.

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* Brock, R. W. Summ. Rep. Geo. Surv. Can., 1903, pp. 66, 67. Robertson, W. F. Ann. Rep. Min. of Mines, B.C., 1903, pp. 116-119. Jacobs, E. Ann. Rep. Min. of Mines, B.C., 1909, pp. 116, 117.

The total amount of development, consisting of adits, crosscuts, drifts, shafts, winzes, and raises, amounts to approximately 12,000 feet. The main adit is known as the *Sunshine* tunnel, which cuts the vein at a depth of 750 feet below its outcrop. From this level an underground shaft was sunk to a depth of 450 feet, and levels were driven at intervals. In this work a number of ore-lenses were discovered and mined. The ore was hoisted to the adit level, trammed to surface and sorted, the first-class ore being shipped to the smelter, and the balance stored on the dump for future treatment; the ore being first roughly sorted in the stopes and only the better-mineralized portion hoisted. There is, therefore, stored in the stopes and on the dumps a very large tonnage of ore which is of too low a grade to ship to the smelter without previous treatment, but which contains approximately: Gold, 0.3 oz.; silver, 25 to 35 oz.; lead, 4 to 5 per cent., together with some zinc.

In addition to the two main lodes, there is a series of subsidiary veins connecting the two. In some of these good-sized masses of ore were found. All known ore-shoots in the upper levels have been mined out and the working costs have materially increased with depth, owing to the fact that the ore has to be hoisted several hundred feet, and there is a good deal of water to be pumped. In order to overcome this and reduce the costs of mining, it would be necessary to go farther down the mountain-side, and drive a long crosscut to the vein, and, as the portal of this crosscut would be several hundred feet below the upper terminal of the existing tram, it would necessitate a rearrangement of the mine plant and involve the expenditure of a large amount of capital, which the management did not consider advisable without first doing additional prospecting, and this, under present conditions, is not possible. The mine is therefore closed, except for a few leasers who are taking out what little ore remains in the workings. The proportion of shipping-ore to the actual tonnage of rock broken is very small, and, as in the case of the *Nettie L.*, the real value of this property lies in its larger masses of comparatively low-grade ore.

This was realized by the Silver Cup Mines, Limited, predecessor to the present owners, which, under the advice of its engineers, erected a milling plant at Five-mile,* which was intended to treat the low-grade ore, not only from the *Silver Cup* mine, but also that from the *Nettie L.* The process installed here consisted in first crushing and wet-concentrating the ore, giving the concentrates a chloridizing roast, and then amalgamating in pans. Unfortunately the tailing losses were exceedingly high, owing partly to the sliming of the grey-copper, which, as previously stated, is a heavy silver-carrier, and partly to the serious losses in mercury from the amalgamating-pans. The plant was operated for about a year, and some 10,000 tons of ore was treated, but the results being unsatisfactory the plant was shut down and has since remained idle.

For such an ore as that produced by the *Silver Cup* and *Nettie L.* mines, containing a fairly intimate mixture of iron pyrites, galena, zinc-blende, and grey-copper, the process outlined above is obviously unsuited. The solution of the problem is more likely to be found in a first concentration by water over jigs and tables, with regrinding and retreatment of the coarse, followed by separation of the fines by one of the flotation processes, which would undoubtedly save the grey-copper. Three concentrates should be produced, galena, iron sulphide, and zinc-blende, from the jigs and tables, and the fine concentrates from the flotation section containing the bulk of the grey-copper and such iron pyrites, zinc-blende, and galena as went over with them. These concentrates could then be finally separated by means of an electrostatic separator, or perhaps with a pneumatic jig.

* Robertson, W. F. Ann. Rep. Min. of Mines, B.C., 1903, p. 120. Hadow, E. G. Ann. Rep. Min. of Mines, B.C., 1904, p. 116.

It should be possible to design a process for the treatment of this ore, which would save the bulk of the metallic minerals, and to separate them, that each would be a marketable product. A process which will successfully concentrate this type of ore is a necessity for this portion of the Trout Lake Division, as between the *True Fissure* mine on the north-west and the *Silver Cup* mine on the south-east there is a tremendous tonnage of low-grade ore available, but the plant installed must be one suited to the ore, and not try to make the ore suit the process, which is an impossibility, as the old Silver Cup Company found out. It is generally stated that the plant at Five-mile cost $250,000, rather an expensive experiment.

Triune.* This property is situated on the north slope of Triune mountain, which forms the divide between the headwaters of Triune and the North fork of Brown creek, and is at an elevation of 7,500 to 8,000 feet. The ore outcrops in the face of a precipitous bluff beneath a small glacier which occupies the basin at the head of Triune creek. The portal of the upper adit is only a few feet below the glacier, under which it has been driven; consequently the temperature never rises above freezing-point, and even in the middle of summer the ground remains frozen and the walls of the adit covered with frost crystals. If this level is not used for any length of time it becomes filled with ice, and was so filled at the time of my visit. In the winter-time there is a constant danger from snowslides.

The formation is a dark slate, having a north-westerly strike and a dip of 70 degrees to the north-east, much broken and twisted by local disturbance. Associated with it are a number of dykes of the rusty-weathering diabase-schist, between one of which and the slate occurs the main *Triune* vein, which varies in width from 2 to 8 feet, but is very irregular. Three adits have been driven, the two upper ones of which are in the ore, and the third is a crosscut commenced some 250 feet vertically below them, from a bench cut in the solid rock of the hillside, upon which a small bunk-house has been built in such a manner that any snowslide coming down (which is liable to happen at any time during the winter) will be carried over the building without harming it. This crosscut was never completed to the vein, the property having been shut down in 1905 and has since remained idle.

Between the years 1901 and the end of 1905, 534 tons of ore was shipped, assaying approximately: Gold, 0.9 oz.; silver, 250 to 400 oz.; lead, 33 to 50 per cent. An aerial wire-rope tram was built in 1901 from the bunk-house to a lower terminal at the end of the wagon-road on Lardeau creek, but, as it was constructed down the Triune basin and creek, the snowslides of the following winter carried away several of the towers, wrecking the tram, which was never rebuilt. It would be possible to build a tram along the sides of the basin in such a place and at such an elevation that it would be safe from slides.

The ore produced from this property is of as high a grade as any produced in the Trout Lake District, and there is every reason to believe that additional development will open up new ore-shoots. This property and its workings have been described in detail in the references given in the foot-note, and very little additional work having been done since that time, it is not necessary to repeat those details here.

Morning Star. This property is situated in the side of a glacial cirque on Triune mountain, on the east side of Triune pass, at an elevation of 7,750 feet. There are two veins upon this property, both of which have a strike of N. to N. 10° W., and one a vertical dip and the other a dip of 45 degrees easterly. The formation in which these veins occur is a belt of siliceous lime containing a good deal of green chlorite, and having a strike of N. 45° W. and a north-easterly dip of 70 degrees. The vertical vein,

* Brock, R. W. Summ. Rep. Geo. Surv. Can., 1903, pp. 69, 70. Robertson, W. F. Ann. Rep. Min. of Mines, B.C., 1903, p. 122.

known as the *Morning Star* vein, has been opened by two adits, driven on its course, from the face of a bluff where it outcrops. The upper adit shows the vein to consist of a series of quartz stringers, following a line of fissuring through the lime. These stringers vary in width from a few inches to a foot, and contain galena, grey-copper, iron pyrites, and a little zinc-blende. This level being close to surface, the grey-copper has been largely weathered to a carbonate, forming quite showy specimens, with the brilliant blue and green hues of that mineral. A sample taken across 4 inches of ore in the face of the upper adit, at a distance of 50 feet from the portal, assayed: Gold, 0.6 oz.; silver, 107.8 oz.

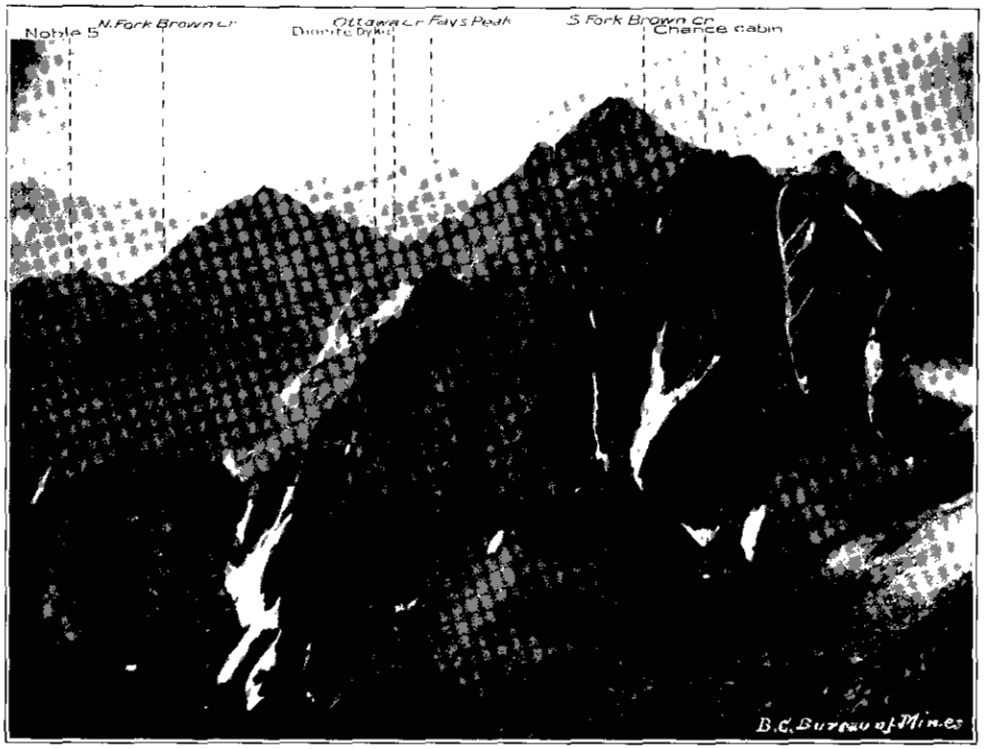
About 15 feet above this adit, on a little bench in the bluff, occurs the second vein, which is locally known as the "Flat" vein. This occupies a joint plane in the lime and was undoubtedly formed at the same time, and by the same solutions, as the other. In a small cut made in the outcrop there is exposed 4 to 6 inches of ore containing galena and grey-copper, a sample of which assayed: Gold, 0.25 oz.; silver, 137.4 oz.; lead, 44.6 per cent. A short distance down the mountain, in the direction of the dip of this flat vein, at the side of a draw, a prospect-shaft was sunk some years ago, in the bottom of which the continuation of the vein was cut, and found to contain galena, iron pyrites, and grey-copper. About 100 feet below this shaft, occupying the bottom of the basin, is a small mass of ice, all that now remains of the glacier which once covered this mountain.

Chance.

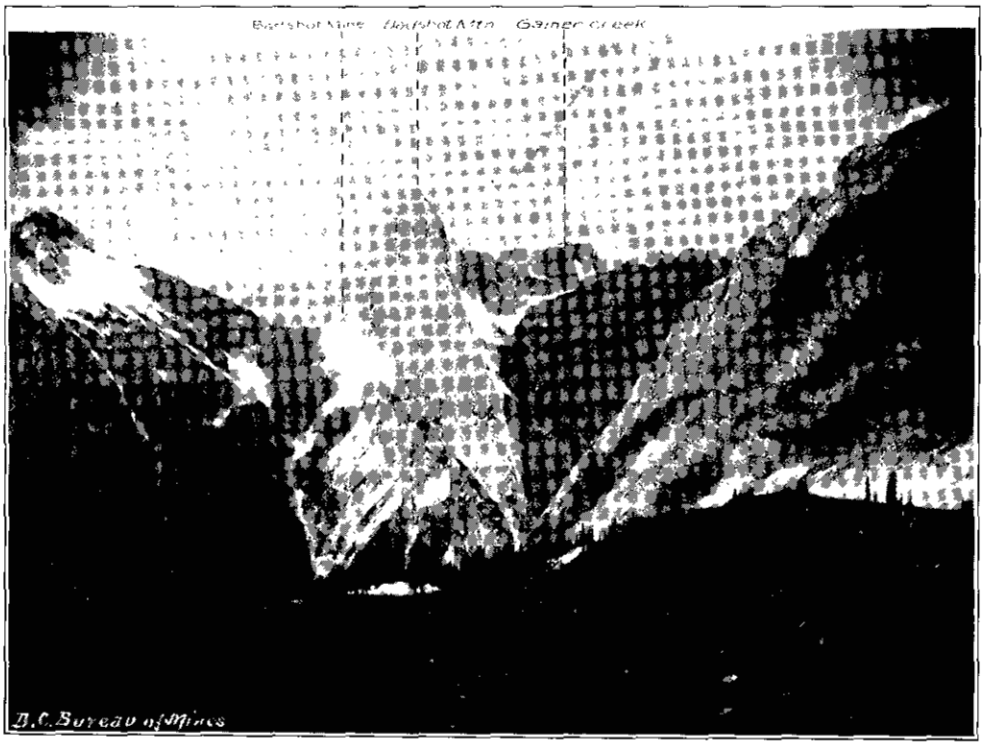
On the opposite side of the cirque is situated the *Chance* mine, the lower adit on which has an elevation of 7,550 feet. The vein here has a strike of N. 25° W., with a dip of 72 degrees north-easterly, occurring in a belt of carbonaceous phyllite having a strike of N. 45° W. and a north-westerly dip at a low angle. Between this phyllite and the *Morning Star* lime-belt is a dyke of diorite in which the hornblende is of a decided green colour, and occurs in good-sized individual crystals and clusters, giving the rock a porphyritic appearance. This diorite extends from the head of Triune pass to, and across, the South fork of Brown creek, beyond which it has not been traced.

The *Chance* vein has been opened by two adits, the upper one of which is 100 feet vertically above the lower. For the first 65 feet this upper adit is a crosscut to the vein, upon which a drift has been made in a southerly direction for 165 feet. In these workings the vein is well defined, with slickensided walls, and consists of quartz containing inclusions of phyllite, and is mineralized with galena and iron pyrites, which in places form bunches of solid ore, while the minerals occurring in layers give it a banded appearance; grey-copper occurs sparingly in these workings. A sample taken across the face of the south drift over a width of 18 inches, where the vein consists of quartz and phyllite, well mineralized with iron pyrites, galena, and a little grey-copper, assayed: Gold, 0.08 oz.; silver, 161.2 oz.; lead, 12 per cent. A sample taken from the east side of the south drift 15 feet back from the face, where there was 3 inches of solid galena ore containing some iron pyrites, assayed: Gold, 0.38 oz.; silver, 97.1 oz.; lead 31 per cent. In the face of the north drift the vein is only 8 inches wide, and consists of a white quartz containing fragments of included phyllite, and is sparingly mineralized. An average sample taken from this place assayed: Gold, a trace; silver, 2.2 oz.

The lower adit commences in a rock-slide, and then continues as a crosscut through the phyllites to the vein, which it cuts in a distance of 100 feet. From the point of intersection a drift has been driven in a northerly direction following the vein, the idea being to come under the downward continuation of the ore showing in the south drift of the upper level. In the face of the north drift in the lower adit there is about 4 inches of quartz mineralized with galena and chalcopyrite, but it has not yet been driven far enough to reach its objective point.



Noble Five Ridge—Trout Lake M.D.



Badshot Mountain—Trout Lake M.D.

Timber is difficult to obtain at this altitude; consequently in that part of the lower level requiring timbering the sets have been placed rather far apart, and the sides of the level between them have been walled up with flat slaty rock obtained from the rock-slide. A retaining-wall made of the same material has been built at the portal of the adit. The owner of the property, David Morgan, deserves a great deal of credit for the careful and neat manner in which he has done this work, and the ingenuity which he has displayed in making the rock-slide material take the place of timber for supporting the workings.

Both this property and the *Morning Star* are situated several hundred feet above timber-line, and, owing to their altitude, are covered by snow during the greater portion of the year; the cost of mining and development is consequently high. They are easy of access during the summer, the British Columbia Government having built a trail along the North fork of Brown creek, on an easy grade, over which a horse can be ridden with comfort.

The veins in the *Morning Star* and *Chance* properties are supposed to be the continuation of those which occur in the *Triune*, which in turn are generally believed to be a continuation of those from the *Cup*. Sufficient work has not been done to definitely decide this one way or the other, but there is no doubt that they all occur in the same belts of phyllite and limestone.

I.X.L.

This property is situated on the north side of the North fork of Brown creek, on the slope of Triune mountain below the *Morning Star* property, which it adjoins. The formation here consists of a greenish talc-schist, having a strike of N. 45° W., with a north-easterly dip of 75 degrees. The vein has a north-south strike, with a dip varying from 25 to 70 degrees to the east, and is undoubtedly the southerly extension of the *Morning Star* vein. On the *I.X.L.* the vein outcrops in the precipitous side of a very steep draw, where it has been developed by two adits and some surface prospecting, the uppermost cut being an an elevation of 7,500 feet. The upper adit (elevation 7,050 feet) follows the vein in a northerly direction for 50 feet, showing it to have a width of from 6 to 18 inches, and to consist of quartz well mineralized with galena, iron pyrites, zinc-blende, and grey-copper. Some years ago several tons of ore are stated to have been stoped from this level and shipped to the smelter with satisfactory results, but particulars are not now available.

About 20 feet back from the face of this level a winze was sunk to a depth of 6 feet, in the sides of which the vein has a width of 12 inches, and an average sample taken of this assayed: Gold, 0.2 oz.; silver, 24.8 oz.; lead, 9.5 per cent. At the head of a raise, immediately over the winze which comes to surface in the draw about 30 feet vertically above the level, is a seam 6 inches wide of oxidized ore on the foot-wall side of the vein, showing little unaltered sulphides. A sample of this material assayed: Gold, 1.2 oz.; silver, 20.6 oz.

One hundred and fifty feet vertically below the upper adit a second level has been driven on the vein from its outcrop in the side of the draw. This level has been driven a distance of 200 feet in a northerly direction along the strike of the vein, which here has a width of 12 to 18 inches, with well-defined walls. The ore consists of galena, iron pyrites, chalcopyrite, zinc-blende, and a little grey-copper in a gangue of quartz containing some green chlorite. The vein at this level has a dip of 70 degrees to the east, and a sample taken across it at the face assayed: Gold, 1.46 oz.; silver, 12.0 oz. Between the vein and the foot-wall is 6 inches of crushed, oxidized rock, a sample of which assayed: Gold, 0.7 oz.; silver, 10.3 oz.

This property is situated below timber-line and is connected with the trunk trail along Brown creek by a branch trail, which, however, is both steep and rough and will need repairs before it can be safely used for "packing," there being a few places where it would be dangerous to take a horse.

Noble Five.

This property is situated on the south side of the North fork of Brown creek, on the north slope of the narrow ridge forming the divide between the two branches of Brown creek. This ridge consists of a wedge-shaped mass of bare rock largely devoid of timber, and in the winter-time continually swept by snowslides. The formation is a carbonaceous calc-phyllite having a strike of N. 45° W., with a dip of 67 to 75 degrees north-easterly, the strike of the rocks being almost at right angles to the trend of the ridges.

The *Noble Five* vein follows pretty much the strike of the enclosing rocks and is exposed at several places in the bluff, where, at an elevation of 6,250 feet, a cut and drift 30 feet long has been made on it. In this cut the vein has an average width of 18 inches and consists of quartz mineralized with galena, iron pyrites, and grey-copper. An average sample taken across the vein, over a width of 18 inches at the face of the drive, assayed: Gold, 0.36 oz.; silver, 117.3 oz.; lead, 16 per cent. Fifty-five feet vertically below and a short distance east of this level a diagonal crosscut has been commenced to come under the "ore-showing" at depth. This, however, has not as yet been driven far enough to cut the vein.

In a few other places on the precipitous mountain-sides ore along the outcrop of this vein has been found. The means of getting to these places was to climb an almost vertical cliff from ledge to ledge, and at one time bars of iron had been driven into the rock, from which ropes were hung to assist in such climbing. Most of these ropes have not been renewed or used for several years, so it was not deemed safe to visit these places along the outcrop, especially as there was no additional information of material importance to be obtained by so doing.

In the draw a short distance west of this vein, just above the top of a rock-slide, there are a number of stringers occupying fracture-planes in the phyllites. These stringers have a north-south strike and dip to the east at an angle of 80 to 85 degrees. They are of quartz, well mineralized with galena and iron pyrites, a sample of which assayed: Gold, 0.46 oz.; silver, 19.6 oz.; lead, 14.3 per cent. Just above these stringers is an open fissure conforming to the general strike of the formation, but dipping at a slightly steeper angle. This fissure varies in width from a few inches to 2 feet, and is lined with crystalline calcite; it can be traced for a distance of over 1,000 feet. Near the foot of the mountain, in Brown Creek valley, north-west of the *Noble Five* vein, and in the timber, an outcrop of quartz has been found containing galena and iron pyrites.

Owing to the amount of talus which covers the ground at this place the vein has not been traced out, so that its course and dip cannot be stated with any degree of accuracy. It appears, however, to be striking in a south-easterly direction and to be cutting the formation at a low angle. Very little work has been done on this as yet, and no samples were taken.

The diorite dyke mentioned in connection with the *Chance* prospect crosses Brown creek on the south side of the draw above mentioned, and constitutes the steep bluff upon which the I.X.L. cabin is situated. On the north side of this dyke, between it and the *Noble Five* phyllites, is a band of crystalline limestone containing green chlorite; this is the south-east extension of the limestone which occurs in the *Morning Star* property. Where it crosses Brown creek the diorite dyke has a width of 200 feet. On its south side is a wide belt of serpentine containing asbestos in the cross-seams and along the slips. This rock is much disturbed and has been subjected to a great deal of pressure. To the south of this serpentine, going up the valley of Brown creek, occur belts of black slates and phyllites.

In the latter is situated the *Cromwell* property, where a quartz vein 6 inches to 4 feet wide, having a strike of N. 15° E. and a dip of 74 degrees easterly, outcrops along the precipitous mountain-side. It has been developed by a few surface cuts and an adit along its course

for a distance of 70 feet. The elevation of this adit is 7,400 feet, and in order to reach it an exceedingly steep rock-slide has to be climbed, across which there was at one time a trail. This has become pretty nearly obliterated by the action of the rain and snow carrying the loose rock down over it, and, as little work has been done here during the past two seasons, the trail has not been rebuilt. One of the owners of the property, however, informed me that they expect to resume work next year, when a new trail will be built.

In the adit above mentioned the vein is well defined, with smooth walls, and at the face has a width of 15 inches. It is of quartz, mineralized with iron pyrites and a little chalcopyrite, an average sample of which assayed: Gold, 0.32 oz.; silver, 2.5 oz.; copper, 2.7 per cent. Near the mouth of the adit the vein had a width of 3 feet, from which 11 tons of ore was mined and sent to the smelter, yielding: Gold, 5.33 oz.; silver, 5.64 oz. This ore was of course sorted. Average samples taken from the vein exposed in the floor of the level over the first 35 feet in from the portal assayed: Gold, 1.16 oz.; silver, 1.15 oz.

Owing to the difficulty in getting to the adit and the frequent interruption to the work during the winter months, caused by snowslides, a new level has been started farther down the mountain-side. This will involve crosscutting approximately 100 feet before the vein is reached, but by drifting north along the course of the vein it is expected that the downward extension of the ore from which the shipment was made will be found, and that shipments of good-grade ore can then be resumed. The workings are situated well above timber-line, but the ground in which the vein occurs is firm, and therefore requires little artificial support.

Alpine Group. On the summit of Silver Cup ridge, about a mile south-east of the head of the North fork of Brown creek, is situated the *Alpine* group, where a quartz vein 3 feet wide outcrops along a comparatively level stretch of ground. The vein has a north-south strike, with a dip of 84 degrees to the east, and has been prospected by several open-cuts over a distance of 200 feet, and by a prospect-shaft sunk to a depth of 40 feet, at an elevation of 7,075 feet.

The ore consists of iron pyrites, galena, and zinc-blende in a quartz gangue, an average sample of which assayed: Gold, 0.1 oz.; silver, 3.3 oz.; lead, 4.6 per cent. Owing to the fact that this ore is comparatively low grade, and because of its situation that it must be developed by means of shafts (unless a prohibitively long crosscut be driven), and its distance from the main lines of transportation, the property has been allowed to lie idle for several years.

About two miles farther south-east, on the *Jewell* property, at an elevation of 7,300 feet, along the north slope of an ancient glacial basin, in a schist formation striking N. 45° W., with a north-easterly dip, is a quartz vein 2.5 to 4 feet wide, having a strike of N. 55° E. and a dip of 70 degrees to the north-west.

The vein is well defined and cuts the formation nearly at right angles. It has been developed by a series of surface cuts and prospect-shafts for a length along its course of some 300 feet. The mineralization consists of galena, iron pyrites, and a little zinc-blende. An average sample taken across the vein in the bottom of one of the prospect-shafts, over a width of 2.5 feet, assayed: Gold, 0.12 oz.; silver, 1.9 oz.; and a selected sample of the solid galena from the cuts assayed: Gold, 0.06 oz.; silver, 54.0 oz.; lead, 78.3 per cent. This vein can be developed by means of adits to a depth of probably 800 feet below its outcrop, but the lower level will require a somewhat long crosscut, as the dip of the vein is into the mountain; therefore, the deeper the workings, the greater the distance between the surface of the hill and the vein.

Skyline. Five miles farther south-east, along the summit of the divide, between the head of Ottawa and Haskin creeks to the north, and Stobart and Neil creeks to the south, at an elevation of 8,000 to 8,600 feet, on what is

known as the *Skyline* property, is a belt of silicified schist having a strike of N. 45° W., with a dip of 70 degrees to the north-east, cut by a series of joint planes striking N. 25° E. and having a south-easterly dip of 65 degrees.

Between this schist-belt and a carbonaceous phyllite lying next to it on the north-east is an irregular quartz vein from 2 inches to 4 feet wide, containing some pyrites with a little galena. This vein has been developed by a series of surface cuts along the steep mountain-side upon which it outcrops. An average sample taken across 4 feet of quartz in one of these cuts assayed: Gold, a trace; silver, 0.2 oz.; while a selected sample of the galena, which occurs sparingly in small bunches in the vein, assayed: Gold, 0.8 oz.; silver, 25.6 oz.; lead, 18 per cent. The work has been done along a narrow ridge of bare rock, having a general north-and-south trend, sloping to Trout lake on the south and to Healey creek on the north. Snowstorm pass cuts through the ridge 100 feet below the vein-outcrop, beyond which it again rises steeply, forming the divide between Ottawa and Haskin creeks, reaching an elevation of 9,300 feet in a peak locally known as Fay's peak. On the slope of this peak is a belt of calc-schist having a strike of N. 45° W., with a north-easterly dip of 70 degrees, cut by a series of fissures striking north-easterly; along the larger of which, ranging in width from 4 to 12 inches, there has been developed some quartz mineralized with iron pyrites, chalcopyrite, and a little galena; these towards the centre of the schist-belt are rather more numerous than elsewhere. The schist itself is slightly mineralized with iron and copper sulphides.

At an elevation of 8,800 feet, just above the glacier on the south-west slope of Fay's peak, a surface cut has been made along this copper-bearing schist, and near the centre, over a width of 8 feet, the mineralization is a little more pronounced. An average sample taken across this 8 feet assayed: Gold, a trace; silver, 0.2 oz.; copper, 0.2 per cent. Farther down the mountain-side other prospect-holes have been made at intervals, in some of which little streaks of well-mineralized quartz have been found; an assay of one of these showed it to contain: Gold, 0.1 oz.; silver, 5.6 oz.; copper, 3.25 per cent. This copper-bearing formation has been traced down the mountain-side into the basin at the head of Ottawa creek, at an elevation of 7,000 feet, where a 50-foot prospecting-adit has been driven along the more mineralized portion. A selected sample assayed: Gold, 0.13 oz.; silver, 5.0 oz.; copper, 4 per cent.

At the foot of the south-east slope of Fay's peak, in the Bonanza basin at the head of the Middle fork of Haskin creek, is the *Bonanza* claim (elevation 6,800 feet). Here a vein from 1 to 3 feet wide occurs, conforming in both strike and dip to the enclosing carbonaceous phyllite, which has the prevailing north-westerly course and north-easterly dip.

The vein consists of quartz mineralized with iron pyrites and a sprinkling of galena. It has been developed by an adit 160 feet long and several surface cuts, average samples from which assay: Gold, 0.2 to 1.8 oz.; silver, 1.5 to 6.0 oz.

Fidelity.

This property is situated about half a mile south of the head of American creek, and three miles north-west of the town of Gerrard, on the north-east side of Trout lake, at an elevation of 6,800 feet. On this property there are two veins, one consisting of quartz from 5 to 8 feet wide sparingly mineralized with iron pyrites, conforming in strike and dip to the enclosing schists, and the other consisting of quartz mineralized with iron pyrites and galena, having a more northerly strike, cutting the formation at a low angle, the galena occurring as a streak from 4 to 6 inches wide between the vein and the hanging-wall.

Development consists of a series of surface cuts and an adit driven in from the outcrop for a short distance. In this adit the vein lies almost flat, but is getting steeper towards the face. The workings are in the side of an ancient glacial cirque, and it is probable that the

rocks have been bent over by the weight of the ice-mass. In the years 1912-13 this property was operated under lease, and, from the adit, ore was mined, sorted, and the following shipments made:—

25 tons assaying: Gold, 0.22 oz.; silver, 52.7 oz.; lead, 45.1 per cent.; zinc, 1.8 per cent.
23.86 tons assaying: Gold, 0.18 oz.; silver, 70.0 oz.; lead, 61.2 per cent.
10 tons assaying: Gold, 0.26 oz.; silver, 58.1 oz.; lead, 51.4 per cent.

The zinc content of the last two shipments was traces only. The galena is fine-grained, with a silky texture, and contains antimony.

The nearest railway point to this property is Gerrard, the ore being transported to that place by means of rawhides on the snow.

Golden Crown. This property is situated on the Middle fork of Stobart creek, on the south-west slope of a spur from the Silver Cup mountains, on the north-east side of Trout lake, at an elevation of 6,000 to 6,500 feet. The vein consists of a highly crystalline quartz, having a strike of N. 25° W. and a dip of 70 degrees to the north-east cutting the enclosing carbonaceous phyllites at a low angle in both strike and dip.

The vein-outcrop forms one side of a draw formed by the erosion of the softer phyllite hanging-wall rock. The vein is well defined and stands out prominently like a stone wall. It has been prospected to a small extent by means of surface cuts across it and two short adits. The upper cut, at an elevation of 6,500 feet, shows the vein to have a width of 18 feet, and to consist of highly crystalline quartz, sparingly mineralized with iron pyrites. An average sample taken across 12 feet on the foot-wall side of the vein in this cut assayed: Gold, a trace; silver, 0.5 oz. A sample taken across 15 feet from the hanging-wall side assayed: Gold, 0.25 oz.; silver, 0.15 oz.

Below this cut, a few feet farther up the draw, an adit has been driven, but the mouth of which having caved rendered it inaccessible. The ore on the dump at the mouth of this adit is much more mineralized than is the vein in the cut above mentioned. About 300 feet south-east of the cut, down the draw along the strike of the vein, at an elevation of 6,350 feet, a second adit has been commenced to crosscut the vein. This adit, however, is in a rather bad condition, and it was not considered safe to venture far into it, as there was a good deal of loose rock overhead which a slight jar would probably bring down. However, an average sample was taken across 5 feet of the hanging-wall portion of the vein as exposed in this working, and assayed: Gold, 0.7 oz.; silver, 0.9 oz. Associated with the vein at this place is some galena, of which there is several hundred pounds on the dump. Two samples were taken of this galena, which assayed: Gold, 0.2 and 0.12 oz.; silver, 57 and 61.4 oz.; lead, 59.15 and 68.5 per cent. respectively.

There is a trail from the lake-shore up Stobart creek to the *Arallu* cabin on a fairly good grade; this trail passes within about half a mile of the *Golden Crown* workings; the property is therefore favourably situated.

Winslow. This property is situated near the head of Burg creek, on the north-east side of Trout lake, at an elevation of 5,500 to 6,800 feet. The vein is of quartz from 6 to 12 feet wide having a strike of N. 25° W. and a north-westerly dip of 53 degrees, outcropping along a steep hillside, upon which it has been opened by a number of surface cuts and four adits driven from different levels.

The two upper adits are only a few feet below the outcrop and within the zone of oxidation. In these the quartz vein is about 8 feet wide, well mineralized with iron pyrites, a considerable proportion of which has been leached, giving the rock a honeycombed appearance. Free gold can be frequently seen in the little cells left by the oxidation of the iron pyrites. From the

ore extracted in driving these adits a quantity was sorted and sacked in readiness for shipment to the smelter, the object apparently being to make a smelting test of this class of ore. These sacks, however, have rotted and most of them burst open. An average sample was taken from the ore thus exposed, which assayed: Gold, 5.4 oz.; silver, 4.6 oz.

About 100 feet below these workings another adit, known as the No. 4, has been driven on the vein at an elevation of 6,300 feet. For the first 30 or 40 feet this is a crosscut through the country-rock to the vein, which it then followed in a south-easterly direction for some 300 feet. This portion of the adit is entirely within the vein, and, as no crosscuts have been made, it is difficult to say how wide it is, but, as near as can be judged, it will average 10 feet. The ore from this adit was stated to contain from 0.4 to 0.6 oz. gold to the ton. In order to check this statement, a large sample was taken, representing as nearly as possible an average of the vein exposed in the level, crushed and quartered down. The resultant sample assayed: Gold, 0.4 oz.; silver, 0.6 oz. The quartz at this level is well mineralized with iron pyrites, and it is possible here and there to detect particles of free gold, not only associated with the iron pyrites, but also in the quartz. An examination of the dump at the mouth of the adit, where there is a considerable tonnage of ore, showed several pieces of quartz in which free gold could be seen.

Near the floor of a basin at the base of the hill, some 700 feet below, a main working-adit had been started to develop the vein at depth, but, owing to lack of finances, was stopped before the objective point was reached. This is much to be regretted, as there is every reason to believe that with systematic development this property would become a profitable producer of bullion.

There is a heavy flow of water from the No. 4 adit, carrying in solution considerable iron, as shown by the deposit of iron oxide formed along the bottom of the level, and the bottom of the little stream made by this water as it issues from the level, indicating the presence of decomposing iron sulphide in the rock through which it percolates.

Okanagan.

Just over the summit of the ridge above the *Winslow*, at the head of Silver Cup creek, at an elevation of 7,200 to 7,300 feet, is situated the *Okanagan* property, where there is a well-defined quartz vein from 1 to 3 feet wide, having a north-south strike, with a dip of 70 degrees to the east, cutting across a belt of siliceous schists which strike N. 50° W. and dip 55 degrees north-easterly. This schist-belt lies between the *Cromwell* quartzite dyke on the south and a second quartzite dyke on the north. These dykes are only about 400 feet apart.

The *Okanagan* vein has been prospected along its outcrop by a series of surface cuts and trenches for a distance of 200 feet, and by a prospect-shaft 10 feet deep. The quartz is mineralized with iron pyrites, which occurs both in bunches and as disseminated particles, and was said to be very rich in gold. To determine this, a sample free from quartz was obtained from the surface cuts, and examined carefully for visible gold, without finding any, but on being assayed proved to contain: Gold, 13.7 oz.; silver, 7.9 oz. An average sample taken across the vein exposed in the prospect-shaft over a width of 3 feet assayed: Gold, 1.9 oz.; silver, 2.9 oz.

In a shallow draw a short distance south of the shaft a crosscut has been started to cut the vein at a vertical depth of 40 feet. This crosscut has been driven a distance of 150 feet, but has not reached its objective point, although it is expected that this will be accomplished in a few feet more driving. In addition to this vein, there are a number of others, also seams and bunches of quartz, the majority of which conform to the strike of the enclosing schists, while others occupy joint planes at angles thereto. Some of these are said to be gold-bearing, but have had no work done on them and were not sampled.

The property is situated above timber-line, and must be developed by means of shafts, owing to this part of the summit being comparatively level.

In addition to the mines and prospects described, there are a number of others at various places along the Silver Cup mountains upon which more or less work has been done. Among these may be mentioned the *Copper Queen*, near the head of Six-mile creek, where a vein has been developed by an adit and a shaft; the *U and I*, situated at the head of Cup creek, where a small gold-bearing vein has been developed by means of a prospect-shaft, close to the northerly quartzite dyke previously mentioned, towards which it dips; the *Silver Plate*, on the summit at the head of Neil creek; the *American*, at the head of the Middle fork of Haskin creek the *Kootenay Belle*, at the head of the South fork of Haskin creek; and several others.

These prospects are situated at high elevations, ranging from 6,400 to 7,600 feet, and have more or less showings of ore; but their owners were looking for ore sufficiently rich to ship direct to the smelter without previous treatment, and this, owing to the locations of the properties and their distance from transportation, required an ore having a value of not less than $75 a ton. Ore, therefore, which would only assay $10 to $30 a ton was disregarded.

There are without doubt several veins on the Silver Cup mountains worthy of further development; notable among these are the *Golden Crown* and *Winslow*, which give promise of supplying a large tonnage of ore containing a sufficient amount of gold to yield a fair profit if treated in a mill on the ground.

LIME DYKE MINERAL BELT.

This belt is the south-easterly continuation of the same series of limestones, slates, and phyllites that occur at the head of Lexington and Poole creeks, in the Lardeau Division. In the Trout Lake section they have their greatest development along the upper portion of Ferguson, Gainer, Lardeau, and Hall creeks.

Between this and the Central Mineral Belt series occurs a belt of chlorite-schist much altered and showing evidence of having been subjected to enormous pressure. This is particularly well developed along the headwaters of Surprise creek, a tributary of Ferguson creek, into which it flows near Circle City, about six miles north of the town of Ferguson.

Surprise. About two miles up Surprise creek is the *Surprise* group of claims, where there is a vein occupying a fissure in the chlorite-schist, having an east-and-west strike with a northerly dip of 80 degrees. The schists themselves at this place have a strike of N. 60° W., with a north-easterly dip of 75 degrees, and are cut by a series of joint planes having a N. 30° E. strike and south-easterly dip of 80 degrees. The vein-filling consists of iron pyrites and galena in a calcareous gangue containing inclusions of the chlorite-schist, together with calcite.

The vein has been prospected by a number of surface cuts and two shallow shafts along its course for a distance of 500 feet, and in the south bank of the creek it has been crosscut for 12 feet, showing it to be well defined, with slickensided walls. An average sample taken across this 12 feet assayed: Gold, a trace; silver, 2.8 oz.; lead, 9.6 per cent.

At the source of Surprise creek, above a glacier on the northern slope of the summit of Nettie L. mountain, the belt of chlorite-schist is well exposed in a series of perpendicular bluffs, caused by the weathering along the steep dip and jointing of the rocks. In the rock debris at the foot of these bluffs the presence of copper has been noted from time to time, and some years ago a group of claims was located and some development-work done, with, it was claimed, satisfactory results. Owing to lack of transportation, however, and the difficulty of access to this part of the country, the claims were allowed to lapse, and the ground remained open until 1912, when it was restaked, and, at an elevation of 6,050 feet, a crosscut driven into a bluff, showing some copper-stain, for a distance of 22 feet. It was claimed that the whole of this

rock contained copper in workable quantities, and in support of the statement an assay certificate was shown, said to have been the result from an average sample taken across the face of the crosscut, showing it to contain: Gold, 0.01 oz.; silver, 0.5 oz.; copper, 5.7 per cent. Another analysis was produced, made by J. O'Sullivan, of Vancouver, from a sample supplied him, which was stated to be a representative sample of the copper-bearing chlorite-schist outcropping along the ridge for a distance of 3,000 feet. The analysis showed the sample to contain: Gold, 0.01 oz.; silver, 2.5 oz.; copper, 3.5 per cent.; iron oxide, 10.39 per cent.; alumina, 6.61 per cent.; lime, 3.5 per cent.; sulphur, 1.3 per cent.; insoluble, 70.6 per cent.; water and carbonic acid, 3.7 per cent. It was also stated that this mineralized belt had a minimum width of 500 feet and a maximum of 1,500 feet, and that there were thousands of tons of this class of material in the talus at the foot of the bluffs. Samples were produced showing specks said to be copper-glance scattered through the chlorite-schist, and others showing quartz and calcite containing the same mineral.

On investigation it was found that the chlorite-schist belt has an average width of 1,000 feet, lying between a dark-coloured carbonaceous calc-schist containing iron pyrites on the hanging-wall, and a rusty-weathering, much-decomposed schist (where exposed) on the foot-wall. The crosscut above mentioned was very carefully sampled along both sides from its portal to the face, a measured distance of 18 feet. The samples were combined, crushed, and quartered down, and on being assayed proved to contain: Gold, a trace; silver, 0.6 oz.; no copper. Another sample was taken at the face of the crosscut over a width of 5 feet, by cutting two parallel grooves across it spaced 18 inches apart; the rock thus obtained was crushed and sampled down, and an assay showed it to contain: Gold, a trace; silver, 0.1 oz.; no copper.

These results are quite in accordance with what was expected from an examination of the rock, as there is a notable absence of copper-stain, except along some of the small quartz-filled seams. The rock, however, does contain some specks of an iron-coloured mineral having a metallic lustre, which, when accompanied by a green stain, might be mistaken for copper-glance (chalcocite), and as in the rock from the crosscut in question these mineral particles are very small, it is difficult to make tests in the field to determine its real character, especially by those not familiar with mineralogy. Samples of the rock taken from this crosscut, and since examined, show the mineral in question to be ilmenite, or titanic iron ore.

Some 2,000 feet south-east of this crosscut, in a draw at an elevation of 6,900 feet which cuts the formation, and at the head of a talus slope, a side-hill cut has been made showing a number of narrow stringers occupying cracks in the rock. These stringers consist of quartz, mineralized with copper-glance and bunches of crystalline ilmenite. It was stated that a sample taken across the full length of this cut gave a good assay in copper. A sample taken by the writer across 50 feet along the face of the cut (being careful to reject the seams which showed copper-glance), on being assayed, gave traces only in gold and silver, and no copper. From these results it is evident that the samples previously assayed did not represent an average of the schist-belt over its entire width, and that in taking these samples pieces of copper-glance must have got into them.

In the talus slope above mentioned a number of boulders and fragments of conglomerate were observed, the pebbles in which were elongated, and some of them broken, indicating that it had been subjected to squeezing. The cementing material of this conglomerate is rich in chlorite, and the whole rock has a dark colour. In weathering, the chlorite is first carried away, leaving the pebbles standing out in a conspicuous manner. The rock from which these boulders came was not seen in place, but is stated to outcrop in an ancient glacial basin at the head of the draw. Boulders of a similar conglomerate rock were noted in the valley of Poole creek above Hillman.

t Stope in Adit, Blue Bell Mine—Trout Lake M.D.

Rawhiding Ore from True Fissure Mine—Trout Lake M.D.

Little Robert.

At the head of Ferguson creek, on its east side, at an elevation of 7,200 feet, is the *Little Robert*, on which there is a quartz vein from 2 to 5 feet wide in a band of lime. In its strike the vein conforms to the enclosing rocks, but on its dip cuts the lime towards a belt of slate which lies next it on the south.

The ore consists of bunches of galena and grey-copper in a quartz gangue. Development-work consists of a surface cut and a shallow pit at the foot of a bluff above a small glacier, at an elevation of 7,250 feet, and a crosscut started, at an elevation of 7,000 feet, from the hanging-wall side, with the intention of cutting the vein at depth. It has not yet been finished.

Two small shipments were made of sorted ore from these cuts and pit, one of which weighed 200 lb. and the other 5,000 lb. The former assayed: Silver, 110.8 oz.; lead, 21.5 per cent.; and the latter assayed: Silver, 114.0 oz.; lead, 24 per cent.

Big Five.

On the east side of Ferguson creek, at an elevation of close to 8,000 feet, is the *Big Five* property, where, it is stated, there is a belt of limestone impregnated with galena, which is not only disseminated through the rock, but also occurs in masses. This ore, however, is considered of too low a grade to permit of its being mined under existing conditions, and the property is idle. Owing to the bad condi tion of the trail leading to this property it was not visited by the writer.

There are a few other prospects in this part of the Lime Dyke Belt, but, as they have had no work done on them for a number of years, were not visited.

On Gold gulch, a tributary of Gainer creek, which enters that stream two miles above Ten-mile, there is a belt of lime 100 feet wide, having a strike of N. 50° to 55° W. and a southerly dip at an angle of 80 degrees. On the foot-wall of this line is a grey-spotted phyllite, beyond which is another belt of lime containing chlorite.

Hidden Treasure.

About a mile up Gainer creek from its mouth is located the *Hidden Treasure* property, a group of claims on the south side of the creek, and extending nearly to the summit of the divide. The mineralization occurs along fracture-planes in the lime, parallel to its strike, and also along a series of joint planes which have a strike of N. 65° W. and a north-easterly dip of 23 degrees. At the intersection of the fractures more or less replacement has taken place, and it is not unusual to find bunches of galena at these places. A narrow canyon crosses the formation, made by a small tributary stream having its source in the glacier crowning the summit of the divide. Where this canyon cuts through the lime it shows it to be heavily impregnated with iron over its entire width, and to contain galena in bunches and disseminated through it.

At an elevation of 5,900 feet on the hanging-wall side a short adit has been driven into the mineralized lime, a sample of which, taken across a width of 5 feet, assayed: Gold, a trace; silver, 1.4 oz.; lead, 8.7 per cent. Some 1,500 feet south-east of this cut along the strike of the vein, at an elevation of 6,250 feet, a prospect-shaft has been sunk on the outcrop near the hanging-wall to a depth of 8 feet. The lime here is heavily impregnated with iron oxide, and contains, in addition, iron pyrites and galena, and a sample taken across 5 feet in this shaft assayed: Gold, a trace; silver, a trace; lead, 4 per cent.

On the foot-wall side of this lime-belt, below the shaft, at an elevation of 6,200 feet, is a fault occupied by a light-coloured dyke containing much quartz and calcite, mineralized with galena and iron pyrites. This is 18 inches wide, and a sample taken across it, where exposed in a cut, assayed: Gold, a trace; silver, 0.2 oz.; lead, 1.5 per cent. Some 500 feet north-west of this cut, on the foot-wall side of the lime, at an elevation of 5,850 feet, a crosscut has been made for a distance of 10 feet, showing the lime to be of the same character as elsewhere,

but here apparently more heavily mineralized. A crosscut is being driven through the foot-wall phyllites at a place 3,000 feet south-west of the ore-exposure in the small creek above mentioned. The object of this crosscut is not only to develop the mineral-bearing lime in this part of the property and at a depth of 200 feet below its outcrop, but also to have the workings where they will not be interfered with by snowslides in the winter; the upper part of Gold gulch being particularly bad in this respect. The portal of the crosscut is in a patch of timber, as is also the cabin, so they are reasonably safe.

This mineralized lime-belt has been traced across Gainer creek, into the basin at the head of Poole creek. The general appearance of this mineralized lime-belt on Gold gulch is very similar to that on Surprise creek and on the *Scout* property, in the Lardeau Division, of which it is claimed to be the continuation. While the percentage of mineral contained in the rock is low, there is apparently a great deal of it, and if it be found that the entire mass will average 5 or 6 per cent. lead, together with some silver, it could no doubt be profitably worked, as it can be mined at a low cost from the valley of Gainer creek and concentrated on the spot, there being ample water available for a mill, plenty of timber, and a mill-site free from snowslides. It is to be regretted that at no point has there been a crosscut made completely through the mineralized lime-belt, from one wall to the other. This, however, will probably be done when the crosscut now being driven reaches the ore-bearing formation.

Badshot. Near the head of Gainer creek, on its west side, at the foot of a precipitous mountain composed of limestone seamed with quartz, is situated the *Badshot* mine, where there is a quartz vein several feet wide, having a south-easterly strike and north-westerly dip at an angle of 45 degrees.

Some 300 feet of development-work has been done on this vein, consisting of a crosscut, an incline shaft some 70 feet deep, and drifts in both directions therefrom. The ore consists of galena, containing grey-copper, iron pyrites, and a little zinc-blende, in a gangue of quartz and calcite.

Two shipments have been made from the property, one of which consisted of 22 tons of ore, assaying: Silver, 157.0 oz.; lead, 56 per cent.; zinc, 4.6 per cent.; and the other of 32 tons, assaying: Silver, 177.0 oz.; lead, 56 per cent. Selected samples of coarse-grained galena from this vein assayed: Silver, 140 to 144.2 oz.; lead, 80 per cent. Samples of fine-grained galena from the same place assayed: Silver, 345.1 oz.; lead, 69 per cent. This latter evidently contained grey-copper, which would account for its high silver content.

The property is situated above timber-line, and is difficult of access in the winter owing to snowslides.

Mohican. On the opposite side of Gainer creek, at an elevation of 6,500 to 7,500 feet, is the *Mohican* property, where quartz veins have been discovered in a belt of carbonaceous calc-schist lying alongside and south of the Badshot lime dyke. The principal vein has a strike of N. 75° W. and a southerly dip of 70 degrees, occupying a fault-fissure, cutting the enclosing schists, which strike N. 50° W. and dip almost vertically. The vein varies from 6 inches to 5 feet in width, and is composed of quartz mineralized with iron pyrites, galena, and zinc-blende. Near the summit of the divide upon which this property is situated this vein breaks up into a series of quartz stringers, which spread out through the enclosing schists for a width of some 30 feet, giving the mass the appearance of a big ore-body, but from an examination of the rock it is evidently of a low grade, the mineralization not being very pronounced. In the narrower parts of the vein the ore-bearing solutions, having been confined to a smaller space, caused a heavier mineralization.

The vein is well exposed along the side of a small creek, where a number of cuts have been made along its outcrop for a distance of 200 feet. At an elevation of 6,400 feet an adit has been driven in a south-easterly direction along the vein for a distance of 375 feet. At the

face the vein is approximately 4 feet wide and 125 feet vertically beneath the outcrop. The ore is much leached owing to the fractured conditions of the rock, and the creek which flows alongside the vein-outcrop, much of the water finding its way down through the vein.

While driving this adit some 8.8 tons of ore was sorted out and shipped to the smelter. This proved to contain: Gold, 0.01 oz.; silver, 56.3 oz.; copper, 1.5 per cent.; lead, 27.8 per cent.; zinc, 10.9 per cent. A sample of ore taken from this adit by the writer assayed: Gold, a trace; silver, 3.0 oz.; lead, 7.8 per cent. Samples of the less mineralized part of the vein assayed; Gold, a trace; silver, 0.85 oz. A selected sample of solid galena showing grey-copper from this level assayed: Gold, 0.05 oz.; silver, 118.58 oz.; copper, 7.93 per cent.; lead, 54.64 per cent.

In order to get below the zone of oxidation and at the same time open the ore-body at depth, a crosscut has been commenced some distance down the hill, 300 feet vertically below the vein-outcrop. It was estimated that this level would have to be driven 700 feet in order to come under the ore-shoot in the upper adit, from which the ore shipped was mined. This crosscut has been driven a distance of 300 feet, but, owing to lack of funds, was discontinued; it is stated, however, that work will be resumed shortly.

There are several other outcrops on the property, one of which shows in the bed of the creek previously mentioned, having a strike at almost right angles to the main vein. A selected sample from this assayed: Gold, 0.07 oz.; silver, 148.6 oz.; lead, 73.8 per cent.

Black Prince.

Adjoining the *Mohican* on the east is the *Black Prince* property, where a vein similar to that occurring in the *Badshot* has been found in the lime. The workings are at the base of the mountain, but, as no work has been done for a number of years, were not visited by the writer.

From information obtained it is evident that the ore occurrence here is similar to that in the *Badshot*, and the mineralization consists of galena, grey-copper, and a little zinc-blende, in a quartz gangue containing calcite. Owing to the location of the property and its distance from transportation, at present the expense of getting the ore to the railway for shipment to the smelter is excessive, so that only high-grade ore can be profitably mined; and, as the quantities of this are limited, the properties in this part of the mineral belt remain idle until such time as capital is forthcoming to thoroughly explore and develop the ore-bodies at depth, and to provide such concentration and transportation facilities as may be necessary to profitably work them.

Wagner.

Several other outcrops of galena ore occur along the south-eastward extension of this lime-belt, upon which more or less work has been done. The more prominent are the *Wagner*, on the divide between Lardeau and Stevens creeks, at an elevation of 8,400 feet, where the ore outcrops on a small knoll projecting through a glacier. This property has been previously described in the Annual Report of the Minister of Mines of British Columbia for 1897, and in W. Fleet Robertson's report on Hall creek, which was published in the Annual Report for the year 1909, on page 109. As no important work has been done on the property since that time, it was not visited by the writer.

In this immediate vicinity are also the *Bannockburn* and *Red Elephant* groups of claims, which are described in the same report by Mr. Robertson. These are in the Ainsworth Mining Division, just over the dividing line between it and the Trout Lake Division.

SOUTH-WEST MINERAL BELT.

As previously stated, this consists of a series of siliceous lime-bands, interstratified with slates lying next to a fine-grained granite. Associated with these rocks are occasional masses

of serpentine. So far as at present explored, this belt extends along the south-west side of Trout lake from Staubert creek on the north-west to the head of Poplar creek on the south-east, but the greatest amount of development has been done upon the mineral showings discovered on Trout mountain and those at the head of Canyon creek.

Copper Chief. On the north-west slope of Trout mountain, at an elevation of 4,900 feet, is the *Copper Chief* group of claims, on which a vein of massive pyrrhotite from 8 to 14 feet wide outcrops in a series of bluffs, and has been traced by surface cuts for several hundred feet up the mountain-side. This vein has a strike of N. 30° W. and a dip of 80 degrees north-easterly, conformable to that of the enclosing formation. From a cut on this vein at an elevation of 4,950 feet a sample was taken across a 10-foot face of pyrrhotite, which assayed traces only in gold, silver, and copper. A second sample, taken from a cut higher up on the same vein, assayed: Gold, a trace; silver, 1 oz. Here and there in this pyrrhotite specks of chalcopyrite can occasionally be seen, but, so far, no ore of commercial value has been developed.

In addition to this vein, there are three narrow veins, having a north-south strike and dipping to the east at an angle of 11 to 15 degrees. These are from 3 to 8 inches wide, mineralized with galena, grey-copper, and zinc-blende, which at surface decompose to their respective carbonates. The minerals occur as a streak in the centre of the veins, which is usually less than an inch wide, but occasionally expanding to 4 inches. These veins occur in a belt of siliceous lime and are about 100 feet apart. On the middle vein two short adits have been driven and some surface trenching done. This work shows the vein to have a width of from 3 to 8 inches, frozen to the walls, with little stringers of quartz branching off from it into the enclosing rocks, which near the vein is very siliceous and slightly mineralized with iron pyrites. A sample taken across 4 inches of the ore exposed in the face of the lower of these two adits assayed: Gold, 0.02 oz.; silver, 141.4 oz.; copper, 2.1 per cent. A sample of the mineralized wall-rock at this place assayed: Gold, a trace: silver, 2.2 oz.; no copper. Several small shipments have been made of ore sorted from the narrow veins, one of which, consisting of 3 tons, assayed: Silver, 225 oz.; lead, 16 per cent.; copper, 1.71 per cent.; zinc, 17 per cent.

A short distance north of these adits and 100 feet farther up the mountain-side the outcrop of a second of these small veins has been exposed by strippings for a distance of 200 feet along its strike. This vein is from 4 to 10 inches wide, and, like the one below it, frozen to both walls, with the mineralization concentrated in a streak near its centre. A sample taken from several places along this outcrop assayed: Gold, a trace; silver, 180.8 oz.; copper, 1.1 per cent.; lead, 5.4 per cent. These workings are all on the south-west side of the pyrrhotite vein. On the north-east side of this vein the upper of the high-grade flat veins has been developed by an adit and an open-cut, disclosing a similar type of ore to that in the two adits previously mentioned. The distance between these workings is approximately 1,500 feet.

Horseshoe. Adjoining this property on the north-east, but lower down the mountain, at an elevation of 4,400 feet, is the *Horseshoe* group, where there is a quartz vein in a belt of white crystalline lime, having a strike of N. 45° W. and a dip of 70 degrees north-easterly. Two shafts about 30 feet apart have been sunk on the vein to a depth of 100 and 150 feet respectively. On the 50-foot level of the west shaft a drift has been driven for a distance of 25 feet north-westerly along the vein, which is here well mineralized with iron pyrites and galena. A sample taken across 2 feet of the ore assayed: Gold, a trace; silver, 79.4 oz.; lead, 42.3 per cent. In the other shaft a similar class of ore occurs, but the mineralization is not uniform throughout the vein, occurring more

or less in isolated bunches. A sample taken from the more heavily mineralized portion near the collar of the shaft assayed: Gold, 0.04 oz.; silver, 80.2 oz.; lead, 41.4 per cent.; while a sample taken from the bottom of the shaft at a depth of 100 feet assayed: Gold, 0.02 oz.; silver, 65.4 oz.; lead, 55.6 per cent.

Lucky Boy.

Immediately adjoining this property to the south-east is the *Lucky Boy*, where a quartz vein occurs in a silicified schist containing some lime. The mineralization consists of galena, grey-copper, iron pyrites, and zinc-blende, with some calcite, in a quartz gangue, and varies in width from that of a knife-blade to several feet. It has an east-and-west strike, with an average dip of 50 degrees to the south, but in places becomes almost horizontal and at others quite steep. It apparently follows the major jointing of the enclosing rocks.

The vein has been developed by a number of surface cuts, adits, and an incline shaft sunk to a depth of 200 feet. From this shaft drifts have been made in either direction along the strike of the vein, and a considerable tonnage of ore extracted, from which 400 tons was sorted and shipped, having an assay value of: Silver, 200 to 300 oz.; lead, 20 to 35 per cent.

The property is owned by a Philadelphia (U.S.A.) company, and remained idle from 1906 to 1912, when it was reopened and some ore extracted, of which 28 tons was shipped, assaying about the same as the former shipments. From the shaft on the 100-foot level drifts have been made in either direction along the strike of the vein for a distance of 100 feet, and stopes opened. Near the face of the west drift is a streak of ore 6 inches wide containing much grey-copper; a sample of this ore assayed: Gold, 0.1 oz.; silver, 191.2 oz.; copper, 3.3 per cent. At the head of the stope on this level, 20 feet above it, and 50 feet back from the face, the ore contains a considerable amount of galena and shows a width of 10 inches. A sample of this ore assayed: Gold, 0.4 oz.; silver, 76.8 oz.; lead, 47.2 per cent.

In addition to the vein above described, there are others occupying parallel fissures, but are not so well mineralized, and have had little work done on them. Where the vein widens out it contains inclusions of the country-rock, and there is evidence of replacement.

These properties are distant about four miles north-westerly from the town of Trout Lake, with which they are connected by an excellent trail.

Ethel.

At the head of Glacier creek, on the south-west side of Trout lake, at an elevation of 6,200 to 7,000 feet, is the *Ethel* mine, where there is a quartz vein from an inch to 18 inches wide, striking N. 45° W., with a dip of 60 degrees north-easterly, in a belt of lime-schist. The ore occurs irregularly in the quartz as solid bunches and disseminated through the rock. The mineralization is galena, grey-copper, zinc-blende, and iron pyrites usually rich in silver. It has been developed by four adits, driven from the side of a steep draw, along its strike, the maximum difference of elevation between the highest and lowest drift being 200 feet. The property has been worked spasmodically for a number of years, and several shipments made at different times, the records of some of which, only, are available. One lot of 5 tons shipped in the early part of 1909 assayed: Silver, 307.1 oz.; lead, 28.2 per cent.; zinc, 1.4 per cent.; a specially rich lot of 1,150 lb. assayed: Silver, 560 oz.; lead, 38.6 per cent.; zinc, 2.3 per cent; and a third lot weighing 1,800 lb. assayed: Silver, 171.0 oz.; lead, 17.6 per cent.; zinc, 1.9 per cent. An assay of a selected sample of carbonate ore from close to the surface assayed: Gold, 0.5 oz.; silver, 1,110 oz.; lead, 39.3 per cent.

In sorting the ore which was shipped a considerable quantity of siliceous ore has been accumulated on the dump, the bulk of which assays: Silver, 40 oz.; lead, 4 per cent.; but, owing to the conditions of transportation, this is too low grade for shipment.

The property is connected with the town of Trout Lake by a trail having an average grade of approximately 1,500 feet to the mile, which is decidedly steep for packing over. There would be no difficulty, however, in building an aerial wire tram from the mine to the shore of the lake, and of carrying on operations during all times of the year.

While the vein is comparatively narrow, and the high-grade ore occurs in more or less scattered masses, the whole of the vein can be profitably mined if provided with a concentration plant.

Craig. On the south-east slope of Trout mountain, at the head of Three-mile creek, is the *Craig* property, where there are two veins in the calc-schist. Only a small amount of work has been done on these veins, which are of the same type as those on the *Ethel*, and occur in the same belt of rocks. The ore consists of iron pyrites and galena in a quartz gangue, samples of which assay: Gold, 0.2 oz.; silver, 11.5 to 30.3 oz.; lead, from 2 to 29.6 per cent.

There are other prospects located at different places along this belt, in the valleys of the creeks tributary to Trout lake, upon all of which more or less work has been done, and upon which there are said to be good "showings" of ore. They have, however, not been worked for a number of years, and were not visited by the writer.

Senorita. On Mobbs (Canyon) creek, which flows into the Lardeau river a short distance below the south end of Trout lake, several promising prospects exist, one of which, about two miles from the town of Gerrard, is the *Senorita* claim, where a quartz vein from 1 to 3 feet wide, with slickensided walls, has been discovered. The mineralization consists of galena and grey-copper, selected samples of the latter giving assays as high as 1,000 oz. in silver to the ton. The vein, however, is in a badly shattered zone, and is consequently much broken. Owing to lack of capital, only the necessary assessment-work has been done on this property.

Linson's View. In a basin at the head of the South fork of Mobbs (Canyon) creek a number of claims have been located on a series of veins traversing the phyllite close to its contact with the granite. The *Linson's View*, situated on the north-west side of the basin at an elevation of 6,000 feet, has three known veins traversing it, one of which is quartz mineralized with galena, zinc-blende, iron pyrites, and grey-copper, from 4 to 6 feet wide, occupying a fault-fissure in the granite. It has been developed by a crosscut and a shaft 35 feet deep, from the bottom of which a short level has been driven in a south-westerly direction along the strike of the vein. In doing this work some 900 lb. of ore was sorted out and shipped to the smelter, assaying: Silver, 261.2 oz.; lead, 12.3 per cent. This class of ore occurs as streaks and bunches in the quartz.

The second vein lies at the contact between the schist and lime, where it has been exposed by a few surface cuts. It is from 4 to 8 inches wide, containing galena, iron pyrites, and grey-copper, assaying: Gold, 0.08 oz.; silver, 40.3 oz.

The third vein outcrops 50 feet higher up the mountain, in a carbonaceous phyllite, and is shown by a surface cut to have a width of 10 feet, slightly mineralized with galena and iron pyrites. This vein has a south-easterly strike with a south-westerly dip at a high angle.

Other Claims. At the head of the basin, at an elevation of 4,800 feet, is the *Pedro* claim, where a quartz vein 2 to 3 feet wide, mineralized with galena, zinc-blende, iron pyrites, and a little grey-copper, has been developed by a short adit.

On the south-east side of the basin, at elevations ranging from 5,600 to 7,100 feet, are the *Black Jack*, *Grand Solo*, and *Ruby Silver* groups on all of which quartz veins, having a south-

easterly strike and south-westerly dip, occur in a phyllite formation, having a general north-westerly strike and north-easterly dip.

The veins are more or less mineralized with galena, zinc-blende, iron pyrites, and grey-copper, but, owing to their distance from transportation and high altitudes, can only be worked during the summer months, and only ore of a high grade will pay to mine.

On the *Grand Solo* claim is a quartz vein 2 to 4 feet wide, on the foot-wall side of which is a streak heavily mineralized with galena and grey-copper from 4 to 18 inches wide, a selected sample of which assayed: Silver, 555 oz.; lead, 17 per cent. This sample contained a large proportion of grey-copper. A second sample taken from the same streak in a cut higher up the hill, assayed: Silver, 61.1 oz.; copper, 3.4 per cent.

Near the summit of the divide, at an elevation of 7,800 feet, close to the foot of a glacier, on the *Ruby Silver* claim, is the outcrop of a quartz vein 2 to 4 feet wide, with a streak of galena and grey-copper a few inches in width lying between it and the foot-wall phyllite. Selected samples from this streak assayed: Silver, 129 oz; lead, 30 per cent.; copper, 4 per cent. The vein has been traced along its strike by a series of surface cuts, and has been proved to be the continuation of that on the *Grand Solo*.

These properties are distant about twelve miles from the town of Gerrard, and are connected therewith by a rough and steep trail which, at its upper end crosses the path of several formidable snowslides.

POPLAR CREEK SECTION.

The formation on the south side of the Lardeau river at Poplar is considered to be the south-easterly extension of the Central Mineral Belt, and consists of green schists, slates, and phyllites, with which are associated broad bands of the yellow-weathering diabase-schist.

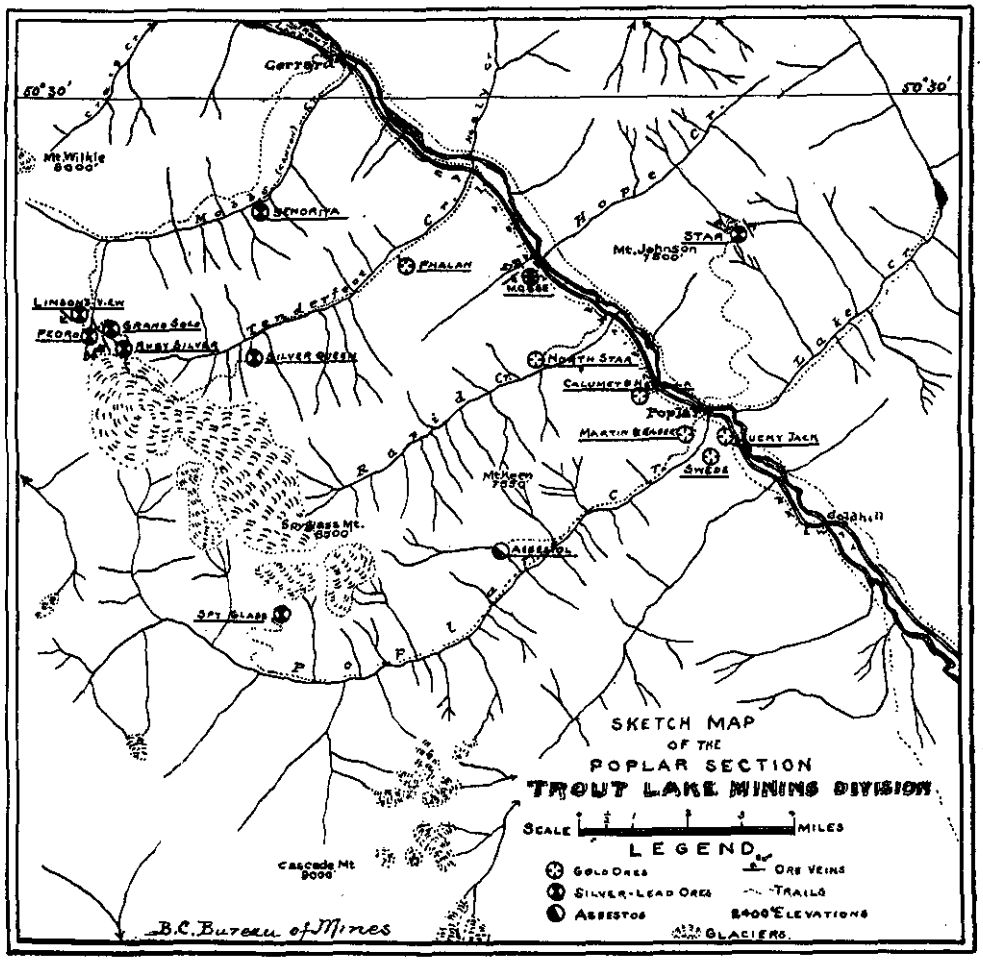
In the diabase-schists and phyllites quartz veins occur, varying in width from almost microscopic stringers to veins several feet wide. Of these veins there are two series, one of which conforms to the strike and dip of the enclosing rocks, and the other cutting them at varying angles, the greater number of the latter being nearly at right angles to the strike of the schists. In a number of places the diabase-schist and the veins associated with it are impregnated with iron pyrites and arsenopyrite, the latter sometimes occurring as solid streaks from a quarter to an inch wide often very rich in gold. Some of the quartz veins also carry gold, but are "bunchy." The arsenopyrite is usually a heavy gold-carrier, weathering to iron oxide, in which the gold is sometimes found as wire, in plates, or as a spongy mass.

Lucky Jack.

In 1903 much excitement was caused in the Poplar Creek district by the discovery of a rich pocket of gold in a quartz vein on the *Lucky Jack* claim, within a hundred yards of the railroad, resulting in quite a rush, and the whole country being staked for miles. Development proved disappointing, however, and a few shots blew out the rich pocket. Subsequent work failed to find any more of this specimen ore, the balance of the quartz, being low grade and the claims becoming involved in litigation, work ceased and has not yet been resumed, although the litigation has been settled.

The district, however, has not received as thorough prospecting and development as indications warrant, exploratory work having been confined largely to surface cuts and shallow adits. The reason for this is that the owners of the claims have not the necessary capital for extensive development, and during 1903-04, when the excitement was at its height, held their claims at such high prices and asked such unreasonable terms that they deterred capitalists from investing, and, when the results of the work on the *Lucky Jack* proved unsatisfactory and no more exciting discoveries were made, interest died down, and has not since been revived.

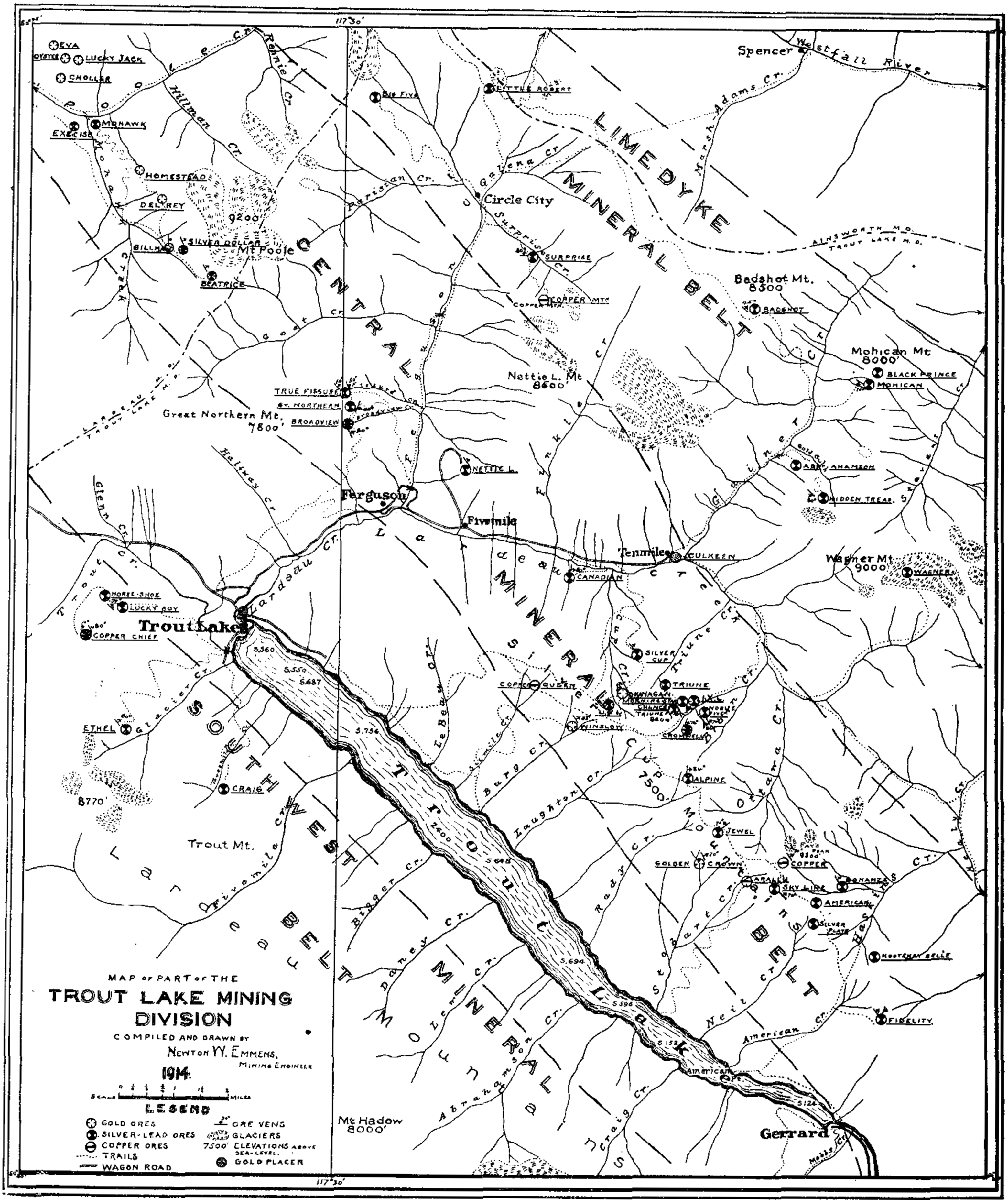
In 1908 some work was done on the *Mobbs* mine, and on the *Swede* group, and on a few other prospects, and work has been going on this summer on the *Calumet and Hecla*, the results of which are said to be encouraging. A brief description of the prospects visited by the writer follows.



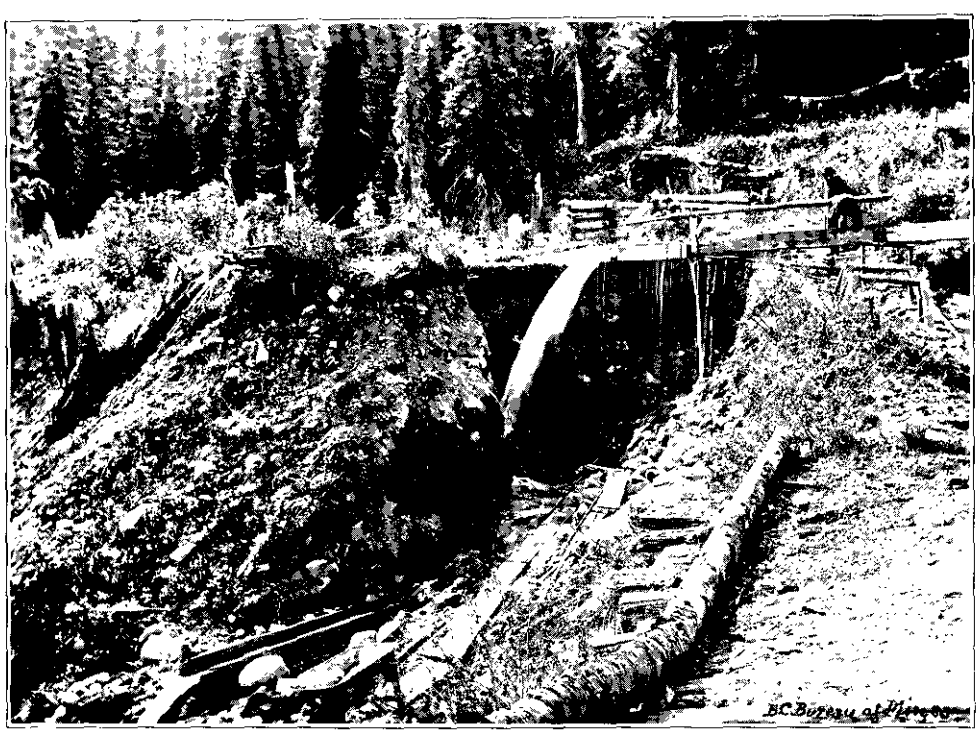
Mobbs Mine.

This property is situated about three-quarters of a mile south-west of the railway-track, at an elevation of 600 feet above it, and 2,700 feet above sea-level. There are two systems of veins on this property, one of which conforms in strike and dip to the enclosing rocks, and the other cuts them at various angles. The more important veins of both series have been explored by means of surface cuts, adits, and winzes.

The "G" vein belongs to the first series, and is an irregular deposit formed by replacement along a fracture-zone in the phyllite. It has been developed by surface cuts and a crosscut which taps the vein 30 feet vertically below its outcrop. From the crosscut drifts were driven 60 feet in an easterly direction and 15 feet in a westerly direction along the strike of the vein. A pocket of galena was found in the vein where cut by the crosscut, and a winze was sunk on it to a depth of 80 feet, in the hope that it was the apex of an ore-shoot. The galena gave out a few feet below the crosscut level, and 30 feet below the collar of the winze the ore-bearing fissure was cut off by a fault which had a north-easterly dip at an angle of 73


MAP OF PART OF THE
TROUT LAKE MINING DIVISION
COMPILED AND DRAWN BY
NEWTON W. EMMENS,
MINING ENGINEER
1914.
SCALE MILES
LEGEND
GOLD ORES
SILVER-LEAD ORES
COPPER ORES
TRAILS
WAGON ROAD
ORE VENS
GLACIERS
7500' ELEVATIONS ABOVE SEA-LEVEL.
GOLD PLACER
117°30'
LIMEDYKE MINERAL BELT
CENTRAL MINERAL BELT
SOUTHWEST BELT
TROUT LAKE
Spencer
Westfall River
Circle City
Mt Poole
9200'
Badshot Mt.
8500
Mohican Mt
8000'
Nettie L. Mt
8600'
Great Northern Mt.
7800'
Ferguson
Fivemile
Tenmile
Wagner Mt.
9000'
Trout Lake
Trout Mt.
8770'
Mt Hadow
8000'
Gerrard
AINSWORTH M.D.
TROUT LAKE M.D.
LARDEAU M.D.
TROUT LAKE M.D.
EVA
LUCKY JACK
CHOLLER
MOHAWK
EXCISE
HOMESTEAD
DEL REY
SILVER DOLLAR
BEATRICE
BIG FIVE
LITTLE ROBERT
SURPRISE
COPPER MTN
BADSHOT
BLACK PRINCE
MOHICAN
TRUE FISSURE
GT. NORTHERN
BROADVIEW
NETTIE L.
HIDDEN TREAS.
CULKEEN
CANADIAN
WAGNER
HORSE-SHOE
LUCKY BOY
COPPER CHIEF
SILVER CUP
TRIUNE
COPPER QUEEN
WINSLOW
CROMWELL
ALPINE
ETHEL
CRAIG
JEWEL
GOLDEN CROWN
COPPER
SKY LINE
BONANZA
AMERICAN
SILVER PLATE
KOOTENAY BELLE
FIDELITY
Lardeau Cr.
Trout Cr.
Glenn Cr.
Halfway Cr.
Goat Cr.
Hillman Cr.
Surprise Cr.
Galena Cr.
Marsh Adams Cr.
Gainer Cr.
Triune Cr.
Cup Cr.
Ottawa Cr.
Laughton Cr.
Burg Cr.
Rady Cr.
Bigger Cr.
Daney Cr.
Abrahamson Cr.
Craig Cr.
American Cr.
Neil Cr.
Stobart Cr.
Glacier Cr.
Fivemile Cr.
Lardeau
Silver Cup
Mohican
Mountains

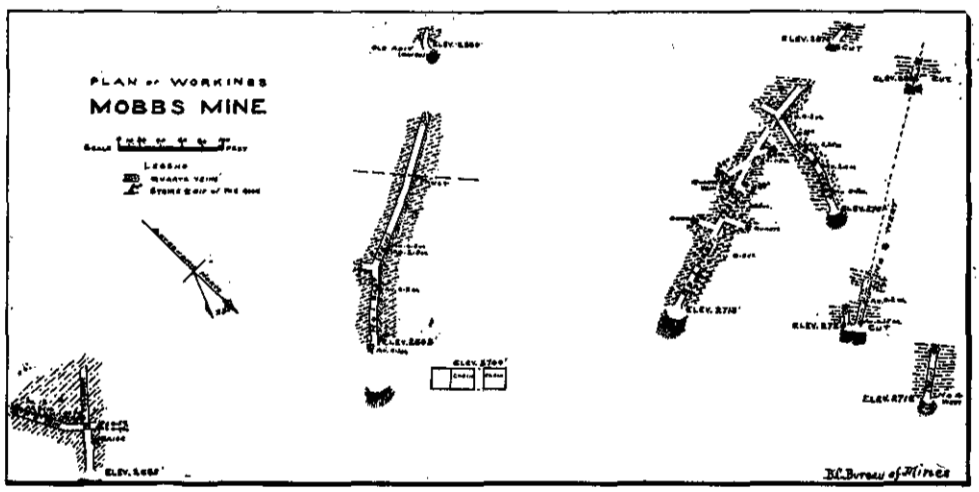
Mohican Mountain—Trout Lake M.D.



Hydraulicking at Ten-mile—Trout Lake M.D.

degrees, a width of 3 feet, and was filled with crushed and broken rock. From the 50-foot level in the winze, and again from the bottom, crosscuts were driven north-easterly beyond the fault, hoping to find the downward continuation of the galena ore, but without result.

The "G" vein consists of quartz, mineralized with iron pyrites and galena, from a few inches to 3 feet wide, a sample of which, taken from the east drift a few feet east of the crosscut, assayed: Silver, 7 oz.; lead, 4.2 per cent.; and a sample across the face of the drift assayed: Silver, 2.1 oz.; lead, 1 per cent. A sample from the ore showing in the face of the west drift assayed: Silver, 0.9 oz.; lead, 0.5 per cent. From the pocket of galena ore found by the crosscut several tons were sorted out, a sample of which assayed: Silver, 95 oz.; lead, 77.5 per cent. All the above samples gave negative results for gold.



Of the cross series of veins, the No. 1 east and Nos. 1 and 2 west have received the most development. The No. 1 east is from 2 to 4 feet wide, occupying a well-defined fissure separated from both walls by a gouge, and showing slickensides in several places. Its mineralization consists of iron pyrites, galena, and a little free gold, in quartz gangue. It has been developed by a number of surface cuts, a shaft 23 feet deep, and a adit on its course 220 feet long. Samples taken at various places along this vein show it to contain: Gold, from 0.05 to 0.3 oz.; silver, 2.5 oz.

Two hundred and ninety feet west of this No. 1 east is the No. 1 west vein, which occupies a similar fault having a strike of S. 57° W., with an almost vertical dip. The vein is from 18 inches to 5 feet wide, mineralized with iron pyrites, occasional patches of galena, and some free gold, in a gangue of quartz having a banded structure. It has been developed by several surface cuts and an adit 200 feet long. Samples taken at various places along this adit assayed: Gold, from 0.3 to 0.35 oz.

At 89 feet in from the portal a small quartz vein conforming to the strike of the formation was passed through. At 140 feet in a second small quartz vein was found on the west side of the drift, the eastern extension of which was cut 10 feet farther on. A sample taken from the western limb of this vein assayed: Gold, 1.5 oz.; and panned quite well.

The No. 2 west vein has an average strike of S. 45° E., with a dip to the south-west at an angle of 37 degrees. Commencing at a place 49 feet vertically above and 180 feet north-west of the portal of the No. 1 west adit, an adit has been driven along the No. 2 west vein for a distance of 128 feet, where it makes junction with the No. 1 west vein, and is apparently cut off by it. A crosscut driven through this latter and a drift along it to the south-west fails to find any continuation of the No. 2 west vein.

This No. 2 west vein is from 15 to 20 inches wide, and gave the following assays from samples taken across it at different places in the adit: At 20 feet in from the portal the sample assayed: Gold, 0.5 oz. At 38 feet the sample assayed: Gold, 2 oz. At this place a few specimens showing visible gold were obtained, but no pieces in which gold could be seen were included in the sample assayed. Sixty feet in the sample assayed: Gold, 0.25 oz.; and at the junction of this vein with the No. 1 west the sample assayed: Gold, 0.3 oz.

The Nos. 3 and 4 west veins lie still farther to the west of the No. 2 and have been prospected to a limited extent by surface cuts and a short adit. In width these veins vary from 2 to 4 feet, and samples assay: Gold, from 0.1 to 0.25 oz. to the ton. A number of panning tests of ore from the surface cuts showed small quantities of free gold.

The accompanying map of the workings shows the relative positions of the several veins, adits, and cuts, their altitudes and places from which samples were taken, with the assay results.

South-east of the *Mobbs* mine, on Rapid creek, is the *North Star* group, where a similar vein system occurs. On this property some stringers of arsenopyrite in a diabase-schist have been found, which are rich in gold. The development on this property consists of surface cuts and an adit, but, as it has been idle for a number of years and no information was to be obtained which would be of material assistance in forming an opinion as to the mineral resources of the district, and also owing to lack of time, the property was not visited.

Calumet and Hecla.

At the *Calumet and Hecla*, a property half a mile north-west of the town of Poplar, within a few hundred yards of the railway-track, development-work was in progress this summer. On this property there is a mass of quartz, having a strike of N. 45° W. and a slight north-easterly dip, some 20 feet wide, occupying a zone of crushing in the diabase-schist, which here forms the country-rock. Several open-cuts have been made along its outcrop, and a shaft (elevation 3,000 feet) sunk thereon to a depth of 34 feet. From the bottom of the shaft crosscuts were driven 5 feet to the north-east and 10 feet to the south-west through the quartz. At the bottom of the shaft the ore-body consists of a mass of crushed schist and quartz mineralized sparingly with iron pyrites, on the hanging-wall side of which there is 8 feet of solid quartz, and on the foot-wall side 4.5 feet. In order to determine the value of this material, samples were taken at intervals across the bottom of the shaft, commencing from the hanging-wall side, as follows: Sample No. 1—5 feet of quartz assayed: Gold, 0.1 oz.; silver, 0.8 oz. Sample No. 2—3 feet of quartz assayed: Gold and silver, traces. Sample No. 3—4 feet mixture schist and quartz assayed: Gold, 0.15 oz. Sample No. 4—2 feet crushed quartz and schist assayed: Gold and silver, *nil*. Sample No. 5—4.5 feet quartz assayed: Gold and silver, traces.

From the collar of the shaft three samples were taken, commencing from the hanging-wall side, as follows: Sample No. 6—4 feet quartz assayed: Gold and silver, traces. Sample No. 7—12 feet schist assayed: Gold, 0.1 oz. Sample No. 8—8 feet quartz on the foot-wall side assayed: Gold, 0.15 oz.

A sample taken across 4 feet of quartz, 7 feet below the collar of the shaft, where it was a little more highly mineralized, assayed: Gold, 0.1 oz.

Two hundred and seventy feet down the hill north-easterly from the shaft, and some 40 feet below it, a crosscut was driven to tap the vein. The total length of this crosscut is 269 feet, and it has passed through the place where the vein should have been, without discovering it. The diabase-schist was cut at 225 feet in from the portal of the crosscut, and at 240 feet a fracture-plane was passed through, containing some quartz stringers having a north-westerly strike. A drift was made along this for a distance of 68 feet in the hope that it would lead

to the vein, but with negative results. Some samples were taken along this drift, and from some mineralized streaks in the diabase passed through by the crosscut, which were assayed for gold and silver, but were not found to contain any of these metals.

There are on this property other vein-outcrops, one of which, along a fault, contains some copper in addition to gold. At the time of my visit to the property this summer development was in progress, which consisted of driving exploratory crosscuts through the diabase-schist towards the copper-bearing vein above mentioned, and the gold-bearing quartz vein. These were being driven from an approximate elevation of 2,400 feet, but, aside from cutting a few stringers of quartz containing iron pyrites, nothing of importance had been discovered, but these crosscuts had to be driven some distance farther before they could be expected to cut the downward continuation of any of the known ore-bearing fissures.

Close to one of these new crosscuts there was found, a few years ago, a stringer containing galena rich in gold. This stringer was only a few inches in width, and the rich galena only occurred for a short distance in it, but was exceedingly rich, some specimens containing as much as 25 per cent. gold, which occurred native in the galena. It was rather hoped that the work going on this summer would discover another one of these rich stringers.

The results of this exploratory work will be watched with interest, as, if it be found that the mineralized fissures contain ore of a commercial value at the depth at which these crosscuts will intersect them (some 600 feet below their outcrops), it will go a long way towards restoring confidence in the camp, and will stimulate development of other properties.

In the immediate vicinity of the town of Poplar are located the *Lucky Jack*, *Swede*, and *Gold Park* (Martin & Gilbert) properties, in which occur quartz veins and stringers both parallel to and crossing the diabase-schist and phyllite formations. The veins are of quartz, varying in width from a fraction of an inch to as much as 6 feet, and mineralized with iron pyrites, galena, arsenopyrite, and native gold.

On the *Gold Park* several veins occur at close intervals, and at surface the decomposing diabase-schist lying between them yields gold by panning. An attempt was made to sluice some of this decomposing surface material, but it did not pay. In a few places, both on the *Gold Park* and *Swede* properties, stringers of arsenopyrite traverse the formation in all directions, forming a stockwork. Some of this mineral is very rich in gold, assays of selected specimens showing it to contain as much as 325 oz. of that metal to the ton. A mill test of 8 tons of ore taken from the *Swede* group some years ago yielded gold to the value of $246 gross, a trifle over $30.81 a ton. It is obvious, however, that there was not much of this material available, or the property would not now be idle.

In 1910 a considerable amount of prospecting was done along that part of the diabase-schist on the *Swede* property containing arsenopyrite stringers. The work consisted of sinking a number of test-pits and driving an adit on some of the quartz veins. While this exploration-work did not reach any great depth, it was on the whole disappointing, many of the pyrite stringers proving to be gash-veins, and playing out a few feet below the surface of the ground. The quartz veins also were found to be spotty and to be low grade between the richer spots. Sufficient work has not yet been done, however, to finally decide the value of this property, one way or the other.

About five miles up Poplar creek from the railroad a belt of serpentine crosses the creek, having a north-westerly strike and of much the same appearance as that noted on Brown creek. This serpentine contains asbestos in the seams which traverse the rock along the slips.

Along the path of a snowslide on the steep mountain-side, 200 or 300 feet above the level of the creek, the rock is exposed over a considerable area, showing seams and masses of asbestos

in a number of places. The asbestos at surface has a short fibre and is quite brittle, but probably could be utilized in the manufacture of insulating material for boiler and steam-pipe coverings, etc. No work has been done on this property to ascertain its commercial value.

Star. On the north-east side of Poplar creek, on Mount Johnson, between Lake and Hope creeks, is situated the *Star* group of claims, at an altitude of 7,300 feet. The formation consists of carbonaceous calc-schist, phyllite, and limestone, very similar to the rocks noted on Surprise creek and in Gold gulch, lying between the Central and Lime Dyke Mineral Belts.

On the property are two veins, one of which consists of quartz mineralized with galena and iron pyrites, having an average width of 6 feet, with a strike of N. 63° W., cutting the formation at an angle of between 20 and 25 degrees, with a steep dip to the north-east. The second vein consists of quartz carrying iron pyrites and galena in a dark, banded limestone of a schistose structure. The quartz does not occur as a well-defined vein, but is a series of stringers between the laminæ of the limestone, and conforming to both their strike and dip.

These quartz stringers vary in width from a few inches to several feet. It is rather a band of mineralized limestone than a vein proper. The strike of this rock is N. 40° to 45° W., with a slight dip to the north-east. Development-work consists of surface cuts and shallow adits a few feet long. The quartz vein has been proved for a distance along its outcrop, of several hundred feet on the north slope of the divide, where, in an ancient glacial basin, a short adit has been driven, showing it to be well mineralized with galena and iron pyrites. A sample containing galena from this place assayed: Gold, 0.2 oz.; silver, 30.3 oz.; lead, 29.6 per cent. A sample of quartz containing iron pyrites from which the galena had been removed assayed: Gold, 0.2 oz.; silver, 11.5 oz. In a cut 300 feet below this adit is an outcrop of galena, from which a sample taken assayed: Silver, 34.16 oz.; lead, 44.44 per cent.

Down the creek which flows from the basin into Hope creek a large amount of float has been found, which presumably comes from this vein.

The lime vein has been opened on the south side of the divide by a series of surface cuts and short crosscuts. The mineralization consists of galena, iron pyrites, and a little zinc-blende, and has an average width of 4 feet. Samples taken from several of the cuts, combined, quartered down, and assayed, show it to contain: Silver, 2.64 oz.; lead, 23.23 per cent. At this altitude timber is not plentiful, the trees being stunted and not well suited for mine purposes. There is, however, plenty of suitable timber available down the creek which heads on this side of the divide and flows into Lake creek.

It is probable that prospecting will show this mineralized lime-belt to outcrop farther down the Lake Creek slope, where an adit could be driven on it and thus develop it at depth. In this event it could be easily and cheaply mined, there being ample facilities for economic mining, and the ore could be taken to the railroad by way of Lake creek. The quartz veins could be similarly developed from the Hope Creek side, and its ore taken out by way of that stream to the railroad.

There are several other prospects tributary to the town of Poplar upon which more or less work has been done at various times, but which have lain idle now for a number of years. Particulars of these, as well as additional information with regard to some of those already mentioned, will be found in a report by R. W. Brock, contained in the Summary Report of the Geological Survey of Canada for the year 1903, on pages 72 to 77, and in the report for the year 1904, on pages 89 and 90; also in the report of W. Fleet Robertson, which appeared in the Annual Report of the Minister of Mines of British Columbia for the year 1903, on pages 112 to 116.

PLACER GOLD.

The existence of placer in Lardeau creek and the Lardeau river, in the Trout Lake Mining Division, has been known for a number of years, but, so far, all attempts at saving the gold have proved failures, partly owing to the difficulty in diverting the water, and partly to the presence of large boulders in the stream-beds where the gold occurs.

Near the town of Trout Lake, at the mouth of a small canyon, during a period of extra low water, a pocket of gold was found a good many years ago in the gravel of the present stream-bed, and the gravel-banks a little farther down the stream contain gold, as can be proved by panning. In order to work this placer, a Spokane company built a dam at the mouth of the canyon, from which a flume was constructed to carry the water of the creek and expose the gravel of the creek-bed, so that it could be mined. The experiment was unsuccessful, however, on account of the heavy flow of water that season, and the following spring's high water took out a part of the flume, which was never rebuilt.

At Ten-mile, a short distance below the mouth of Gainer creek, a placer-miner by the name of Peter Culkeen has done much exploration-work endeavouring to locate pay-gravel in an ancient lake-basin. Lardeau creek at this place is crossed by a rim of hard rock, through which it has only recently (geologically speaking) cut, and which it has not yet worn down to grade, but flows over in a low fall.

Placer gold has been found on both sides of this rim, and the supposition is that on bed-rock in the basin above gold in paying quantities exists. Mr. Culkeen has been acting on this theory for the past few years, and during his leisure-time has done a considerable amount of trenching, sluicing, and hydraulicking with home-made apparatus. It is his intention, during the low-water period this fall and winter, to drive a crosscut through the rock-rim of the basin and explore the gravel along bed-rock above it. There is too much water in the gravel to permit of its being explored by shafts, which Mr. Culkeen attempted to do, but only succeeded in sinking a few feet before the water drove him out.

He has found gold in several places in the gravel; some pieces shown to the writer were a good size, but considerably flattened and worn smooth, showing that they have been transported some distance. In the Lardeau river below Poplar gold has been found in the present bed of that stream as far south as Gold Hill, in the Ainsworth Mining Division. The river, however, is full of boulders, some of which are quite large, and contains such a heavy flow of water that it would only be possible to work it by means of a dredge.

An attempt is being made to do this by an American company, the dredge being located in the river a short distance above the railroad bridge at Gold Hill, in the Ainsworth Division. What the results are is not yet known. Owing to lack of time, and the dredge being outside the district under examination, it was not visited by the writer, nor did inquiry elicit any definite information. The problem of successfully dredging the Lardeau river is a difficult one, on account of the swiftness of the stream and the presence of boulders, which add materially to the cost of operations.

ACKNOWLEDGMENTS.

In making the examination of the Trout Lake Mining District the writer is particularly indebted to the following gentlemen for assistance and information: Mr. J. T. Lauthers, Mr. J. C. Kirkpatrick, Mr. Alex. McLean, Mr. P. Culkeen, Mr. H. Rogers, Mr. Dave Morgan, Mr. Wilson, manager at the Calumet and Hecla, and others.

NELSON DISTRICT.

NELSON MINING DIVISION.

REPORT OF J. CARTMEL, GOLD COMMISSIONER.

I have the honour to submit the annual report on the Nelson Mining Division for the year ending December 31st, 1914.

A considerable amount of prospecting and development work in a small way has been prosecuted during the year and still continues, but it goes without saying that the outbreak of war has had a detrimental effect on mining generally.

It is gratifying to note, however, that many individuals and small syndicates are still able to continue work upon the properties in which they are interested, while, of course, those properties producing gold are not affected except in so far as the obtaining of capital for further development is concerned.

Silver King. The *Silver King* is owned and operated by the Consolidated Mining & Smelting Company; work on the mine was suspended early in the fall owing, no doubt, to conditions brought about by the war. Seven hundred and forty-five feet of drifts and cuts were run and raises to the aggregate extent of about 335 feet. In all, 13,421 tons of ore was shipped to Trail, which yielded 234 oz. gold, 107,187 oz. silver, and 420,133 lb. of copper.

Molly Gibson. Very little was done on this mine, which, with the *Silver King*, is owned and operated by the Consolidated Mining & Smelting Company of Canada. Drifts and cuts to the extent of 402 feet were run and 500 tons of ore shipped, from which was recovered 24,489 oz. silver and 110,910 lb. lead.

Queen Victoria. This mine is operated by the British Columbia Copper Company, but no work has been done on it since early in the summer.

Granite-Poorman. J. P. Swedberg, of Nelson, has recently obtained a lease of this property and has a force of about a dozen men working at the present time. The mine is well equipped and good results are confidently looked for.

California Group. Wm. A. Moore had four men working on the *California* for about six months during the past year, and 50 tons of ore from same was shipped to the Trail smelter. In addition, a small shipment (12 tons) was made from the *Union*, which adjoins the *California*, and on which there is a good showing. Two men are still working here and five on the *Cliff*, another of the group, and it is intended to make monthly shipments from now on.

Pingree. Several men have been working for some time past on this property, which is under the management of Frank E. Pearce.

Venus. This mine is being worked under lease and bond by A. H. Gracey and associates. During the summer an average of eighteen men was employed in development and ore-extraction. Several lots of ore were put through the *Athabaska* mill, which was rented, and development-work is being continued.

The *Exchequer*, a well-known property in the same vicinity, is also being operated under lease by Frank Phillips and associates, but nothing much has been accomplished as far as I can learn.

Perrier. This property is owned by a syndicate of Nelson men, which has five men working. During the past year a pipe-line was laid to carry water under pressure for the purpose of operating a compressor plant, and a hydraulic pump installed in the shaft to handle seepage water, of which there is considerable. The shaft was sunk 15 feet deeper and a drift run in on the vein a distance of 25 feet. The ore-shoot is 2 feet wide in the face of the tunnel, and a small trial shipment of 7 tons yielded $16 to the ton in gold.

SHEEP CREEK DISTRICT.

Queen. The principal work at the *Queen* during the past year consisted of stoping from the No. 6 level, and 9,800 tons of ore was crushed in the mill, the exact returns from which I am unable to give, although it is likely to be not far short of $110,000. In addition to the stoping, about 550 feet of drifting was done on the group, which includes a No. 2 tunnel on the *Alexandra* claim, in which is a good showing of ore. An average of twenty-eight men was employed underground and seventeen on the surface; E. V. Buckley is in charge.

Mother Lode. This well-known mine is situated on Dominion mountain, about half a mile up Sheep creek from the *Queen*, at an elevation of 6,000 feet above sea-level, the mine-workings being 650 feet below the outcrop. The mine is worked through adits, the lowest of which is the 500-foot; this, 800 feet in length, being the main tramming adit. A shaft has been sunk 150 feet below this.

The ore is conveyed to the mill, situated on Sheep creek, by means of an A. Leschen & Son aerial tramway 3,700 feet in length, the vertical distance between the loading and discharge terminals being 1,900 feet. The tram has a capacity of 100 tons and is operated by one man only, the buckets being automatically loaded and self-dumping.

The mill, which is very complete, was designed and erected by the Merrill Metallurgical Company, of San Francisco, and has a capacity of 100 tons a day. The installation consists of ten stamps, sliming, amalgamation, and cyanide plant, operated in sections by six Pelton water-wheels. Up to August 1st last the mill was operated as originally designed; that is, crushing in water, classifying, and tube-milling followed by plate amalgamation, the slimes from the classifier going direct to the cyanide plant. After August 1st the plan of crushing in cyanide solution was adopted in place of amalgamation, with the result that the consumption of cyanide was considerably reduced and percentage of extraction increased. Unfortunately, owing to lack of sufficient power, the mill can only be operated about nine months of the year.

Twenty thousand tons of ore was mined and milled during the year, the average number of men employed being sixty—forty-nine at the mine and eleven at the mill.

The total amount of development and exploration work done aggregated 2,093 feet, consisting of drifting 1,546 feet, crosscutting 282 feet, raising 242 feet, and sinking 23 feet.

I am indebted to J. R. Rutherford, general manager of the mine, for the foregoing interesting details.

H.B. On this and adjoining properties no new development-work worth mentioning has been done, those interested confining their efforts to the extraction of lead and zinc carbonate ore from the old workings, of which nearly 2,000 tons of the lead ore has been shipped to the Trail smelter.

Spokane Group.

R. M. and K. K. Laib have done considerable work on this property, which is situated on Cultus creek, flowing east from the head of Sheep creek. The ledge has been shown up on the surface by open-cuts for a distance of 2,000 feet and opened up underground by about 500 feet of tunnel.

The upper tunnel, 105 feet long, shows a continuous ore-shoot which is said to average 39 inches in width. An average sample taken from the poorer part of the dump is reported to have assayed $27 in gold, silver, and lead.

The lower tunnel cuts the ledge at a depth of 75 feet, 210 feet east from the mouth of the upper tunnel, and drifts on an ore-shoot from 1 to 4½ feet wide, a distance of 240 feet, gaining a depth of 140 feet beneath the upper tunnel. It is said that an average sample cut across 4½ feet of ore assayed over $50 in gold, silver, and lead.

Golden Fawn.

H. Y. Anderson, of Nelson, has a lease and bond on this property and has had a force of about a dozen men working during the last four months. The work done, so far, consists mainly of open-cuts and the ore is being put through the Nugget mill. The property is showing up well.

On the *Reno Group*, which is situated near the *Nugget*, there is said to be a very fine showing. W. B. Poole, of Spokane, has had three or four men working here putting in open-cuts.

On the *Summit* group, under lease to Wm. DeWitt and partners, several runs have been made with the small mill on the *Ore Hill* adjoining, which are said to have turned out well—about $50 a ton, I believe.

Emerald.

This property, situated about seven miles from Salmo, is operated by Iron Mountain, Limited, but has been closed down during the last three months of the year owing principally to conditions brought about by the war and incidentally to the bad state of the road at the change of seasons. During the nine months of operation 1,136 tons (dry weight) of ore was mined and shipped to the Trail smelter yielding 837,428 lb. of lead and 1,267 oz. of silver, to the value of $24,239.

An average of seven men was employed in the mine and two outside, and during the year $5,320 was spent on development-work, and in addition a considerable sum on roads, buildings, etc.

The company also did assessment-work on nine mineral claims.

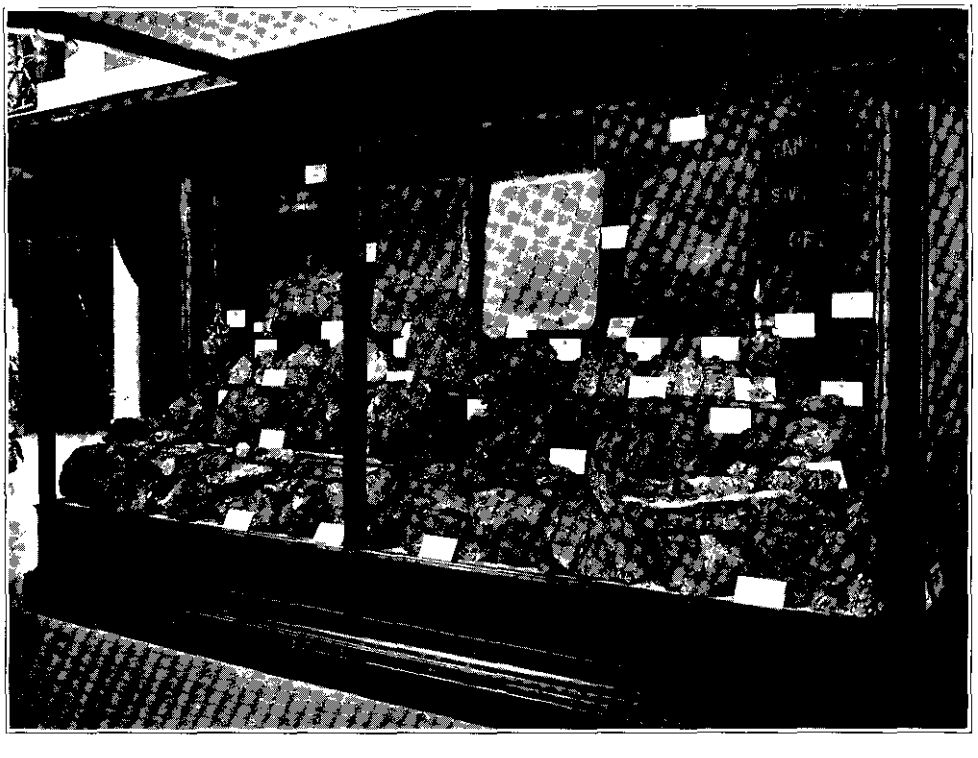
Molybdenite.

The deposit of molybdenite ore at Lost creek, about fourteen miles from Salmo, which was mentioned in my last report, has aroused considerable interest during the past year owing to the comparative rarity of the mineral and the fact that the deposit would appear to be of greater extent than is usual, and the ore in some cases of a very high grade and free from impurities.

The property consists of seven claims, owned by Ross, Bennett, and Benson, but at present is under lease and bond to Bell Brothers of Salmo, who have had an average of three men working steadily, as many as eight being employed at the close of the year. Open-cuts have been run in on the dyke at intervals for a distance of 1,400 feet and ore encountered in all.

In August a car of 23½ tons of the ore was shipped to the Henry E. Wood Ore Testing Company, Denver, Colorada. This, for testing purposes, was divided into three different lots secured from separate portions of the dyke: No. 1, of 822 lb., going 30.175 per cent.; No. 2, 29,895 lb., 10.25 per cent.; and No. 3, 17,119 lb., 9.33 per cent. At 20 cents a pound, the rate it was agreed to sell for early in the year, the car netted the owners $815 clear of the cost of treatment and transportation.

Silver-lead Ores and Mill Products—Kootenay District, British Columbia. Panama-Pacific Exposition.



Ores from British Columbia Mines and Products of Smelter operated by Consolidated Mining and Smelting Co—Trail, British Columbia. Panama-Pacific Exposition.

Another car of 25½ tons is now about ready for shipment at Salmo, and a table test shows same to run about 14 per cent. The owners expect to receive 70 cents a pound on this shipment, having already had several bids on same from different points in the United States.

There is estimated to be about 1,000 tons of lower-grade ore on the dump at the present time.

Some ore was shipped from the *Zincton*, which adjoins the *H.B.*, on Deer creek, and work was also done on the *Leadville*, *Aspen Group*, *Silver Dollar*, and several other properties in the same vicinity.

YMIR DISTRICT.

Ymir-Wilcox. During the past year development-work was continued on the *Fourth of July* and *Wilcox* veins, which are parallel and about 50 feet apart. This development consists of about 800 feet, mostly on the *Fourth of July*, on the two main ore-shoots of which a large tonnage has been blocked out. The vein is opened some 400 feet in length by 300 feet in depth. The present policy of the company precludes production until completion of the exploration-work in hand. The average content of 30 inches of the ore-body is: Gold, 0.75 oz.; silver, 3.1 oz.; the lead and zinc contents being variable according to local influences in the vein. The property is now equipped with a 10-stamp amalgamation and concentration mill, electrical plant, 75-horse-power compressor, one 2-bucket tramway from main working-tunnel to mill, boarding and bunk houses, etc.

Yankee Girl. On this property a new 3,000-foot tunnel, to attack new ore-bodies, has been started, which will give a depth of 900 feet below the main upper level. Grading was completed for a hydro-electric power and mill installation, the intention being to bring water from Wild Horse creek by 6,500 feet of 3- x 2-foot flume to a penstock, thence by pipe-line 1,200 feet to the water-wheel, under 240-foot head. Plans for the mill are now being prepared. The crew averaged twenty men up to the middle of August, being then reduced by more than half, but will again be increased when work on the new tunnel is well under way.

Dundee. No considerable amount of work was done on this mine during the year, but it is said to be a very promising property, the vein being from 18 to 25 feet in width and carrying good values. The main tunnel encountered the ore-body at a depth of 960 feet below the outcrop and drifted along same a distance of 150 feet. Development will no doubt continue to an increased extent this year.

Some prospecting and development work was also done on the *Jennie Bell*, *Stirling*, *Canadian Pacific*, and several other properties in this vicinity.

ERIE DISTRICT.

Second Relief. A force of from six to ten men has been employed on this mine more or less continuously during the year, principally in raising and stoping, the ore being crushed in the 10-stamp mill on the property, but I am unable to give any details of the amount of bullion recovered. This property has been a heavy producer in the past, and no doubt will continue to give a good account of itself.

PLACER.

In all, twenty-four placer claims were recorded in this district during 1914, the majority having been located on Sheep creek in the vicinity of the *Queen* mine, and, despite all disclaimers to the contrary, the impression is that the first locators were attracted by the knowledge that a certain amount of fine gold was escaping into the creek with the tailings from the *Queen* mill, and had been for some years past.

Some so-called nuggets were shown by two men who had worked a little farther up the creek (just below the old *Kootenay Belle* mill), but these had the appearance of being either small pieces of amalgam which had been retorted, or irregular-shaped buttons of gold. At all events, they had the effect of creating a little local excitement, with the result that a number of claims were located on that portion of the creek, and while some work was done there during such time as the stage of water permitted, I do not know that anything worth reporting resulted.

Early in the summer a creek lease was staked on the Salmo river near Hall Siding, on the Great Northern Railway, a few miles this side of Ymir. This was granted, and a considerable amount of work done on the ground with encouraging prospects, but, owing to damage caused to the works by a sudden freshet in the early fall, the work was discontinued for the balance of the season, but will doubtless be recommenced this spring.

On Forty-nine creek, where in early days an hydraulic company operated and succeeded, in spite of numerous difficulties, in recovering a considerable amount of heavy gold, five creek leases were staked by a syndicate of Nelson men over ground formerly covered by leases which had been cancelled. These new leases have been authorized and sufficient capital interested to properly test the ground, and if the results justify it the property will be taken over by a company able to work them to the best advantage. Some work done on this ground during the summer resulted in encouraging prospects being secured, although bed-rock was not reached. As this property is situated less than ten miles from Nelson and a good road leads practically right to the ground, there are no great difficulties in the way of transportation to contend with, and the outcome of the venture will be awaited with considerable interest by the people hereabouts.

OFFICE STATISTICS—NELSON MINING DIVISION.

Free miners' certificates (individual)	567
" " (special)	5
" " (company)	5
Claims recorded (mineral)	256
" (placer)	24
Certificates of work recorded	536
Agreements, transfers, etc	83

Revenue.

Free miners' certificates	$2,944 00
Mining receipts, general	2,635 25
Total	$5,579 25

ARROW LAKE MINING DIVISION.

WALTER SCOTT, MINING RECORDER (OFFICE AT NAKUSP).

The Mining Recorder submits the office statistics, and says: "Nothing but the ordinary assessment-work has been done this year upon mineral claims."

OFFICE STATISTICS—ARROW LAKE MINING DIVISION.

Free miners' certificates	25
Certificates of work recorded	15
Mineral claims recorded	8
Cash paid in lieu of work	$100

ROSSLAND DISTRICT.

TRAIL CREEK MINING DIVISION.

REPORT OF H. R. TOWNSEND, GOLD COMMISSIONER.

I have the honour to submit the report of mining operations in the Trail Creek Mining Division during the year 1914.

This Division enjoys the distinction of, this year, showing no decrease, but instead a substantial increase of about $170,000, despite the war and its attendant conditions.

The only important mines in this Division are those at Rossland, which for several successive years have produced more than half of the total lode-gold output of the Province, as well as the silver and copper associated with the gold in the ores of this camp. The gross value of the mineral production of this Division, practically all from Rossland mines, during the period of 1894-1914 shows a total of more that $62,000,000. As the average annual total value for five years, 1909-1913 has been approximately $3,040,071, it may be seen that the mines at Rossland are continuing to add substantially to the value of the mineral production of British Columbia. The records show that from a total of about $100,000 in 1894 (the records at that time were not very accurate and vary considerably) there was an increase year after year until, in 1902, the maximum amount for any year was reached with a value of $4,893,395. The output for 1914 shows a total value of $3,449,210, which is higher than for any other year since 1908, which seems to afford convincing testimony that confidence in the stability of the mining industry of Rossland camp is well warranted.

The Consolidated Mining and Smelting Company of Canada, Limited, and the Le Roi No. 2, Limited, continue to be the principal operators in this Division, and, although the latter company was closed down on account of the war in Europe, the production of the Division for the year exceeded that of 1913 by $167,000. The mines operated by these companies produced this year ore to the value of $3,449,210. The aggregate of the workings in the properties operated by these companies on Red mountain is between fifty and sixty miles.

The properties in the South Belt of Rossland camp have been at a standstill during the year, but a deal has been made lately whereby the *Blue Bird* group, owned by the Rosalia Mining Company, will be developed by E. L. Tate during the present year.

The most important company in this Division is the Consolidated Mining and Smelting Company of Canada, which owns and operates in this Division the *Centre Star* and *Le Roi* groups in the Rossland camp and the copper and lead smelter at Trail.

In addition to these, the company has acquired and operates a number of silver-lead mines in other Mining Divisions, the ores from which are sent to Trail for treatment.

The Trail smelter is also operated as a customs smelter and handles all the lead ores smelted in the Province.

The Consolidated Company has continued improving the smelting plant at Trail, and has spent upwards of $500,000 on the plant during the year.

The annual report of the company for its fiscal year ending September 30th, 1914, of course, deals with the company's operations as a whole, including both mines and smelter. This report shows, however, that four dividends were paid during the fiscal year, amounting to $476,376, or at the rate of about 8 per cent. on the stock issued and paid up.

The financial statement of R. H. Stewart, the general manager, says: "Operations for the year show a net profit of $474,012.24 after writing off $193,149.69 for depreciation on plant and equipment and charging to Profit and Loss Account $492,465.91 expended during the period in development on our properties. Increase in plant account for the year, deducting depreciation and sales of plant, amounted to $366,567.55. Increase in property account, $283,422.31."

Centre Star.

The *Centre Star* group, comprising the *Centre Star, War Eagle, Iron Mask, Mugwump, Idaho, Enterprise, Virginia, Red Mountain, Stewart Fraction, Pilgrim, City of Spokane, Iron Horse, Monte Christo, Butte Fraction, Lulla Fraction, Iron Colt Fraction, Virginia Fraction, Paul Boy, Mabel, Monte Christo Fraction, Trophy Fraction, Buckeye, Eddie J., Monita, Overlooked Fraction,* and the *Daisy Fraction,* produced 173,666 tons of ore of a gross assay value of $2,162,943.79.

The work done during the year was 10,377 feet of drifting and crosscutting, 1,279 feet of raising, 157 feet of sinking, and 10,752 feet of diamond-drilling. The average number of men employed was 450.

Le Roi.

The *Le Roi* group, comprising the *Le Roi, Pack Train, Black Bear, Ruby Fraction, Pearl Fraction, Durham, Treadwell, Le Roi-Annie Fraction, Nelson No. 2, Abe Lincoln, St. Patrick Fraction, St. Peter Fraction, Sunset, Alabama, Annie E., Grand Prize, Deer Park, Martha Rose Fraction, Patricia Fraction,* and *Day After Fraction,* produced 96,686 tons of ore of a gross assay value of $1,085,176.44.

The work done was 2,515 feet of drifting and crosscutting, 279 feet of raising, 12 feet of sinking, and 10,889 feet of diamond-drilling. The average number of men employed was 200.

As will be seen by comparing the above groups with the list in the reports of previous years, a number of new claims have been added to each during the past year.

Le Roi No. 2.

The *Le Roi No. 2* group, consisting of the *Annie, Annie Fraction, Josie Fraction, No. 1,* and *Poorman,* mined 26,886 tons of ore, of which 10,286 tons was milled and 16,599 tons shipped to the smelter, together with 1,168 tons of concentrates. The value of the ore shipped was $307,750.65 and of the concentrates $21,244.07.

The work done was 2,664 feet of drifting, 73 feet of raising, 182 feet of sinking, and 8,602 feet of diamond-drilling. The average number of men employed was 115.

The company has lately secured a bond on the *Giant-California.*

Inland Empire.

The claims in this group are the *Inland Empire, Berlin, Saginaw, Saginaw Fraction, Glendale, Hidden Hand, Washington, Inland Fraction, Independent,* and four other claims not yet Crown-granted. No ore was shipped, but the following work was done on the property: Drifting and crosscutting, 1,500 feet; raising, 40 feet; and diamond-drilling, 1,200 feet. This was all done in the way of development-work, and has resulted in showing up some large bodies of milling-ore which the company intends to work extensively next year. The number of men employed was fifteen.

OFFICE STATISTICS—TRAIL CREEK MINING DIVISION.

Mineral claims recorded	33
Certificates of work	85
Certificates of improvement	1
Bills of sale	10
Free miners' certificates (individual)	132
" " (company)	5
" " (special)	2

BOUNDARY DISTRICT.

GREENWOOD MINING DIVISION.

REPORT OF W. R. DEWDNEY, GOLD COMMISSIONER.

I have the honour to submit the annual report on mining operations in the Greenwood Mining Division for the year 1914.

Owing to the activity in real estate and other attractions, Greenwood almost forgot the mineral wealth which lay at her door; with the advent of "hard times," however, old-time prospectors turned again to the hills, with the result that this Division has not suffered to the extent one might have expected through the closing-down of the British Columbia Copper Company's mines and smelter and from the effects of the war.

Properties surrounding Greenwood are being actively worked and a feeling of optimism is apparent throughout the Division.

The operations of the Greenwood smelter of the British Columbia Copper Company, Limited, from January 1st to August 22nd, when it was closed down, were as follows:—

Total ore treated	303,429 tons.
Metals recovered—	
Gold	14,442 oz.
Silver	63,501 "
Copper	4,116,190 lb.
Estimated production from United States ores, included in the above metals—	
Gold	5,170 oz.
Silver	24,163 "
Copper	164,561 lb.
Ore shipments received at smelter—	
Mother Lode (B.C. Copper Co.)	178,049 tons.
Queen Victoria (Nelson Mining District)	7,920 "
Lone Star and *Washington* (U.S.)	1,988 "
Napoleon (U.S.)	5,332 "
Rawhide (New Dominion Copper Co.)	88,440 "

The Granby Consolidated Mining, Smelting, and Power Company, Limited.

Ore shipped	741,989 tons.
Development—	
Drifting	3,444 feet.
Raising	3,923 "
Sinking	15 "
Diamond-drilling	13,984 "

During the year a "Bucyrus" electrically driven power-shovel, type 40-R, capacity 1½ yards, working 48 tons, and a 5 x 8 Fig. 1140 Goulds electrically driven single-acting pump, were installed. The mines closed down on August 3rd and remained closed until December 3rd, during the period of depression in the copper market.

Jewel-Denero Mines, Limited.

Ore mined and milled	16,526 tons.
Ore shipped to smelters	*Nil.*
Precious metals recovered by cyanide—	
Gold	6,512 fine oz.
Silver	33,236 "
Average men underground	34
Average men on surface	18

The mine and mill have been running steadily throughout the year. The main shaft was deepened from 330 to 540 feet, and new levels were run at 430 and 540 feet. The 430-foot level was drifted 500 feet and the 540-foot level was drifted 270 feet.

SKYLARK CAMP.

E.P.U. Group.—W. E. McArthur, of the McArthur Contracting Company, took a lease and bond on this property in September last, starting work with three men, which number has been increased to six.

The property was worked about eight years ago and considerable valuable ore was shipped. The vein broke and the mine was shut down. Mr. McArthur has succeeded in picking up the ore past the break and has drifted some 60 feet on the vein.

A car of ore was shipped in December to the Granby smelter at Grand Forks, which returned $827.14 after deducting freight and treatment charges. Another car of ore has been shipped, from which returns are expected of about $60 a ton. A bunk-house and cook-house have been erected on the property.

PROVIDENCE CAMP.

Strathmore Mine.—The mine is now under lease to Charles Kinney and Duncan McIntosh, of Greenwood, who have six men employed and are taking out good ore. Two car-loads are ready for shipment.

Togo Mine.—A shaft is down 100 feet on this claim, which is being worked by Carl Bender, Charles Johnson, and others. No ore has been shipped. A living-house, stable, and blacksmith-shop were built during the year.

SMITH'S CAMP.

Tipperary Mine.—Very good ore has been struck on this property, which is owned by Duncan Buchanan. Assays run from $7 to $15 a ton in gold and silver. The ore is improving with depth.

GREENWOOD CAMP.

Prince Henry Group.—This group of claims, owned by the Prince Henry Mining Company, has been leased to George Boug, C. Hamerstadt, and J. L. Morrison, of Greenwood. On this property, which was worked several years ago, there is an inclined shaft 225 feet deep. The mine is equipped with an electric hoist. At the present time the power-line is being rebuilt from Greenwood to the shaft.

Argo Mine.—I must pay tribute to the remarkable zeal and perseverance of Ola Lofstad, president of the Argo Mining and Tunnel Company, Limited, who, after several years of patient effort, has at last struck a lead in the *Argo* tunnel.

A small force of men has been kept at work, practically continuously, during the past year; at present writing there are four men employed, and the results are distinctly encouraging.

The property is being developed by a tunnel, which from a recent survey made by C. AE. Shaw, B.C.L.S., shows a length of about 1,150 feet, giving a vertical depth of about 550 feet. The tunnel runs in an easterly direction, the portal being only about 500 feet from the track

of the Canadian Pacific Railway and from Boundary creek, thus affording easy access to water and transportation.

The company has now a ledge of milling and concentrating quartz in the face of the tunnel, 10 feet wide, but, as the hanging-wall has not yet been encountered, the absolute width is uncertain.

Underlying the foot-wall was encountered a heavy seam of talc, about 4 feet wide, assaying $4, in which are to be found pieces of quartz, probably carrying the values. This ore-body, lying, as it does, on talc, would be considered by mining men a very favourable condition, as it indicates a fissure-vein, and it would seem that with a suitable plant the property should prove a paying one. The company may decide to make some shipments to a smelter this spring.

CARMI.

Carmi Mine.—The following is a report of operations covering the period of October, November, and December, 1914: This property was obtained by taking over the option of Alexander Robinson from F. J. Finnucane, the owner, of Spokane, Washington, by R. Lyman, of Salt Lake City, Utah; W. N. Burke, of Denver, Colorado; P. M. Collins, of Butte, Montana; and Alexander Robinson, of Victoria, B.C., who retains a one-sixth interest. The property is bonded for $30,000, and the *Butcher Boy*, which adjoins the *Carmi* on the west, is also bonded by the same parties for $25,000 from Robert D. Kerr, of Midway, B.C.

There are two distinct fissure-veins extending entirely through both properties; work, however, has only been done on the south vein. All work up to this date in the mine has been done on the 100-foot level at the working-shaft, as they are unable to treat the ore at a profit on the 165-foot level with their present equipment on account of its limited capacity. The 5-stamp mill at present used will only handle about 20 tons a day.

Preparations are now being made to add to the old equipment, which will be augmented by another 5-stamp battery, 950-lb. stamps, and three concentrating-tables, also some slime-treating equipment to facilitate better extraction of the ore. The new equipment is expected to be installed and in operation by May 1st. The mine is being worked at the present time, and concentrates are being stored until the resumption of traffic on the Kettle Valley Railway which runs through the property.

Ore mined	1,130 tons.
Ore milled	1,115 "
Ore from stope, 100-foot level	950 "
Ore from drift, 100-foot level	180 "
Development—	
Drifting east	60 feet.
Drifting west	5 "
Tons of concentrates made—	
Shipped	67, value $35 a ton.
On hand	40
Oz. bullion—	
Shipped	381.15, value $10 a oz.
Not returned	62
Days run	52
Ore shipped	15 tons.
Average men employed, mine	12
Average men employed, mill	5
Outside labour, superintendent, assayer, etc	5
Pay-roll per month	$2,800
Ore ready to stope, 100-foot level	4,000 tons, av. val. $14.
Ore ready to stope, 165-foot level	5,000 " av. val. 6.

NEAR BEAVERDELL.

Sally Mine.—Five men are working at the *Sally* mine, near Beaverdell, under the management of James Drum. I have been unable to obtain particulars as to tons of ore shipped during the year 1914.

PLACER-MINING.

Four locations were made and two rerecords during the year. One placer-mining lease is in good standing at the present time.

I have to thank the managers and owners of the mines mentioned in this report for their kindness in sending me particulars of their operations during the year just closed.

OFFICE STATISTICS—GREENWOOD MINING DIVISION.

Free miners' certificates issued	225
Locations (quartz)	56
" (placer)	4
Rerecords (placer)	2
Certificates of work	175
Transfers, etc.	31
Certificates of improvements	2
Crown grants	1
Filings	16

GREENWOOD MINING DIVISION.

NOTES BY PROVINCIAL MINERALOGIST.

BRITISH COLUMBIA COPPER CO., LTD.

Under date April 15th, 1915, the directors of the British Columbia Copper Company, Limited, have submitted to the shareholders their report, together with the certified balance-sheet and Profit and Loss Account, for the year 1914. The report follows:—

"On account of the unsettled condition of the copper market, incident to business disturbances in the latter half of the fiscal year, the company's smelter at Greenwood, Boundary District, and operations at the mines from which the ore-supply had been drawn, were suspended last August, but the development and exploration at Copper mountain, Similkameen, were continued in a restricted way in order to conserve your company's resources.

"As shown in the balance-sheet herewith, this company has borrowed from the Canada Copper Corporation, Limited, $340,000, to December 31st, 1914.

"The company's engineers recently made a preliminary valuation of the company's mining and smelting properties, and the value shown in the balance-sheet is based on their report. The amount written off for property in the Boundary District and the *Lone Star* and *Napoleon* properties, in the State of Washington, including the stock and bonds of the New Dominion Copper Company, Limited, is $1,781,095.20, leaving the present book value of $1,377,431.22. The Copper Mountain properties are shown on the books at a present valuation of $2,022,568.78 making a total of $3,400,000, as shown in the balance-sheet.

"The above mentioned transaction has reduced the balance as shown in Profit and Loss Account, December 31st, 1913, by approximately $500,000, leaving balance to Surplus Account, December 31st, 1914, of $23,530.45.

Copper-gold Ores and Smelter Products—Boundary District, British Columbia.
Panama-Pacific Exposition.

Clay and Cement Industries of British Columbia and other Provinces.
Panama-Pacific Exposition.

"The management is again indebted to the intelligent co-operation of its operating force under unusually adverse conditions.

"*Profit and Loss Account.*

"To Operating disbursements—		
Mining, smelting, freight, refining, and selling charges, general office and administration expenses, maintenance and fixed charges and expenses incurred during the time the plant was closed	$788,684 64	
Custom ore purchased	162,434 84	
"By Proceeds of metal shipments		$899,851 17
Miscellaneous earnings		11,503 76
Balance, being loss for the year		39,764 55
	$951,119 48	$951,119 48

"*Balance-sheet.*

"Liabilities—			
Capital stock—			
Authorized, $3,000,000 in 600,000 shares of $5 each.			
Issued, 596,709 shares.			
Less 5,000 " in treasury.			
591,709 " of $5 each		$2,958,545 00	
Accounts payable		146,704 54	
Loans and advances from banks		58,794 04	
Canada Copper Corporation—			
Amount advanced on mortgage	$340,000 00		
Accrued interest thereon	8,160 00		
		348,160 00	
Reserve for sundry liabilities	$ 500 00		
Reserve for employers' liability	5,016 76		
		5,516 76	
Surplus		23,530 45	
"Assets—			
Properties, equipment, shares and bonds in other companies, etc			$3,400,000 00
Metals and smelter products, supplies, etc			112,801 23
Prepaid insurance and taxes			4,693 00
Sundry debtors			6,567 19
Cash on hand and in banks			17,189 37
		$3,541,250 79	$3,541,250 79"

CANADA COPPER CORPORATION, LTD.

The first annual report of the Canada Copper Corporation, Limited, which has mining properties in British Columbia and its head office in New York City, has been issued. Under date of April 16th, 1915, the chairman, Newman Erb, reported as follows :—

"This company was organized in March, 1914, with an authorized capital of $5,000,000, divided into 1,000,000 shares of $5 par value. As of December 31st, 1914, there were outstanding 600,200 shares, leaving unissued 339,800 shares, 200,000 of which are held for conversion of debentures.

"At the time of the organization of the company there were authorized 1,000,000 6-per-cent. convertible debentures, of which there were outstanding as of December 31st, 1914, $600,000. The remaining $400,000 of debentures and 199,800 shares of stock may be issued for future requirements.

"Under the plan of organization, stockholders of the British Columbia Copper Company, Limited, were invited to subscribe to the debentures of your company, and at the same time to exchange their shares for shares of the Canada Copper Corporation. There were so exchanged 444,952 shares of British Columbia Copper Company stock, now owned by your company, and the balance of 155,048 shares and $155,048 par value of debentures were taken over by the underwriters.

"There has been loaned to the British Columbia Copper Company, Limited, to December 31st, 1914, $340,000 against that company's notes, secured by a first mortgage, which funds have been expended for the purchase and development of the properties under option.

"The balance-sheet of your company, as of December 31st, 1914, is herewith submitted, together with detailed report of your general manager covering operations for the year.

"*Balance-sheet.*

"The balance-sheet, as at December 31st, 1914, shows the following liabilities and assets:—

"Liabilities—

Capital stock (authorized, $5,000,000) issued	$3,001,000 00	
Debentures (authorized, $1,000,000) issued	600,000 00	
"Assets—		
Investment, British Columbia Copper Co. stock		$3,000,000 00
Notes receivable, secured by mortgage		340,000 00
Interest accrued on notes		8,216 67
Mining property		9,394 73
Incorporation, legal, and general expense	$53,271 30	
Debenture coupon No. 1	18,000 00	
	$71,271 30	
Less interest received	8,988 98	62,282 32
Cash on hand		181,106 28
	$3,601,000 00	$3,601,000 00"

GRAND FORKS MINING DIVISION.

REPORT OF S. R. ALMOND, GOLD COMMISSIONER.

I have the honour to submit the annual report on mining in the Grand Forks Mining Division for the year 1914.

In making this report, I would state that through the lack of anything new pertaining to the industry occurring during the past year in this Mining Division, the report must of necessity be confined to a small field.

The only work, excepting the operations of the Granby Company and the ordinary development-work done in prospecting mining claims, was done in Franklin camp on the *Union* mine. This property shipped several hundred tons of ore to the Granby smelter at Grand Forks, and when that smelter was closed for the last four months of the year shipments were made to the Trail smelter.

I have no data as to the net returns to the ton obtained after transportation and smelter charges had been deducted, but the average assay value of the ore shipped was about $34 a ton.

The mine as worked by the locators has been a paying proposition from the grass-roots. The ore has been hauled by teams some twenty miles or more to Lynch creek, which is a station at the end of the branch of the Kettle Valley Railway running up Granby river (North fork of Kettle river).

From statements made by prospectors, it would seem that there are many other claims, both in Franklin and Gloucester camps as well as the *Union*, that have good surface showings. The working of the *Union* by the locators and the success of their efforts thus far has given quite an impetus to prospect-work in the two camps.

The Granby Consolidated Mining, Smelting, and Power Company's smelter at Grand Forks is the chief copper-producer of the Boundary District; in the last fifteen years this company has, on an average, shipped from its mines at Phœnix to its smelter at Grand Forks nearly 700,000 tons of ore annually, or a grand total of about 10,500,000 tons.

The information given in following excerpts has reference to the company's Boundary District properties, and is taken from the annual report of the company for its fiscal year ending June 30th, 1914:—

"At Phoenix the acquisition of the *Snowshoe* mine, adjoining the *Gold Drop* mine, added 140,000 tons to the total ore of the mines there, while the diamond-drilling and other development-work has further increased this by 142,684 tons, the total ore to date showing as 15,132,368 tons, from which has been shipped 10,440,837 tons, the remainder of the developed ore being 4,691,531 tons.

"The development-work for the year ended June 30th, 1914, at Phoenix has been more extensive than during any previous year, and though the total tonnage increase of ore has not been considerable, a part of this tonnage increase is of higher grade than the average ore remaining in the mine. The operating cost of 80 cents per ton of ore shipped, which includes all costs of breaking, handling, timbering, development-work, and general expense, compares very favourably with former years, and indicates the commendable care which has been exercised in handling the output from this mine.

"The exploration-work and investigation of near-by properties, which has been carried on from the Phoenix office, and confined mostly to the district south of this point and east of the Republic camp of the State of Washington, has so far shown only negative results.

"The Grand Forks smelter treated 1,225,745 tons of ore during the year and produced therefrom: Copper, 21,181,000 lb.; silver, 407,560 oz.; gold, 43,232 oz., at a cost for smelting and converting of $1.28 a ton, which cost is as low as has ever been obtained at this plant."

Elsewhere it is stated that the quantity of Granby ore from Phoenix mines smelted was 1,201,955 dry tons, and that 23,940 tons of foreign ore was smelted as well, probably all at Grand Forks, so that the metal recoveries given include those from custom ores, doubtless of higher grade than the Granby ores. From the report of C. M. Campbell, superintendent of mines at Phoenix, the following notes have been extracted:

"Ore shipments were: From above No. 3 tunnel, 483,065 tons; from *Victoria* shaft, 544,351 tons; from *Gold Drop* mine, 177,139 tons; total, 1,204,555 tons. Returns from the smelter show a recovery of 16.89 lb. copper, 0.033 oz. gold, and 0.2 oz. silver per ton of ore. The development-work done in the mines at Phoenix consisted of sinking 15 feet, raising 7,051 feet, and drifting 6,581 feet; total 13,647 feet. There was also 19,670 feet of diamond-drilling done.

"The average cost per ton of ore, on cars, including all development, was 80.4 cents. This means an increase of 5 cents a ton over last year's costs. This increase is in part due to extra development and in part to extra work necessary to mine and handle ore from outlying and thinner ore-bodies. In addition to this, more waste was handled than ever before—namely, 176,027 tons."

The president of the company, in his report dated October 6th, included the following statement: "Since the close of the fiscal year a quarterly letter was issued advising the shareholders that the market conditions arising in August had rendered advisable a curtailment of production, and that accordingly operations at Phoenix and Grand Forks had been suspended." Toward the end of the year arrangements were made under which the company resumed smelting, two furnaces having been blown in on December 7th and two more later in the month. The men concerned returned to work at lower wages by 25 per cent. than they were receiving before the suspension in August. It was announced quite lately that the company had decided to allow 5 per cent more; that is, to pay the men 20 per cent. less, not 25 per cent., than the old rates. There is stated to be a prospect of two more furnaces being blown in shortly.

The *Boston Commercial* the other day showed in a table of dividend payments by copper companies that during the last six years the Granby company had paid the following sums as dividends: In 1914, $448,928; in 1913, $897,858; in 1912 and 1911, *nil;* in 1910, $148,481; in 1909, $270,000. This gives a total in that period of $1,765,267.

OFFICE STATISTICS—GRAND FORKS MINING DIVISION.

Free miners' certificates	186
Locations	94
Certificates of work	153
Filings	24
Certificates of improvements	1
Crown grants	1
Transfers	31

MINERAL AND OTHER RESOURCES OF THE NORTH FORK OF THE KETTLE RIVER.

REPORT BY A. G. LARSON, M.E., ASSISTED BY CLARENCE S. VERRIL, M.E.

The undersigned made an examination of the country tributary to the North fork of Kettle river, including the Franklin mining camp, with special reference to the mining, timber, and agricultural resources, and the development of these resources by the construction of a railroad from the present terminus of the Kettle Valley Railway at Lynch creek up the East branch of the North fork to Franklin camp.

The following report is made as a result of this examination, and the conclusions have been arrived at after careful consideration of the future possibilities of the district as well as the present conditions.

GENERAL DESCRIPTION.

The country traversed by the North fork of Kettle river represents a valley about sixty miles long and about one mile wide, extending in a generally north-and-south direction with Grand Forks at the lower terminus of the valley where the North fork forms its junction with the main stream.

The general character of the country is undulating, with hills rising on either side of the valley to a height of from 300 to 500 feet. The river has a comparatively gentle grade throughout its entire length; the altitude above sea-level being 1,700 feet at Grand Forks and 2,800 feet at Franklin camp, forty-five miles to the north, thus giving an average grade of less than one-half of one per cent.

The logical route of railroad-line would follow the river very closely, and would therefore obtain a very easy grade for transportation. (*See* Map.)

The land in the valley is fertile and well watered, and most of it should be suited for agricultural purposes, being similar in climate and soil to the land in the immediate vicinity of Grand Forks, which has proved so productive under cultivation, while the uplands above the valley are well adapted for grazing purposes.

In the country tributary to the main valley there are some very considerable areas of fine timber, including white pine, cedar, larch, hemlock, and spruce.

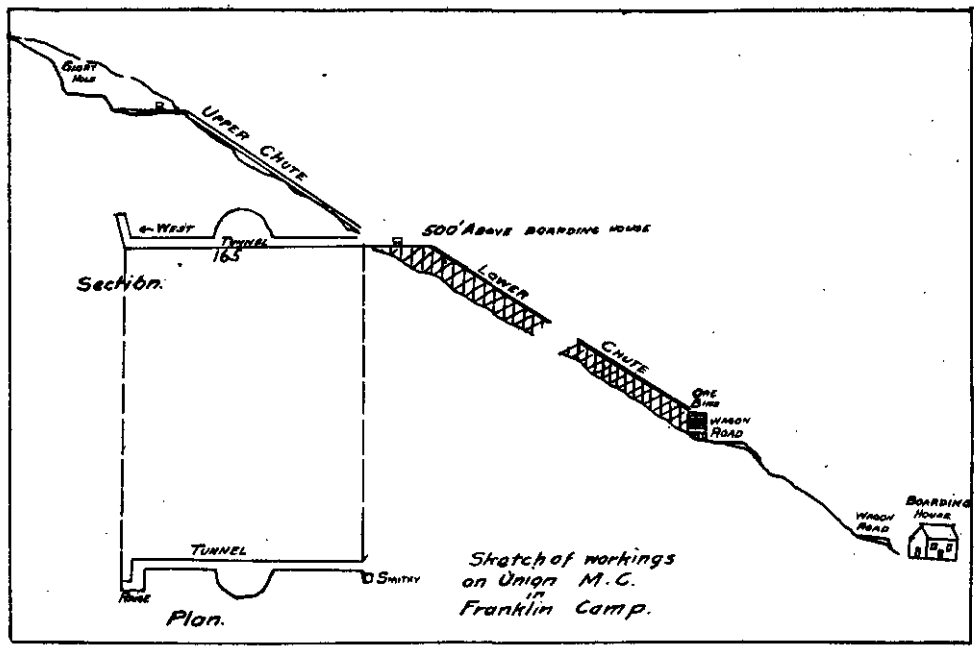
There is a large amount of water-power available from the North fork, the East and West branches of the North Fork, and from several of the tributary streams, such as Franklin and Gloucester creeks.

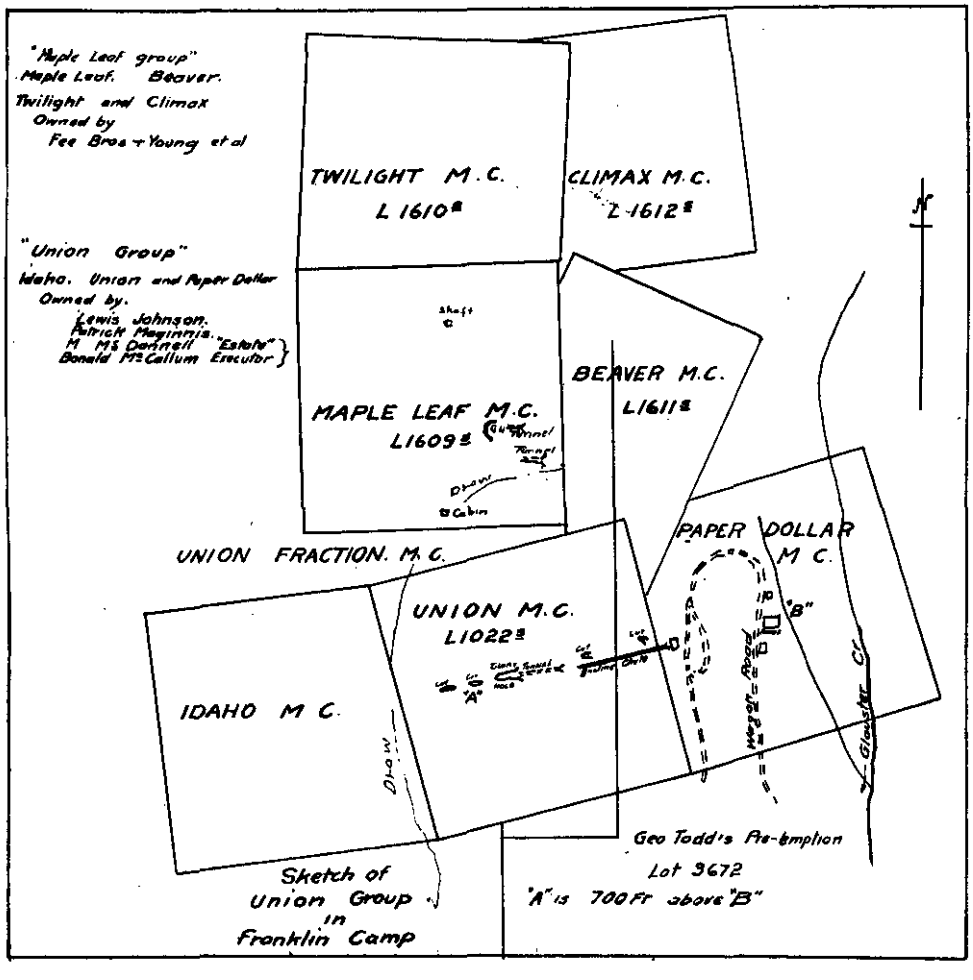
MINERAL RESOURCES.

In the general vicinity of Franklin camp there are a number of promising mining properties which would be well worth the serious consideration of capital for development into producing properties, if transportation facilites were provided for by the extension of the railroad from Lynch creek. Under present conditions the high cost of transportation is practically prohibitive to the development and working of the large mineral resources indicated in this district.

The Union.

One property known as the *Union* is actually producing, however, in spite of the adverse conditions of transportation, and as an instance of what these conditions are, the following facts are significant: This property is owned by two prospectors, Louis Johnson and Patrick Maginnis, and the estate of a third, deceased. With no capital, these two men have opened up their property and are now shipping from 30 to 40 tons of ore a day to the Granby smelter at Grand Forks; notwithstanding that it costs them $13.50 a ton for wagon-haul from the mine to Lynch creek, $1.50 a ton railroad freight from Lynch creek to the Granby smelter, $6.75 a ton smelting charge, making $21.75 a ton, in addition to the cost of mining and loading into the wagons, which brings the total cost up to approximately $25 a ton.





The smelter returns on this ore show an average grade of about $35 a ton in gold and silver, for over 800 tons, the amount which had been shipped at the time of this examination.

From this it will be observed that the property is now yielding a profit of approximately $10 a ton. Since the above shipments were made, however, the smelting charge has been reduced from $6.75 to $5.50 a ton, increasing the profit by $1.25 a ton and making the total $11.25 a ton on this grade of ore.

This ore is being mined in two different places on the property, part of it being quarried from the surface where the ore outcropped and part being stoped from a tunnel level about 100 feet below the outcrop.

The actual width of the ore which is being mined is about 20 feet, but this only represents a portion of the full width of the ore-body owing to the fact that only the higher-grade portion will stand the high transportation charges. In the tunnel level, ore is exposed for a width of 40 feet, and average samples across this 40 feet gave values of $26.30 a ton in gold and silver.

From this it can readily be seen that, while the entire body of ore could be mined at a good profit if it were not for the high cost of transportation, under the present conditions it is only possible to take out the very best of the ore, thus making the operation an extravagant one and preventing the development of the property to its best advantage.

The fact that the *Union* has been able to produce such a high grade of ore in commercial quantities is a very unusual condition; and cannot be expected to prevail for any great length of time. With a railroad to afford reasonable transportation facilities, however, the future of the property would promise exceedingly well, for, with an ore-body of this size, it is reasonable to assume that further development would make possible a steady production of ore of sufficient grade to pay a good profit under the more economical operating conditions.

Because this property was obliged, owing to lack of capital, to pay its own way from the start, and that to do this it has been necessary, as explained, to mine only the best of the ore, there has not been any systematic development of reserve ore, and it is therefore impossible to measure up "ore in sight." However, the unusually liberal width of the ore-bodies exposed and their high value indicate the probable development of a large tonnage, provided the transportation difficulties are overcome, so that the lower-grade portions of such ore-bodies can be profitably mined.

With the railroad extended from Lynch creek to Franklin camp and proper equipment installed for mining operations, the total cost of mining, freight, and smelting this ore should not exceed $10 a ton; and, judging from present conditions, there is every reason to believe that a large tonnage of ore would be developed which would yield a good margin of profit.

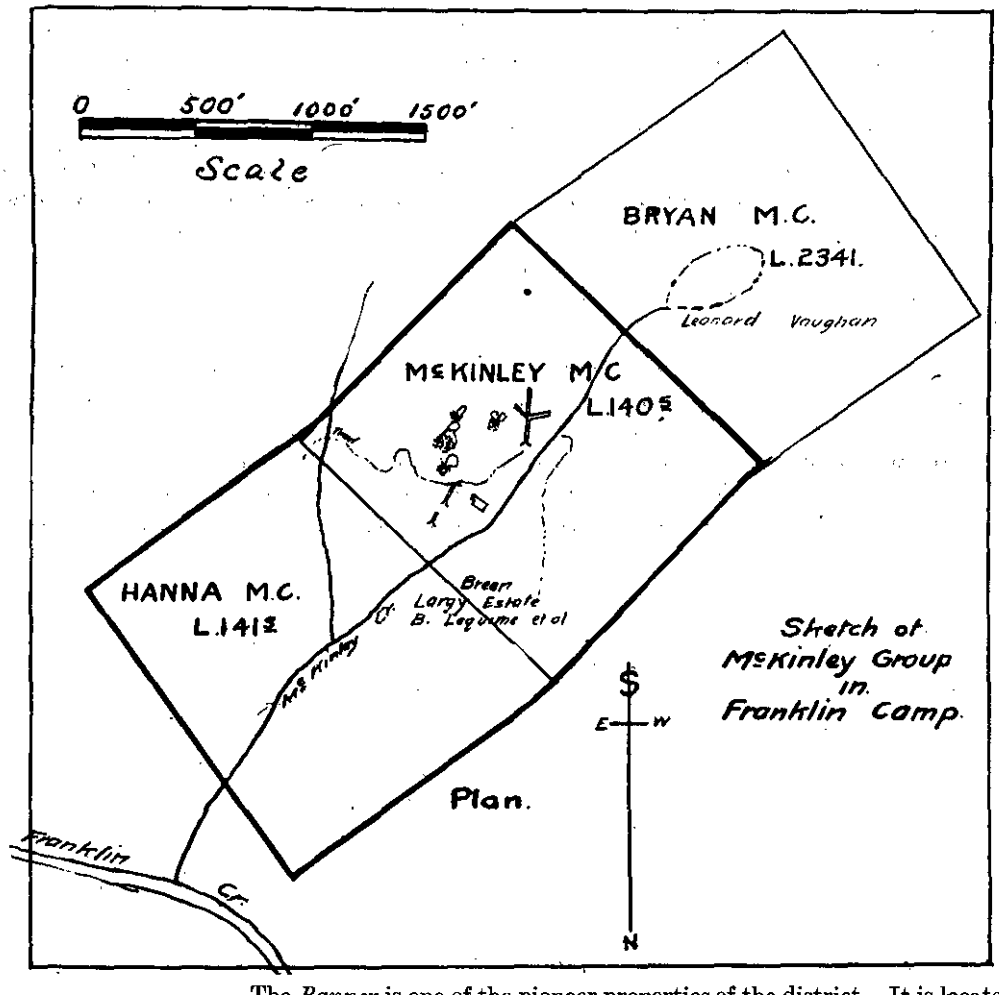
In the immediate vicinity of the *Union* there are several other properties upon which similar geological conditions exist, and upon which development-work might be reasonably expected to bring about similar results in opening up pay-ore in commercial quantities. But these other properties have not thus far developed sufficient high-grade ore on the surface to operate under the present conditions, and the low-grade ore cannot be profitably mined without railroad transportation; therefore there is comparatively little done on them in the way of development.

McKinley.

At the *McKinley*, located a mile and a half west of the crossing of Franklin creek by the wagon-road to Gloucester (*see* Map No. 2), the ore-bodies occur as sulphides and oxides of iron carrying copper and gold, but closely associated with the limestone. The surface exposures on the *McKinley* show bodies of pyrite-chalcopyrite ore of liberal size, and it is claimed that the results of diamond-drilling proved the persistency of this ore at depth, but the results of the diamond-drilling were not available for inspection. There are several tunnels on the *McKinley* which were apparently started with the intention of cutting the ore-bodies, but, while there is considerable low-grade ore exposed in this way, the indications are that these tunnels were run under the dip of the main ore-shoots.

This property is well worthy of further exploration and development-work, and capital would undoubtedly be forthcoming to undertake such work if transportation facilities were such as would make this grade of ore marketable.

The general character of the ore and its manner of occurrence are similar to the conditions prevailing at Phoenix and Deadwood, and there are good possibilities for the development of ore-bodies of this character once the transportation difficulties are overcome.



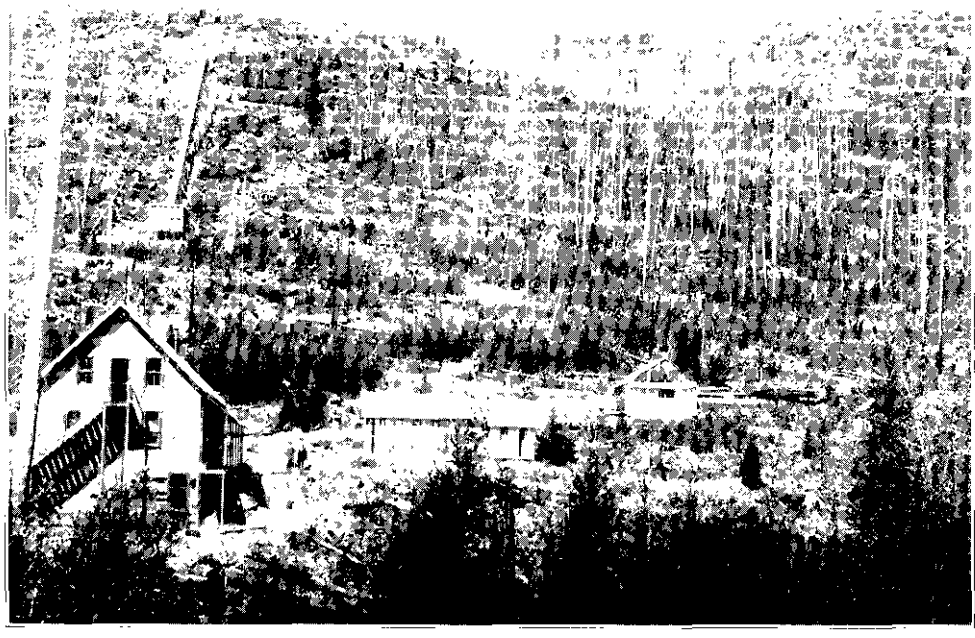
Banner.

The *Banner* is one of the pioneer properties of the district. It is located on the east slope of Banner mountain, and includes the following claims, locally known as the *Banner* group: *Aldie*, *Deadwood*, *Franklin*, *Banner*, *Rio*, *Homestake*, *May*, *Banner Fraction*, and *Bullion*. (*See* Map No. 2 and accompanying sketch.)

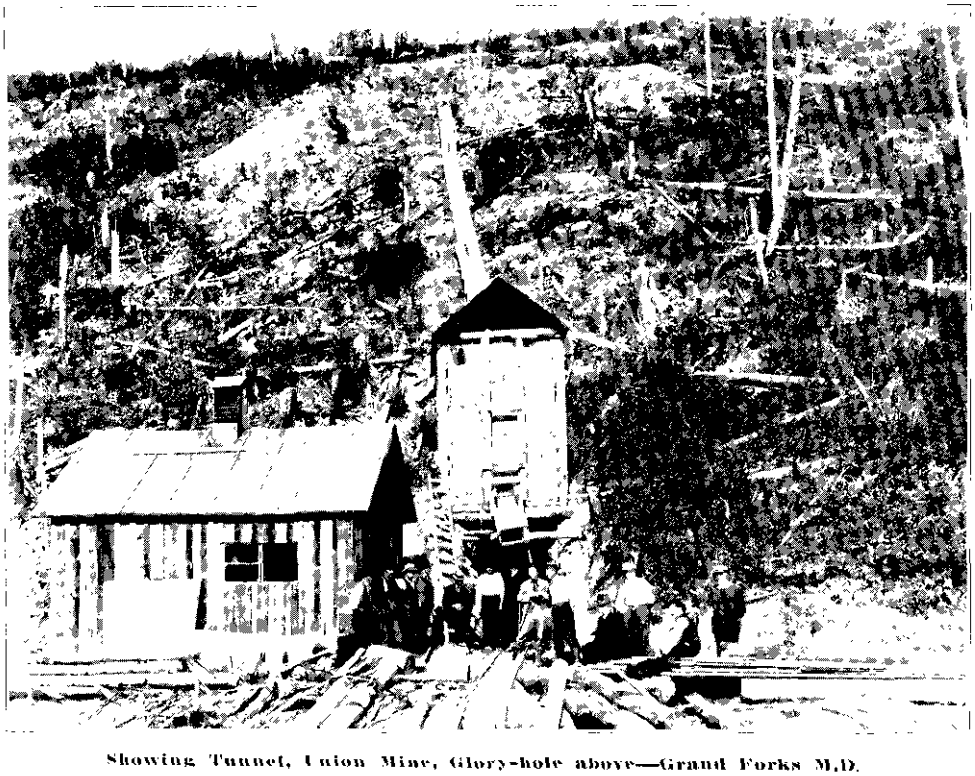
On the *Banner* claim a tunnel has been driven into the hill for a distance of 215 feet, in a generally northerly direction, and has crosscut an ore-body which, at this point, is 30 feet wide, showing sulphides of copper, lead and zinc in a quartz gangue. This is low-grade ore, but its liberal width and strong mineralization are very favourable indications for the development of large bodies of ore which could be profitably mined under economical conditions for transportation and operation.

On the surface, about 100 feet vertically above the tunnel, a shaft has been sunk 15 feet which is entirely in ore, and which is apparently part of the same ore-body that shows in the tunnel. A general sample from this shaft, representing the average of the ore thus exposed, gave assay results of $22.30 in gold, copper, silver, and lead, as follows:—

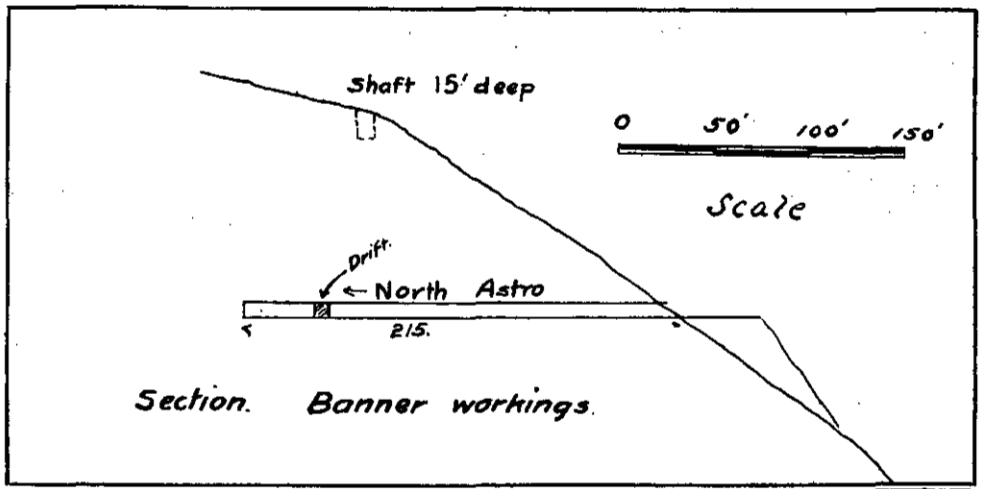
		Gross Value.
Copper	4.5 per cent.,	or $13.50
Silver	4.0 oz.,	" 2.00
Gold	0.14 oz.,	" 2.80
Lead	5 per cent.,	" 4.00
Total value		$22.30

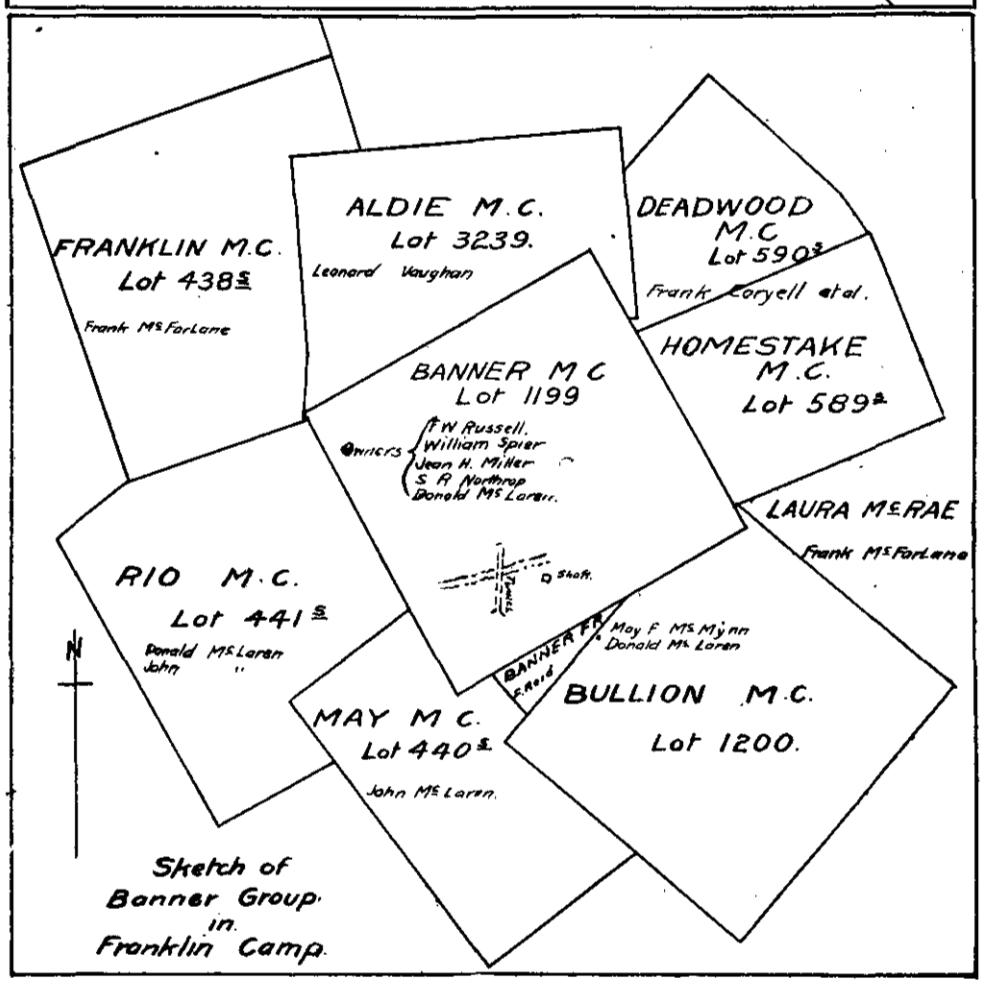


General View, Union Mine—Franklin Camp—Grand Forks M.D.



Showing Tunnel, Union Mine, Glory-hole above—Grand Forks M.D.





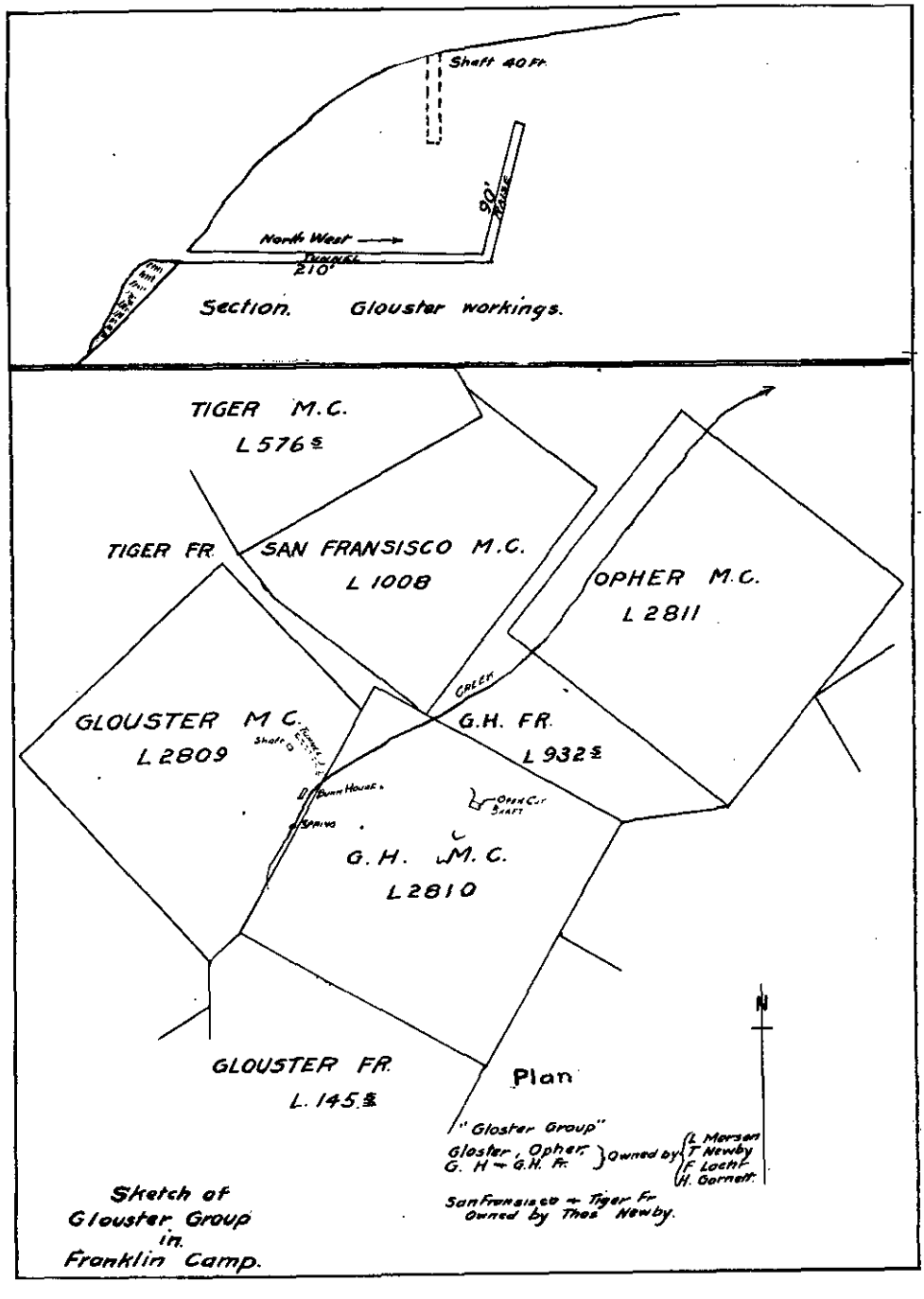
The value of this ore is very encouraging; and taken into consideration together with the large body of low-grade ore exposed in the tunnel, it is strong evidence towards the probable development of large ore-bodies of commercial value if transportation facilities were such as to permit of its economical treatment.

This property is well worthy of serious consideration for its further development and fully justifies such work.

Other Properties.

There are a number of other properties in the district which have very favourable indications for the development of a large tonnage of low-grade ore which would be marketable with railroad transportation.

The following sketches are brief descriptions of those examined, and show that the district is not limited to a few isolated properties, but that the mineralized area is large and persistent,



and that the possibilities of the district as a possible producer are most encouraging, considering the conditions under which their owners have been obliged to labour owing to lack of economical transportation.

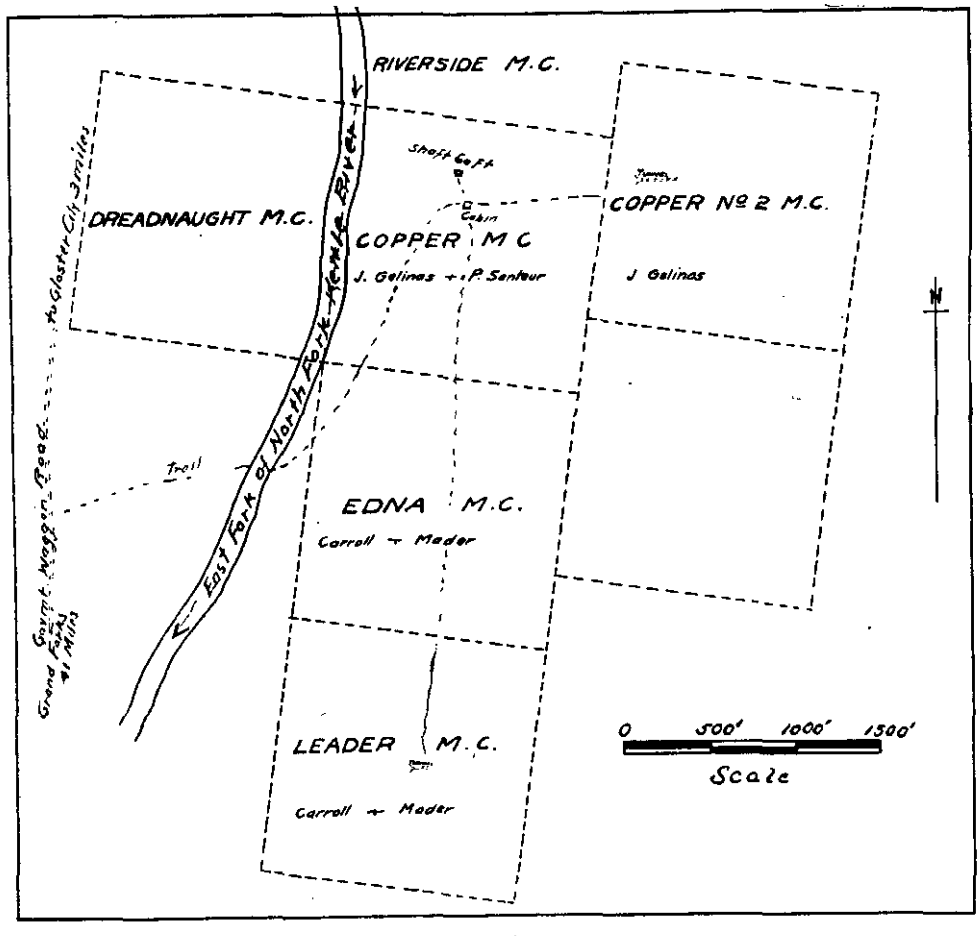
Gloucester Group.

As shown on the accompanying sketch, this property consists of the following claims: *Tiger*, *Tiger Fraction*, *San Francisco*, *Ophir*, *Gloucester*, *Gloucester Fraction*, *G.H.*, and *G.H. Fraction*. The property is situated on the Gloucester Creek slope of Franklin mountain. The ore is chiefly copper and iron sulphides occurring in the contact between silicified granodiorite and greenstone. Development-work consists of a 200-foot tunnel, with a 90-foot raise and a shaft of 40 feet deep, as shown on sketch.

While no large bodies of ore have so far been developed, there is evidence of strong mineralization, and the occurrence of chalcopyrite in the altered granodiorite is a favourable indication for the development of ore of commercial value.

Copper Group.

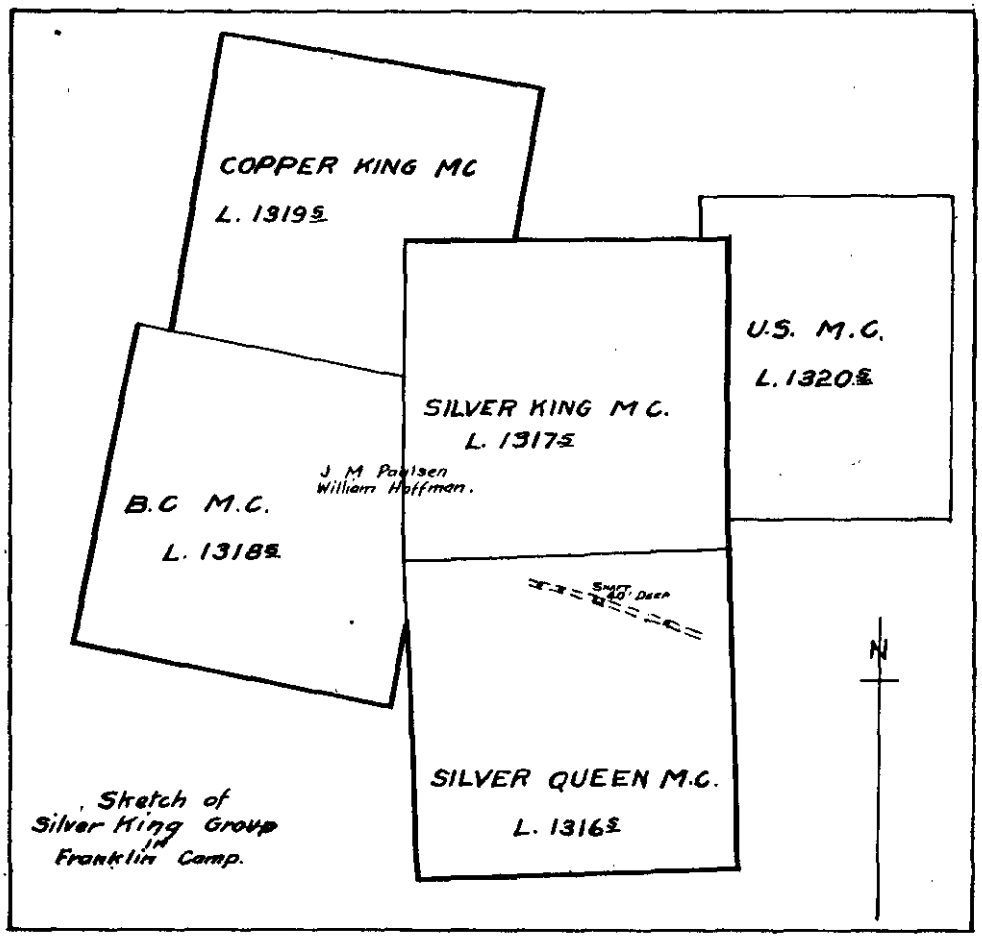
This includes the *Riverside*, *Copper No. 1*, *Copper No. 2*, *Dreadnaught*, *Edna*, and *Leader* claims, and is situated three miles south of Gloucester camp, on the east side of the East branch of the North fork of Kettle river, as shown on sketch. The character and manner of occurrence of the ore are very similar to the conditions found on the *Gloucester* group, the ore being pyrite and chalcopyrite scattered through quartz which occurs as a silification of the granodiorite.



There is not sufficient work done on the property to form a conclusive opinion, but the geological conditions and general indications are favourable to the formation of ore and are encouraging for further development.

Silver Queen. This property is located well toward the southern end of the camp, about seven miles south of Gloucester camp and one mile north-west of the wagon-road from Grand Forks to Franklin camp, and in the locality locally referred to as "Morell's camp." There are five claims in the group, the *Silver Queen*, *Silver King*, *Copper King*, *B.C.*, and *U.S.*

On the *Silver Queen* claim a vein is exposed 5 feet in width, consisting of iron, copper, and lead sulphides in a quartz gangue. A shaft, said to be 75 feet deep, has been sunk on the vein, but was full of water at the time of examination.



A general sample of the dump from the shaft gave the following assay results:—

			Gross Value.
Silver	1.4 oz.,	or	$0.70
Copper	1.0 per cent.,	"	3.00
Lead	0.5 per cent.,	"	0.40
Total value			$4.10

Other properties examined were the Morell claims, just to the south of the *Silver Queen;* the *Golden Zone*, situated on the east side of Gloucester creek and apparently on the same strike as the *Union;* the *United Verde*, on Banner mountain west of the *Union*, and similar in formation to the *Union* and *Golden Zone;* and the *Nelson* group, on the east side of the East branch of the North fork, about half a mile east of the *Union*.

These properties all have good indications for the possible development of ore in commercial quantities, but, at the time of examination, sufficient work had not been done on them to form any conclusive opinion as to their prospective value.

GEOLOGY.

The geology of the district is quite complex and would require a great deal of time to work out with any degree of accuracy, but the following table of the formations taken from Summary Report, 1911, Geological Survey of Canada, page 134, from the report by C. W. Drysdale, shows the general rock formations of the district, and this with reference to the two geological maps, also in Drysdale's report, will serve to give a fairly comprehensive idea of the general geology of the district :—

Table of Formations.

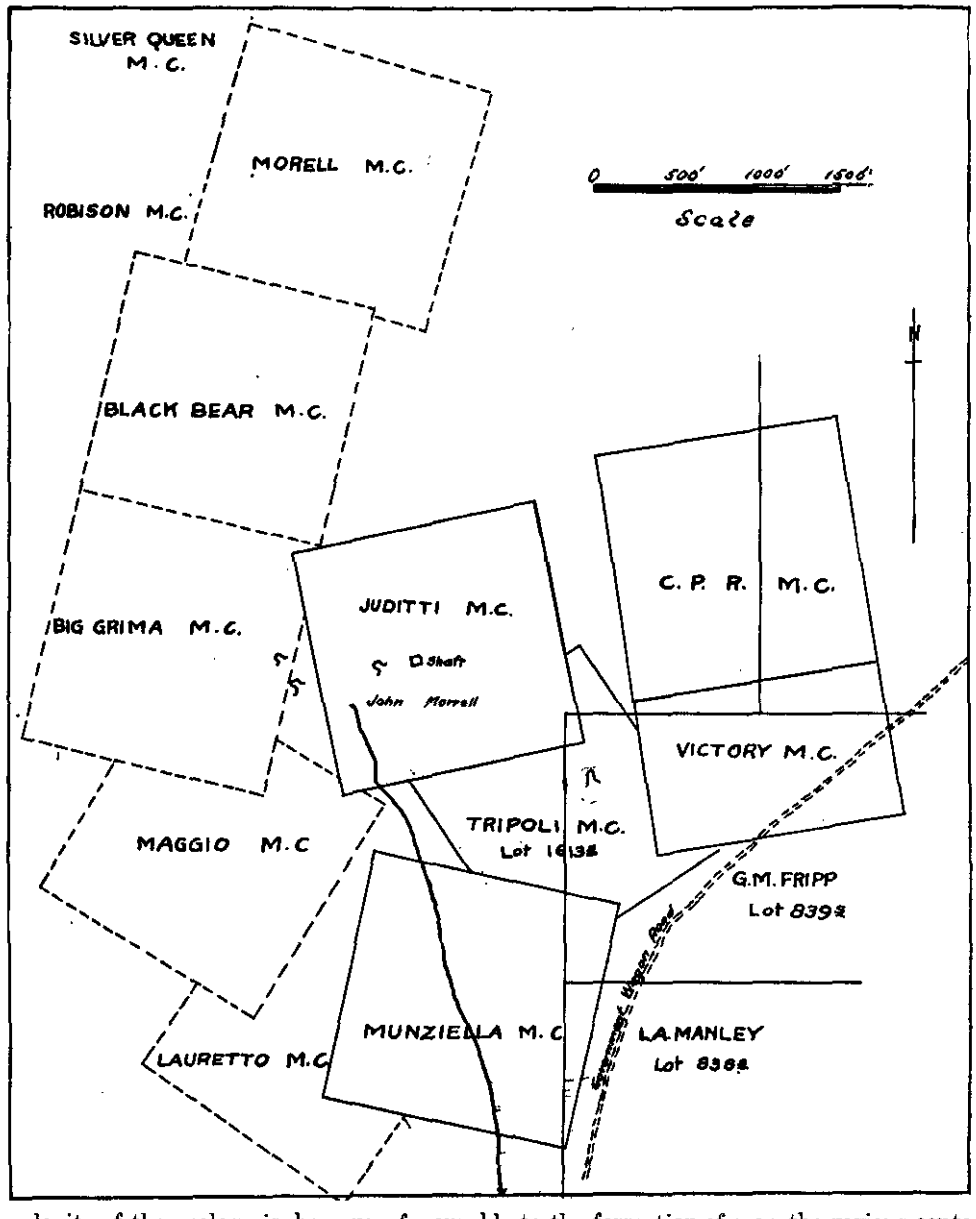
System.	Formation.	Lithological Character.
Quaternary	Superficial deposits	Gravel, sand, silt, boulder-clay.
Miocene (?)	Midway volcanic group	Pinkish pulaskite porphyry, dark basic dyke rocks—lamprophyres; quartz porphyry, and lavas ranging from basalt to andesite and rhyolite.
	Syenite	Pyroxenites (local term "Black Lead")—syenite.
Oligocene (?)	Kettle River formation	Conglomerate, grit, and tuff.
(?)	Monzonite	
Post-Jurassic (?)	Granodiorite	Massive igneous rocks from granite to diorite and in places sheared to gneiss.
Palæozoic (Upper?)	Gloucester formation	Crystalline limestone.
	Franklin group	Greenstone, altered tuff, jasperoid and silicified argillite.

The geological conditions under which the ore occurs vary according to the locality, but, in all cases observed, the ore occurs as a replacement of the limestone by siliceous solutions, as vein-matter deposited in fissures formed by intrusions of the volcanics, or by the mineralization of the rocks themselves as a direct result of the volcanic intrusions.

The mineralized area as represented by "showings" or exposures of ore covers about twenty square miles, extending for about seven miles in a generally north-and-south direction and being about three miles wide, including the territory bounded by the East branch of the North fork of Kettle river on the east, Mineral hill and Gloucester creek on the north, and Franklin creek on the west, with the old Franklin camp near the southern portion and Gloucester City as the general centre of operations.

On some of the properties the ore occurs as a replacement in the original formation which has been almost completely silicified. This condition seems to be the case on the *Union*, and, so far as could be judged from the exposures in the *Union* workings, there is no actual vein or walls to clearly define the ore-bodies, but, where the formation has been thoroughly silicified, ore occurs; the siliceous solutions apparently having been the agency by which the metallic values were carried in solution and deposited, particularly where fissuring has offered opportunity for such deposition. As a result of this condition it is often difficult for the eye to distinguish ore from waste rock, and a thorough and systematic sampling and assaying are necessary for successful mining operations.

By reference to the geological maps referred to it will be observed that the geology is exceedingly complex, representing a great variety of rock formations and covering different geological periods and movements which have brought about the present conditions. This



complexity of the geology is, however, favourable to the formation of ore; the various contacts and intrusions and resultant fissuring offering good opportunity for the deposition of metal-bearing solutions and gases.

Speaking generally, the geological conditions of the mineralized area are most favourable to the formation of ore in commercial quantities. The area is large and the mineralization has apparently been quite general and persistent. The indications point toward the development of ore-bodies similar to those of the Phœnix and Deadwood camps, with the additional advantage of occasional high-grade ore-bodies like those of the *Union*.

TONNAGE.

Reserve ore has not been "blocked out" on any of the properties in the district. It has not been practicable to do this owing to transportation difficulties, as previously explained, and it will not be possible to interest capital in the general development of the camp until this difficulty of transportation has been overcome.

Owing to this lack of the development of reserve ore it is impossible to make any positive or accurate statement as to the actual tonnage of available ore, but, so far as can be judged by present conditions, there are certainly very strong indications for the development of a large tonnage. Just what these possibilities are in actual figures no one can definitely state at the present time, but it would seem that, comparing the present conditions with those of similar camps such as Phœnix and Deadwood when they were in their first stages of development, the possibilities are good for the development of a similar production.

DATA ON UNION MINE, JUNE 26TH, 1914.

Ore shipped to Trail Smelter.

Lot.	Au.	Ag.	Dry Weight.
	Oz.	Oz.	lb.
1.	0.88	20.2	57,542
2.	0.96	32.8	72,864
3.	0.62	32.7	48,800
4.	0.48	29.9	60,570

Ore shipped to Granby Smelter.

Lot.	Au.	Ag.	Dry Tons.
Received at Smelter.	Oz.	Oz.	
1.	0.73	77.1	23,134
2.	0.76	81.0	31,929
3.	0.87	85.8	30,148
4.	0.77	71.2	28,446
5.	0.83	73.6	21,134
6.	0.81	48.5	30,243
7.	0.99	25.6	38,696
8.	0.99	16.6	25,624
9.	1.10	17.7	28,623
10.	0.74	17.6	35,356
11.	0.97	18.2	33,207
12.	1.13	19.8	32,095
13.	0.65	43.5	28,089
14.	0.63	45.9	29,028
15.	0.77	34.2	11,956
16.	0.38	33.0	32,013
17.	0.26	22.0	30,937
Six Cars in Transit.			Wet Tons.
18.	0.6	22.0	40,750
19.	1.01	16.3	37,850
20.	0.88	31.1	35,400
21.	1.12	25.3	34,650
22.	1.38	31.6	30,100
23.	1.02	31.1	31,850
Total	....	....	821,141

Average value, gold	$16.50
" " silver	18.60
" " total	$35.10

Analysis of Lots 1 to 15.

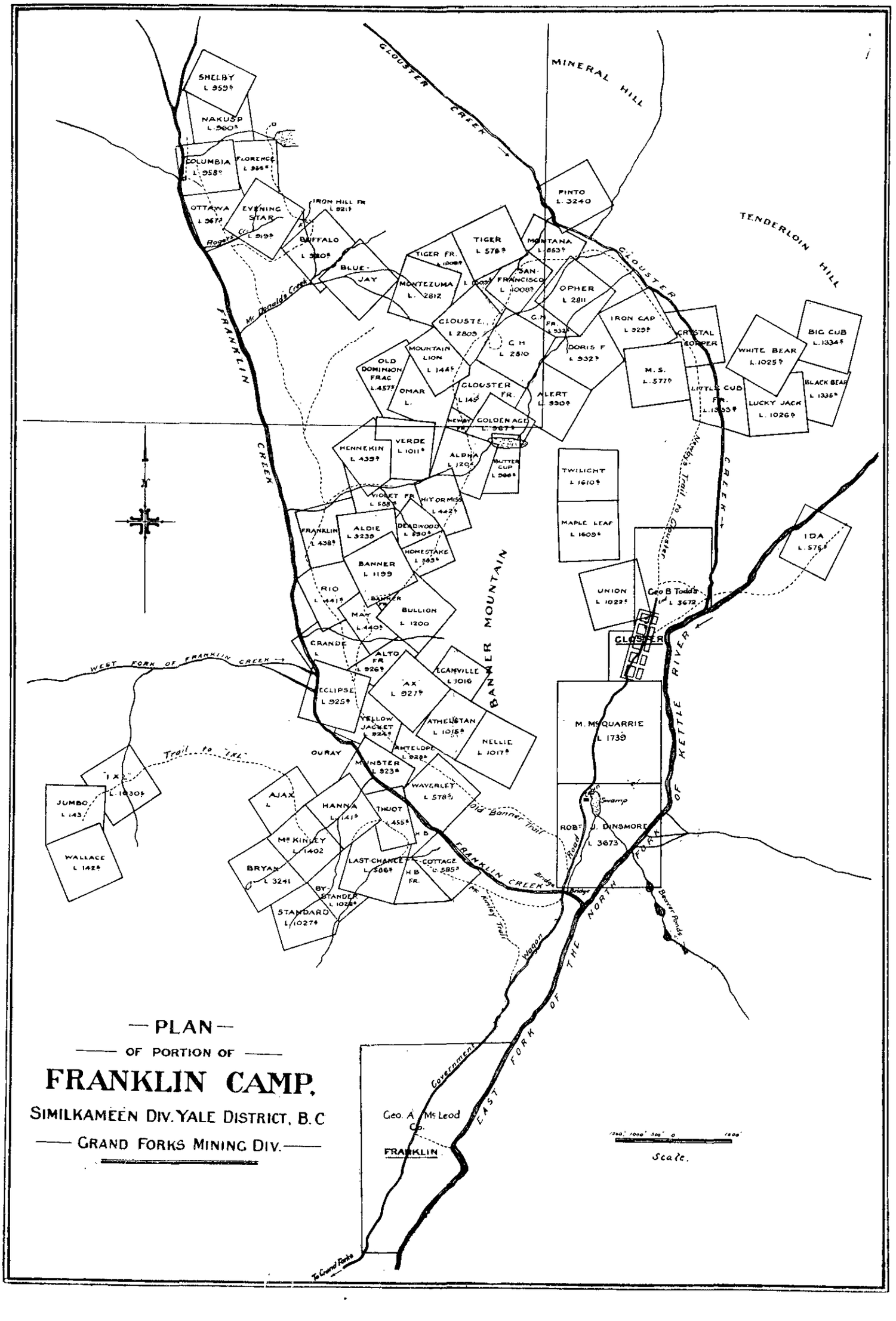
Insol.	Fe.	CaO.	S.	Cu.	Au.	Ag.
76.0	4.7	4.5	1.2	Tr.	0.85	45.0

Freight-haul by wagons to Lynch creek, 25.2 miles	$13.50 a ton.
Lynch creek to Granby	1.50 "
Treatment	6.75 "
Total cost, not including mining	$21.75 a ton.
Freight-haul in by returning wagons	10.00 "

(Signed) W. EATON,
Superintendent.

Description of Samples.

No.	Claim.	Contents.		
1	*Union* claim; 200 feet below working tunnel	Gold	0.02 oz.	$ 0 40
		Silver	8.20 oz.	4 10
		Total value		$ 4 50
2	*Union* claim; taken from side of tunnel under stope, across 20 feet continuous ore	Gold	0.48 oz.	$ 9 60
		Silver	65.8 oz.	32 90
		Total value		$42 50
3	*Union* claim; taken from side of tunnel, across 20 feet continuous ore south of No. 2	Gold	0.42 oz.	$ 8 40
		Silver	3.6 oz.	1 80
		Total value		$10 20
4	*Banner* claim; average of 15-foot shaft, all in ore	Gold	0.14 oz.	$ 2 80
		Silver	4.0 oz.	2 00
		Copper	4.5 %	13 50
		Lead	5.0 %	4 00
		Total value		$22 30
5	*Silver Queen;* average of dump from 75-foot shaft	Gold	Trace.	
		Silver	1.4 oz.	$ 0 70
		Copper	1.0 %	3 00
		Lead	0.5 %	40
		Total value		$ 4 10
6	*United Verde;* bottom of 15-foot shaft, where sinking was in progress	0.2 oz. of silver, with traces of gold, copper, and lead.		
7, 8	Surface rock from *Mary Ann* claim	Results—*Nil.*		
9	*United Verde;* taken 2 feet deeper in bottom of same shaft as No. 6	$3.20 in gold, with traces of copper and silver.		
10	*Golden Zone;* surface rock	Results—*Nil.*		



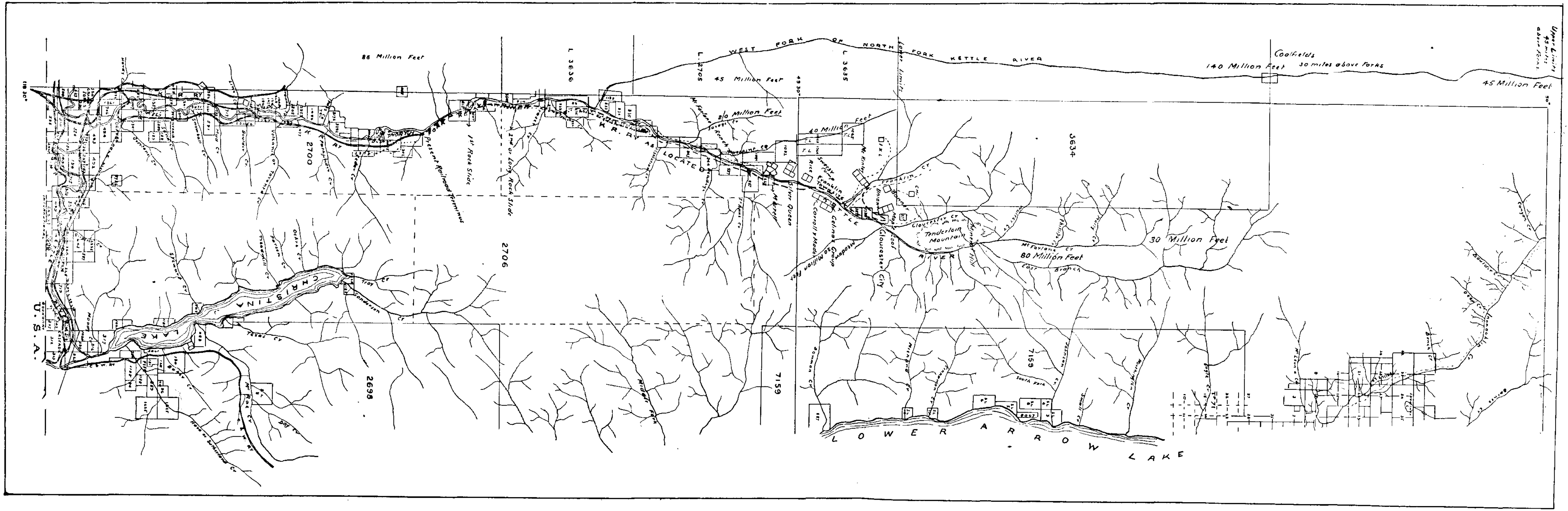
— PLAN —

— OF PORTION OF —

FRANKLIN CAMP.

SIMILKAMEEN DIV. YALE DISTRICT, B.C

— GRAND FORKS MINING DIV. —



86 Million Feet
L 3636
L 2705
45 Million Feet
L 3635
WEST FORK OF NORTH FORK KETTLE RIVER
Coalfields
140 Million Feet
30 miles above Forks
45 Million Feet
40 Million Feet
5634
2700
1st Rock Slide
Present Railroad Terminus
2706
K. R. RY AS LOCATED
Tenderloin Mountain
30 Million Feet
80 Million Feet
East Branch
RIVER
CHRISTINA LAKE
Troy Cr
Sanderson Cr
Texas Cr
U. S. A.
2698
7159
South Fork
LOWER ARROW LAKE

LIST OF OWNERS OF MINERAL CLAIMS IN FRANKLIN CAMP.

(Gloucester Camp included.)

Hannah, McKinley Mines, Ltd.
Thuot, J. H Graham *et al.*
McKinley, McKinley Mines, Ltd.
Bryan, L. Vaughan.
Last Chance, W. Minion.
Cottage, J. S. C. Fraser *et al.*
Bystander, J. M. Paulsen.
Standard.
Snowbird, P. Maginnis.
Royal Tinto, J. Holm.
Sunrise, P. H. Wright.
Manhattan, D. Whiteside *et al.*
Climax, H. W. Young *et al.*
Beaver.
Silver Horde Fraction, A. J. Fee.
Paper Dollar, Mike McDonnell *et al.*
Union Fraction, L. Johnson *et al.*
Idaho, L. Johnson *et al.*
River Elbow, J. Holm.
Evening Star, H. C. Kerman *et al.*
Last Chance, W. H. Hoffman.
Mary Ann, P. J. Byrne *et al.*
Homestake, A. McDonald *et al.*
Ida, J. Newby *et al.*
Rio, J. McLaren *et al.*
Banner Fraction, A. L. Whiteside *et al.*
Union, Lewis Johnson *et al.*
May, H. McLaren.
Bullion, P. Donaldson.
Grand Fraction, F. McFarlane.
Alto, F. M. Kerby.
Eganville, W. J. Prendergast *et al.*
Eclipse, B. LeQuime *et al.*
Athelstan, W. J. Prendergast *et al.*
Antelope Fraction, F. M. Kerby.
Nellie, W. J. Prendergast *et al.*
Ouray Fraction, P. Kelly *et al.*
Munster, D. Whiteside *et al.*
Waverley, G. E. Massie.
Ajax, B. LeQuime *et al.*
I.X.L., J. W. Graham *et al.*
Jumbo, D. Whiteside *et al.*
Wallace Fraction, D. Whiteside.
Shelby, A Chisholm.
Nakusp, J. West *et al.*
Columbia, A Chisholm *et al.*
Florence, A Harkness.
Ottawa, J. West *et al.*
Evening Star, W. Minion.
Pinto, T. Newby.
Iron Hill Fraction, L. D. Wolford *et al.*
Buffalo, J. McDonald.
Blue Jay, J. Holm.
Tiger, H. B. Cannon *et al.*
Tiger Fraction, T. Newby.
Montezuma, H. S. Cayley.
Montana, S. Birch *et al.*
San Francisco, A. Dorais *et al.*
Ophir, G. A. McLeod *et al.*
Gloucester, "
G.H. Fraction, "
G.H., "
Iron Cap, "
Mountain Lion, H. Watlin *et al.*
Doris Fraction, H. C. Kerman.
Chrystal Copper, F. W. Russell *et al.*
White Bear, W. K. White *et al.*
Big Cub, H. C. Kerman.
Old Dominion Fraction, E. G. Cummings *et al.*
Mountain Lion, H. Watlin *et al.*
Omar, M. D. Schenk *et al.*
Gloucester Fraction, G. A. McLeod *et al.*
Alert, F. M. Kerby.
M.S., C. A. S. Atwood *et al.*
Little Cub Fraction, H. C. Kerman.
Lucky Jack, H. C. Kerman *et al.*
Golden Age, "
Newby Fraction, "
Henniken, B. W. Garrison *et al.*
Verde, C. N. Mardon *et al.*
Alpha, F. H. McLaren *et al.*
Buttercup, P. E. Nelson *et al.*
Twilight, H. W. Young *et al.*
Franklin, Mrs. Lindholm.
Aldie, L. Vaughan.
Violet Fraction, B. W. Garrison *et al.*
Hit or Miss, H. A. McLaren.
Deadwood, J. H. Hudson.
Maple Leaf, H. W. Young *et al.*
Banner, Jas. McDonald.
Black Bear, H. C. Kerman.
Grand Forks Girl, P. J. Byrne *et al.*
Elsie, C. M. Tobiassen *et al.*
Royal Tinto, H. Eyre.
Blue Jay, C. E. Anderson.
Acacia Fraction, Donald McCallum.
Auto Fraction, "
Active, F. M. Kerby.
Last Chance, A. Anderson.
Laura McRae, F. McFarlane.

TIMBER.

In the valleys of the East and West branches of the North fork and the valleys of the tributary streams, such as Savage, Bluejoint, Meadow, McFarland creeks, etc., there is a large quantity of fine timber which would be made accessible by the extension of the railroad. The

following estimate of the quantity, variety, and value of this timber was obtained from the Western Pine Lumber Company, of Grand Forks, and from the report of a professional timber-cruiser, B. Bainbridge:—

Location of Timber.	Estimated Quantity.
14 miles from Grand Forks	58,000,000 feet.
17 to 21 miles from Grand Forks	13,000,000 ,,
21 to 30 miles from Grand Forks	15,000,000 ,,
	86,000,000 ,,

The above represents practically all the timber for the first twenty-nine miles north of Grand Forks, except the cottonwood in the river-bottoms, suitable only for pulp-wood and which is roughly estimated at 110,000,000 feet.

West fork, north of C.P.R. B.K.	140,000,000 feet.
,, C.P.R. B.K.	40,000,000 ,,
,, last limit north	45,000,000 ,,
	225,000,000 ,,
East fork on Savage creek	20,000,000 ,,
,, on Bluejoint creek	40,000,000 ,,
,, on Meadow creek	20,000,000 ,,
,, on McFarland creek	80,000,000 ,,
,, on north of McFarland creek	30,000,000 ,,
	415,000,000 ,,
	86,000,000 ,,
	501,000,000 ,,

The average varieties of this timber are estimated as follows:—

White pine	5 % or	25,000,000 feet.
Cedar	25 % or	125,000,000 ,,
Larch	25 % or	125,000,000 ,,
Fir	15 % or	75,000,000 ,,
Hemlock	15 % or	75,000,000 ,,
Spruce	15 % or	75,000,000 ,,
	100 % or	500,000,000 ,,

The value of this timber a thousand, as standing timber, may be taken as about $2, which would mean that there is about $1,000,000 worth of standing timber in the district which would be made available by the construction of the railroad as contemplated.

By referring to Map No. 1, showing the location of the timber and the principal mining properties, as well as the location survey of the projected railroad, one may get a general idea of their relative positions.

AGRICULTURE.

The valley of the North fork of Kettle river and the tributary valleys of the East and West branches of the North fork contain a large amount of land which is adapted to agricultural purposes, and which should prove largely productive under cultivation if transportation facilities were available for the economical marketing of such produce.

In the valley of the North fork, between Grand Forks and Franklin camp, there are some 20,000 acres, taking the average width of the valley as three-quarters of a mile and the length as forty miles, with the addition of probably 10,000 acres in the tributary valleys of the West fork, and streams like Meadow, Bluejoint, Franklin, and Savage creeks, making a total of approximately 30,000 acres of fertile, well-watered land.

The conditions of soil and climate are very similar to those prevailing in the country in the immediate vicinity of Grand Forks, which has proved so productive under cultivation. Between Grand Forks, B.C., and Danville, Wash., there are approximately 2,200 acres of land under cultivation at the present time. The average annual yield of crops from this land at the present time is about $35 an acre, while in ten years the maturity of the young orchards should increase this to about 5,000 acres, with a total average production of about $80 an acre. The climatic conditions of the valley of the North fork and its tributaries would be somewhat more severe than those prevailing in the immediate vicinity of Grand Forks, but the difference is not as marked as would at first seem to be the case. The altitude above sea-level at Grand Forks is 1,700 feet, while the altitude at Franklin camp, forty-five miles up the valley of the North fork, is only 2,800 feet, or 1,100 feet higher, so that the general average for the valley between Grand Forks and Franklin would be approximately 2,250 feet, which, in this section of the Province, is very favourable to the cultivation of average crops of grain, fruit, and vegetables. Figuring the average future yield at $50 an acre as against $80 for the Grand Forks land, which is certainly conservative, we would have an annual production of $1,500,000 from the agricultural resources of this district alone; and it does not seem at all unreasonable that these figures might easily be surpassed, as this does not take into consideration any additional production which might be caused by intensive farming.

There are also large areas of uplands on the rolling hills on both sides of these valleys which should make ideal land for grazing purposes, and there is no doubt that there would be a very considerable production from the development of cattle- and sheep-raising industries if transportation conditions were practicable for such.

RAILROAD-CONSTRUCTION.

The distance of approximately twenty-five miles from the present terminus of the Kettle Valley line at Lynch creek to Franklin, following the general course of the North fork and the East branch of the North fork would afford an easy grade of only about one-half of one per cent. The cost of construction of such a road should not be more than the average cost of railroad in British Columbia. There are no serious engineering difficulties to overcome, and there is less bridge-construction and rock-work than is usually found necessary in a line of this length in the average mountain road of the Province.

In comparison with the benefits to be derived from the development of the agricultural, mining, and timber resources of the district, the cost of such a road is almost insignificant.

Without the road, the development of the district is practically impossible, for the reason that people with capital will not invest in the development of resources where the market for their product, be it lumber, grain, or ore, is shut off by transportation costs which eliminate the possibility of profit.

GENERAL CONCLUSION.

After thorough observation of the various conditions indicative of the future possibilities for the development of the natural resources of the district examined, and after careful consideration of the facts derived from this examination, as herein stated, it is our opinion that the development of the agricultural, timber, and mineral resources is impracticable under the present conditions of transportation; but that with transportation facilities provided for by the extension of the railroad from Lynch creek such development would be entirely practicable, and in all probability of inestimable value to the Province.

NOTES.

The figures upon which the estimates of timber are based were supplied by Mark DeCew, vice-president of the Western Pine Lumber Company, and by B. Bainbridge, a professional timber-cruiser of Grand Forks, B.C.

The assaying of samples taken by the undersigned was done at the Provincial Laboratory, Victoria, B.C., and by J. O'Sullivan, of Vancouver, B.C. All other assays considered are from the Granby smelter at Grand Forks, and are on shipments of 20- to 30-ton lots of ore from the *Union* mine.

The maps accompanying this report are made from data kindly supplied by Forbes M. Kerby, B.C.L.S., of Grand Forks, and from the maps published by the British Columbia Land Office, Department of Mines, and Geological Survey.

OSOYOOS MINING DIVISION.

REPORT OF R. D. TWEEDIE, MINING RECORDER, FAIRVIEW, B.C.

I have the honour to submit herewith the annual report of the mining operations in the Osoyoos Mining Division for the year 1914.

I would state that, outside of the *Nickel Plate* in the Hedley camp, very little mining has been done in this Division during the past year. During the early part of 1914 prospects for a revival were excellent, but conditions changed entirely after August 1st. This is well instanced by the fact that the Guggenheim Corporation endeavoured to secure bonds on the *Dominion*, *Morning Star*, and *Stemwinder* groups of mineral claims in the old Fairview camp, and everything was progressing well towards that end when war was declared. The matter was dropped then and nothing more has been done.

On the majority of claims only sufficient work has been done to obtain necessary certificates of work.

The Hedley Gold Mining Company is the only company that has continued operations without a break, and I am attaching herewith a copy of a communication received from the manager, Gomer P. Jones, giving details of work performed during the full year:—

"Tons of ore milled	78,494
Average assay value	$ 10.80
Total assay value	847,349.39
Extraction by concentration (3,650.67 tons concentrates made and shipped to the Tacoma Smelting Company, Tacoma)	644,851.58
Recovery by cyanide plant	152,489.18"

OROVILLE, WASH.

The Dividend-Lake View Company, whose mine is situated on Kruger mountain, has not shipped for some considerable time. I am also attaching a letter received from the manager, J. C. Fisher, in regard to work done at the mine during the year 1914:—

"The Dividend-Lake View Consolidated Gold Mining Company, Limited, has been comparatively inactive during the year 1914 on account of closing-down of the smelters in this Province. The European war caught us just at the opening of the season and we closed down tight.

"We shipped four cars and had four or five more broken down in the mine when the smelters notified us that they would take no more ore. About two weeks ago the Granby notified us they would again receive our ore, but the season was too far advanced to start the use of the auto-truck. The four cars shipped gave us a tonnage of 152¼ tons, with a net value to us of $1,816.89.

"If financial conditions get back to normal, we hope to do a large amount of diamond-drilling and development-work during the year 1915, besides our ore-shipping."

OFFICE STATISTICS—OSOYOOS MINING DIVISION.

Free miners' certificates	139
Location records	90
Certificates of work	110
Certificates of improvements	4
Transfers	2

OSOYOOS MINING DIVISION.

NOTES BY PROVINCIAL MINERALOGIST.

HEDLEY GOLD MINING COMPANY.

The annual report of the Hedley Gold Mining Company for the year 1914 shows continued profitable progress and results, as under:—

Report of President.—During the past year everything in general, at mine and mill, has gone along very well. The ore-bodies being opened in lower levels continue to hold their size and value. Everything seems to indicate a long life for our mine.

Our Superintendent, G. P. Jones, and his assistants are to be commended for doing good and economical work on our new power plant, which should give us surplus power to develop some portions of our property not now being worked. We hope that this new and cheaper power will increase our earnings enough to pay for the new development-work planned as just mentioned.

Report of General Superintendent.—During the year 1914 the 40-stamp mill treated 78,494 tons of ore of an average assay value of $10.80 and having a total assay value of $847,349.39. Extraction showed a recovery of 94.09 per cent. of the assay value of the ore, or a total of $797,340.76. Extraction by concentration was $644,851.58 and by cyanidation $152,489.18.

All the ore treated in 1914 was mined from the *Nickel Plate* property. Practically all the development-work done was in the nature of extensions of drifts, inclines, crosscuts, or stopes, and nearly all this work was in ore, waste having been encountered only in passing through the andesite sheets that form the foot and hanging-walls of the ore. The boundaries of the big stopes in the upper section have been extended east and west and beyond the lines of payable ore-bodies as previously estimated. The ore on the east side is still of satisfactory grade and strength, which indicates considerably more ore in that direction. The ore in the old stopes is being left, while the lower levels are being pushed forward into new country. The stopes in No. 5 incline below No. 4 tunnel level have all produced high-grade ore, and drill-holes from the third level through the foot-wall indicate another section of payable ore. Assays of the cores taken from these holes give an average value of $20 a ton. This ore will be mined from the second level of the Dickson incline.

The Dickson incline has been extended to 750 feet, and stations have been cut at the 100-, 200-, and 600-foot levels. The whole incline has been provided with pockets and all necessary equipment, so that it is in first-class condition for doing good work. Stopes have been opened on the first, second, and sixth levels, all in ore of satisfactory grade, with that from the stopes on the sixth level, however, of a rather better grade than that from the others.

A 160-foot raise from the sixth level of the Dickson incline to the fourth level of the No. 5 incline above has been holed through; two stations have been cut in it, and from both of these good ore is being mined, as well as from the top of the raise and from the 600-foot level, there thus being four separate beds of ore which are being mined through this raise into the pockets of the 600-foot level of the Dickson incline.

The sinking of the Dickson incline has been resumed; this should intersect and open large bodies of payable ore below, the occurrence of these having already been proved by the diamond-drill. The indications from this part of the mine, as well as those from the ground north-east from the Dickson incline below No. 4 tunnel, are very promising. From the No. 5 incline, at each of the levels, drifts have been run in this direction, and all have encountered shoots of payable ore.

The total amount of new work done during 1914 was not large, which was due primarily to want of power. Fortunately the mine has not suffered as a result, for the ore-yielding sections are in first-class condition for mining, and it is not difficult to maintain an output of ore of the present grade.

In the month of December, 1913, the directors authorized the selection of a site on Similkameen river and the submission of proposals for a hydro-electric power system, plans for which were afterward accepted. Construction-work on the dam was commenced about January 1st, 1914; the whole system was completed and in operation by January 2nd, 1915. The situation of the dam is on Similkameen river, just below its confluence with Twenty-mile creek. The dam is of the stop-log type; from it the water runs in a flume of 9 x 7 feet, inside dimensions, for 15,000 feet, to the forebay, from which the turbines are supplied through an 8-foot steel penstock. The twin turbines, of the Francis type, were manufactured by S. Morgan Smith Company, of York, Pennsylvania; they have a capacity of 2,100 horse-power. The 1,250-k.v.a. alternating-current generator and all the electric machinery at the power-house were supplied by the Canadian Westinghouse Company. The governor was provided by the Lombard Governor Company.

There has also been installed in an addition to the old power-house a new 2,000-foot compressor, manufactured by the Canadian Ingersoll-Rand Company, and direct-coupled to a Canadian General Electric synchronous motor of 440 horse-power. This unit, together with the present compressor, which will also be driven by an electric motor, should supply ample compressed air for the mine and allow a surplus as well. The new plant was started without a hitch and ever since has been operating satisfactorily.

During the year all other departments were brought to their highest efficiency. Special mention may be made of a new tube-mill now being put in. There has also been added to the mill equipment a new 24 x 36 Traylor jaw crusher. At the mine all buildings have been rearranged, so as to have the men's sleeping-quarters as comfortable as possible. A large building has been erected for a dining-room, cook-house, wash-house, lounge-room, etc. There has been installed a complete new fire-protection system with a large tank reservoir for water-supply.

Diamond-drilling, drifting, and stoping indicate that there is at this date as much reserve ore as there was at the corresponding period of last year, and it is of equally good grade. It can be said confidently that the mine never looked better than now, and it has a very promising outlook for the year 1915.

Report of Treasurer.—The net profits for the year 1914 were $388,228.65. The dividends for the year totalled $300,000, or 25 per cent. on the issued capital of the company. The amount of undivided profits after payment of all dividends was, on January 1st, 1915, $360,324.88.

The new, all-the-year-round water-power plant was completed. The expenditure on it in 1914 was $178,980.78, which amount was charged to Capital Account; adding $13,028.57 expended in 1913, the total cost of the system was $192,009.35, or $7,990.65 less than the original estimate of $200,000.

The cost of the new Traylor crusher, $7,079.54, was charged to Capital Account; also the cost of a house built for the mine engineer, $1,979.34. All other expenditures, including extension of the Dickson incline, new mine buildings, and new fire-protection system, were charged to operating expenses.

The company, on its formation in 1909, was provided with a cash working capital of $280,000. To this should be added $360,324.88 of undistributed profits. The following sums have been expended since the company was formed, and charged to Capital Account: Additions to mill and plant, $136,352.96; new mineral claims purchased, $145,913.13; new power plant, $192,009.35; total, $474,275.44. This leaves a working capital of $166,049.44, as at January 1st, 1915, consisting of cash and accounts receivable.

Although the net profits from operations in 1915 were more than enough to pay dividends equal to those of the years 1912 and 1913 (each of a total of $360,000), the directors deemed it wise to maintain a cash surplus of at least $100,000.

Statement of Operations and Earnings.—This gives details of monthly totals. The year's totals are as follows: Tons of ore milled, 78,494; average assay value, $10.80; total value recovered, $797,340.76; expenditures, $409,112.11; profits (including $6,274.76, interest on company's funds), $388,228.65.

Balance-sheet.—Assets: Original investment (mines, mine buildings, reduction plant, etc.), $920,000. Additional investments: Additions to machinery and plant, etc., as shown above, $474,275.44; cash, $108,715.78; accounts receivable, $57,333.66; total assets, $1,560,324.88. Liabilities: Issued capital stock (authorized, $1,500,000), $1,200,000; surplus at January 1st, 1915, $360,324.88; total, $1,560,324.88.

VERNON MINING DIVISION.

REPORT OF L. NORRIS, GOLD COMMISSIONER.

I have the honour to submit my annual report on mining operations in the Vernon Mining Division for the year ending December 31st, 1914.

There has been somewhat of a revival of interest in mining in the vicinity of Monashee, forty-seven miles east from Vernon, where the Fire Valley Gold Mining Company commenced work last September. This company, composed largely of Eastern capital, several years ago bought the *Rossland*, *Evening Star*, and *Mascot* claims from J. S. McCorkell and James McPhail, and leased for mining purposes part of the Monashee Townsite. The work undertaken consists of driving the Fire Valley tunnel from the lowest part of the *Rossland* claim. This tunnel will be at least 1,000 feet long and will attain a depth of about 1,000 feet on the vein. This will prove the continuity with depth of the ore values in this camp. The company remodelled the old Monashee Hotel into a boarding camp, and built a compressor-house, blacksmith-shop, oil and powder houses, and assay office.

The mine is equipped with an Ingersoll-Rand oil-driven air-compressor and three jack-hammer air-drills. On December 31st the tunnel was in 300 feet, following a 5-foot vein, employing twelve men. The development-work so far consists of the *Evening Star* tunnel 300

feet long on the *Evening Star* claim. On the *Rossland* claim the McPhail tunnel is 185 feet long, with two upraises aggregating 130 feet. The Fire Valley tunnel is in 300 feet. Other tunnels, cuts, etc., aggregate 400 feet of work. A. H. Elftman, Ph.D., Minnesota, who is general manager for the company, is in charge of the work.

The same company has also bonded the old *Monashee* claims and has cleaned out the tunnels and made them accessible; and has also bonded the *Silver Bell* group.

Silver Bell.

The *Silver Bell* group consists of the *Silver Bell*, *Silver Horde*, and the *Silver Moon* claims, which were located by W. J. Bell, Gunnar Severide, and E. H. Daniels. These claims are situated on Bromide mountain between the North and South forks of Cherry creek, about eight miles east of the mouth of Pass creek. The development consists of 140-foot tunnel, several surface crosscuts, and stripping along the veins for 400 feet in length. Most of this work is on the *Silver Horde* claim. The vein varies in width from a few inches to 6 feet and carries lead, silver, and gold values. The rich pay-streak is up to a foot in width and assays as high as 600 oz. of silver and 2 oz. of gold. The white quartz, showing very little mineral, assays $10 a ton in gold and silver; specimens of native silver have been found in the pay-streak. This is a very likely appearing prospect and a good trail can easily be built into it.

St. Paul.

Rembler Paul and associates have completed the erection, commenced last year, of a 2-stamp mill on their property, which consists of the *Minerva*, *Zilpah*, *Black Bess*, and *Tough Nut* claims. The mill ran for twenty-eight days and crushed 150 tons of ore.

Some work was done last year on the *Reta* claim, situated half a mile south from the boundary-line of the town of Vernon. This claim is owned by Louis J. Ball and Frank Mitchell. The work consists of one open-cut of 50 feet and another of 20 feet. One sample of the ore sent away for analysis gave a return of 1.4 per cent copper, 73.3 oz. silver, and 0.1 oz. gold.

OFFICE STATISTICS—VERNON CITY MINING DIVISION.

Free miners' certificates	168
Mineral claims recorded	47
Certificates of work	36
Transfers	4

YALE DISTRICT.

KAMLOOPS MINING DIVISION.

REPORT OF E. T. W. PEARSE, GOLD COMMISSIONER.

I have the honour to submit the annual report on the Kamloops Mining Division for the year ending December 31st, 1914.

There has been little mining activity in the Kamloops Division, but faith in the future has been shown by the keeping-up of assessment-work generally, and by the owners of the *Iron Mask* mine in the expenditure of a considerable amount of money in preparing for future development.

No placer-mining or coal-mining has been done this year.

The reports of those who have responded to my request for information are included herewith

KAMLOOPS CAMP.

E. C. Wallinder reports that the *Erin* shaft was sunk to a depth of 330 feet. The *Iron Mask* shaft was sunk 150 feet to the 750-foot level, where drifting and crosscutting are now in progress.

The mill has been enlarged to 750 tons capacity; machine and carpenter shop erected; 500,000-gallon tank for water, storage, and fire-protection; and a 750-horse-power electrical equipment completed.

O. S. Batchelor reports as follows:—

"Batchelor's gold-mill, situated on the Thompson river near Canadian Northern Railway bridge, is receiving gold ores for treatment. A mill-run of ore from the foot of the hill on the *Goldfield* mineral claim gave returns of: Gold, $12.40; silver, $2.16; total, $14.56 a ton. There was no copper in this ore, and with cyanide treatment the extraction was 93.5 per cent. of the gold and 64.3 per cent. of the silver.

"A shipment of 50 tons of ore from Jamieson creek will be milled shortly.

"A number of men are prospecting in the Tranquille, near the mill, for gold ores."

SEYMOUR ARM CAMP.

F. A. McLeod reports as follows:—

"We did not work on claims in the Seymour Arm section this summer, but were up looking over them with a view of doing some more work this coming spring."

OFFICE STATISTICS—KAMLOOPS MINING DIVISION.

Free miners' certificates	233
Records (mineral)	76
" (placer)	1
Certificates of work	94
Bills of sale	13
Certificates of improvements	1
Receipts	$1,744.55

NICOLA MINING DIVISION.

REPORT OF W. N. ROLFE, MINING RECORDER.

I have the honour to submit herewith the annual report and office statistics of the Nicola Mining Division for the year ending December 31st, 1914.

So far as mining development is concerned, the situation remains practically unchanged from the preceding year. Assessment-work has been kept up, however, on all mineral claims of note.

The coal-mines near Merritt have had a very poor year as far as output is concerned, which was not over half of that of the previous year.

In Nicola valley the production of coal was, approximately, as follows: Middlesboro Colliery Company, 60,000 tons; Inland Coal and Coke Company, 53,000 tons; Pacific Coast Collieries Company, 500 tons; total, 113,500 tons. The competition of fuel-oil was felt by these companies, it having resulted in a much decreased demand for use of coal on railways on which previously Nicola coal had been burned in the locomotives.

OFFICE STATISTICS—NICOLA MINING DIVISION.

Locations recorded	43
Free miners' certificates	104
Certificates of work	92
Bills of sale	9

ASHCROFT MINING DIVISION.

REPORT OF H. P. CHRISTIE, MINING RECORDER.

I have the honour to submit my annual report as Mining Recorder for the Ashcroft Mining Division for the year 1914.

The situation remains unchanged from last year. Every confidence is expressed by the owners of mineral claims in this Division as to the future of the district as a large copper-producer, but not much development has been done.

Stuart Henderson is at present developing the *Snowstorm* group and making a trial shipment of a car-load of ore. The result of this shipment will be watched with much interest.

OFFICE STATISTICS—ASHCROFT MINING DIVISION.

Free miners' certificates	71
Certificates of work	56
Conveyances	26
Locations recorded	54

YALE MINING DIVISION.

REPORT OF L. A. DODD, MINING RECORDER.

I have the honour to submit the annual mining report and office statistics for the year ending December 31st, 1914.

PLACER-MINING.

There was very little placer-mining done in this Division during the past season. The principal activities have been confined to the Coquihalla river, where some claims have been worked during the season when the state of the water permitted, and to a number of Chinese working on the bars of the Fraser river. A. Morrison and C. F. Metcalf have established a camp near the mouth of the Pierre river, a tributary of the Coquihalla, and anticipate good results from their claims. They have been principally engaged in putting in a dam and other initiatory work prior to actual mining. The Siwash Creek Mines, Limited, has been idle during the whole year, but has completed a reorganization of the company and expects to resume work this season. A conservative estimate of the amount of placer gold recovered in the Mining Division during the year would be $2,000.

QUARTZ-MINING.

This is the first year I am able to report an actual shipment of ore from this Mining Division. In December, 20 tons of ore was shipped from the *Rainbow* group, situate some twenty-two miles from Hope, on the Hope-Princeton trail, to the Trail smelter. This ore was brought out on pack-horses to the railroad at Hope. The camp is on the Summallow river about a mile from the junction of the Skagit and Skaist rivers, and the *Rainbow* group, which has been taken over by the Canada-States Mining Development Corporation, Limited (H. B. Brown, managing director), consists of four claims—the *Rainbow*, *Keno*, *Wonder*, and *Wonder No. 2*. A portion of this group was reported on by Charles Camsell, of the Dominion Geological Survey, as the *Horseshoe* group, as being probably too low grade to work profitably. Bodies of high-grade ore were, however, discovered in 1914 by W. H. Robinson and James Penny, and work has been carried on, with an average of six men, for some months, which work is to be continued during the winter. The ore-bodies generally are low grade, with high-grade streaks, and carry gold, silver, and copper. A tram and buildings, office, cook-house, dining-room, and bunk-house with accommodation for eight men have been erected.

Several prospectors are wintering on neighbouring claims. A sleigh-road to the camp has been put in by the business-men of Hope, assisted by the Provincial Government, and camps for men and horses have been erected en route.

At 23-Mile camp Frank Fritz and associates have done the most work, and assessment-work generally has been done in the locality.

On the *Aufeas* group, near Hope, work was prosecuted with a force of twelve men during the first half of the year, but was closed down in July. There is some 40 tons of ore sacked and over 100 tons on the dump. These will be shipped as soon as facilities and commercial freight rates over the Canadian Northern Railway are obtainable. The ore, as far as careful sampling and frequent assays can show, has fully maintained its values, and the ore-bodies show no sign of failing or diminishing in any direction.

Quite a little local excitement and consequent locating and recording of claims was caused by the development done by Merrick & Thomson on their holdings at Fifteen-mile, Coquihalla valley. Assessment-work has been done on the better-looking prospects, but in most cases has not yet been recorded, as the claims have yet from three to five months' good standing on their records.

With the exception of about 100 feet of tunnelling on the Mount Baker and Yale Company's claims on Siwash creek, only the necessary assessment-work has been done in the other parts of the Division.

OFFICE STATISTICS—YALE MINING DIVISION.

Free miners' certificates issued	348
Locations recorded (placer and mineral)	260
Certificates of work issued	61
Bills of sale, powers of attorney, options, etc., recorded	28
Filings	6

Revenue.

Free miners' certificates	$1,565 25
Mining receipts, general	1,382 40
Other sources	1,541 95
	$4,489 60

SIMILKAMEEN MINING DIVISION.

REPORT OF HUGH HUNTER, GOLD COMMISSIONER.

I have the honour to forward the annual mining report on the Similkameen Mining Division for the year 1914.

There has been more activity in placer-mining than for several years past on account of the scarcity of work owing to the war in Europe.

On Granite creek R. A. Lambert and associates have done considerable work on their placer leases. They ran a tunnel in solid rock 300 feet long, 6½ feet high, and 4½ feet wide, and also laid 500 feet of bed-rock flume, costing in all for that and the season's work $7,000.

On the right bank of the Tulameen river, about four miles below Granite creek, there is supposed to be an old channel of Granite creek, and a syndicate of Seattle men has acquired a number of leases covering this ground. The operations are in charge of Chester F. Lee, a mining engineer of that city, who has kindly furnished me with the following synopsis of the season's work:—

"The operations of the Lost Creek Mining Company, Limited, on the group of seven hydraulic leases held by the company on the Tulameen river, seven miles above Princeton, consisted, for the year 1914, chiefly in prospecting on the end of the Snowden gravel channel where it is cut by the gorge of the Tulameen river. Drifts were run, pits sunk, and some gravel washed, but water was too scarce during the season to be effective in hydraulic operations. On the Coulthard channel drifts and pits were also sunk to ascertain the character and value of the ground. On the main or so-called Granite Creek channel ground-sluicing was begun on the Six-mile Creek end where the channel is cut by that creek, but cold weather stopped operations before decisive results were obtained at this point. Water rights were taken up on Six-mile and Lost creeks. Results in gold and platinum extracted were encouraging. Ninety-five per cent. of the gold obtained was coarse, and platinum constituted 36 per cent. of the total value of the precious metals extracted."

On Copper mountain the British Columbia Copper Company is prospecting bonded claims with a considerable force of men. Previous to the declaration of war the company had plans prepared for constructing power plant and reduction-works, but these have been laid over for the present.

Assessment has been generally performed on claims not Crown-granted.

OFFICE STATISTICS—SIMILKAMEEN MINING DIVISION.

Free miners' certificates	286
" " (special)	3
Location records	200
Certificates of work	301
Conveyances (mineral claims)	48
Records (placer)	17
Leases (placer)	6
Permits	15
Powers of attorney	10
Conveyances (placer)	3
Certificates of improvements	1

SIMILKAMEEN MINING DIVISION.

NOTES BY PROVINCIAL MINERALOGIST.

The Similkameen Mining Division comprises, practically, all the drainage area of the Tulameen river and the Similkameen above Nine-mile creek.

Many years ago placer-mining was carried on in this section on a considerable scale, and even yet a small amount of placer gold and some crude platinum are recovered each year.

Coal-mining has been in progress near Princeton for some years, and about 18,000 tons of coal was here mined in 1914. Beyond this, mining in this Division has not as yet reached the productive stage, although a great deal of extensive development has been going on for some years, with such success that it seems probable that within a couple of years it will be possible to record a substantial mineral output from this Division.

Much development and other exploratory work has been done on numerous mineral claims on Copper mountain, in Voigt, Princess, and Sunset camps, respectively. Placer-mining has been active, both along the main Tulameen river and on Granite and other tributary creeks, while mineral claims on Treasure mountain, Summit camp, well up the Tulameen toward the eastern slope of the Hope mountains, have been prospected and showings of silver-lead ore opened.

Princess and Sunset Camps.—For the greater part of the last two years the British Columbia Copper Company has been prospecting and exploring a number of claims, eleven or more, situated in these adjoining camps which are on or near the summit of Copper mountain. Much work has been done, the working force having at times consisted of more than one hundred men. A great deal of trenching and open-cut work was done on the surface, while shafts and tunnels were sunk and driven underground. In addition, five or or six diamond-drills were used. No details have been given out for publication, but it has been authoritatively stated that the results of the work as a whole were eminently satisfactory. A year ago the company issued its annual report for 1913, and in that mentioned that the tonnage of reasonably assured and probable ore on one group was estimated at 4,000,000 tons, with an average value of 1.87 per cent. copper, and gold and silver from 25 to 50 cents a ton, and on another group the estimated quantity by that time outlined was 550,000 tons of ore, averaging

1.35 per cent. copper, with 35 cents a ton in gold and silver. If it be taken into account that further satisfactory results were achieved in 1914, there should be little doubt as to the great promise that exists for the eventual establishment in that part of the Province of another important copper-producing centre.

Preliminary surveys have been made for a railway to Copper mountain, to branch off from one of the lines near Princeton, and legislative authority for its construction has been applied for.

Voigt Camp.—Newspaper reports to the effect that the Similkameen Consolidated Copper Company had acquired the *Voigt* copper property, situated on Copper mountain, within a dozen miles of Princeton, do not appear to have been confirmed. The facts are that last July Emil Voigt gave an option on most of the claims in the *Voigt* group to a Pennsylvania syndicate, which made some small payments on account of the agreement to purchase and expended a few thousand dollars on further development-work. About 300 feet of tunnelling was done from points where the British Columbia Copper Company left off developing under its option of purchase a year or so earlier. In three places ore in considerable quantity and of good grade was opened by this new work, and an additional advantage claimed is that the ore contains a large percentage of iron.

Placer-mining.—The hydraulic leases known as Coulthard's *Roany* claims on Tulameen river, about four miles below the mouth of Granite creek, are to be worked, with Chester F. Lee, of Seattle, Washington, to direct operations. During 1914 more than two miles of flume was constructed from Four-mile and Six-mile creeks, and water was brought in at an elevation of about 300 feet above the old channel; some ground was tested under working conditions, but no run of gravel-washing was made. It is expected that both placer gold and platinum will be recovered here in payable quantities when sufficient water shall be obtainable for hydraulicking.

Lambert & Stewart are reported to have done well last summer on their placer lease near the junction of the North fork with Granite creek. For several years Mr. Lambert, the resident partner, has persisted in his efforts to get down to bed-rock above the canyon, but twice his dam went out when the summer freshets came. Then, when the third dam held, his method of working did not prove effective, quicksand instead of bed-rock being encountered. Finally, last winter, he let a contract for a rock tunnel to be 6 feet high, 4 feet wide, and 320 feet long, to carry the tailing below a rock-slide that kept coming down and filling the creek, and this tunnel enabled the miners to get at the gold-bearing gravel. The quantity of gold recovered has not been ascertained by the writer, who has been informed, though, that one clean-up witnessed gave very coarse gold and much platinum. It is stated that throughout the summer more platinum than gold was recovered; the largest nugget of gold found was worth $10.60, calculated at the rate of $17.75 an ounce. The miners were much bothered by a deposit of cemented vegetable matter on which the water had very little effect. Mining is to be resumed here as early as possible next spring.

Wheeler's claim, on the old *Pogue* property, was worked by drifting all last winter and summer, and is reported to have been paying. Some pretty gold specimens from there have been shown; one piece, said to have been chipped off the bed-rock, was more than half gold, some of the nuggets in it up to $2 in value. The *Swede* claim, above Lambert & Stewart's, is said to have paid well all summer; the owners have drifted in several hundred feet and are still working. The gold they get is coarse; one piece taken out was worth $12.60. Amberty staked a bench claim, but did not do much gravel-washing, having been occupied building a chute and putting in boxes until winter set in. Almost the first shovelful he tried gave him one nugget worth $23.40. McLeod & Mitchell, of Vancouver, started working in a small way

on a claim east of the *Pogue*, and in about two weeks took out $250, but, finding that the most profitable way to work would be to hydraulic, decided to put in pump, pipe, and hose, and to get back to mining early in the spring. Kane & Jamieson, from Seattle, started opening up the old *Swan* ground by carrying Ward creek in a flume, but frost and snow coming with the winter necessitated their knocking off until next season. Some others worked in the neighbourhood, but were not successful. However, prospects are good that next season will see more placer-mining being done on Granite creek and tributaries than for years, and more gold and platinum being recovered.

Reports have been published of successful placer-mining on Tulameen river, above the town of Tulameen, but no particulars were obtained. One man is said to have won $200 in gold and platinum in a couple of days, but this report was not verified.

General.—Little is known of the work done on mineral claims on Treasure mountain, nor in other parts of the old Summit camp, near the head of Tulameen river. Nor does there seem to be any news obtainable of work in Law's camp or other parts of these outlying regions.

Coal-mining.—The Princeton Coal and Land Company did not sell so much coal in 1914 as in 1913, having, in common with other coal-producers, felt the effect of a smaller market. The quantity mined last year was 19,535 tons. The development-work done in the company's mine during the period under review consisted of a new slope 400 feet long, with a counter 320 feet, and opening Nos. 4 and 5 East Main levels off slope; No. 4 and counter were each driven 500 feet, and No. 5 and counter a shorter distance. An 11- x 6-inch vertical steam-engine and a 50-kw. Westinghouse generator were added to the machinery equipment, and a pole-line was erected between the power-house and Princeton to serve as a transmission-line for the electric lighting in the town.

At the Coalmont Colliery about 3,500 feet of work was done in underground development during the year. It is reported that in the latter part of March there were discovered two seams of coal, one 7 feet and the other 5 feet in thickness, with a parting of 1 inch of bone, giving practically a 12-foot working seam of coal. A 50-horse-power steam-boiler and a 35-horse-power engine, with fan attached to ventilate the workings, were the only additions to equipment during the year. From April 1st to the end of the year more than 4,000 tons of coal was hauled by horse-teams three miles from the mine to the railway. A transportation system is under consideration, but whether an aerial ropeway or a gravity surface tramway will be decided on is not yet known.

No production in 1914 has been reported from the United Empire property, about four miles from Princeton, from which some 1,700 long tons was mined in 1913.

The annual report of the Canada Copper Corporation contains the following information regarding the operations of the British Columbia Copper Company in the Similkameen District:—

"*Copper Mountain.*—At this camp, which is situated approximately 130 miles west of Greenwood, and fourteen miles by wagon-road south of Princeton, Similkameen, B.C., the company has been carrying on a campaign of prospecting and development by diamond-drilling and trenching. The ore occurring here consists of a mineralized granodiorite, which has been intruded by quartz-porphyry dykes. The latter comprise a rather intricate system. Considerable work was done during the year to determine the location of these dykes, thereby avoiding drilling non-mineralized ground.

"Until August there were four drills in operation, and an average of ninety-one men employed daily. Since that time the working force had been reduced to an average of twenty-eight men a day, with one diamond-drill still being operated.

"Systematic trenching has been done to the extent of 18,315 feet for the year. Owing to heavy overburden, some of the trenches reached a depth of 35 feet. The amount of diamond-drilling for the year was 28,134 feet.

"*Ore Estimates.*—The ore developed to date is computed from diamond-drill holes, trenches, pits, and underground work such as shafts and drifts. A classification has been made as to the situation of the several ore-bodies, some of them following a more or less regular north-westerly and south-easterly course, while others are scattered. The latter are designated 'outlying ore-bodies.' A further distinction is made as to ore occurrence—namely, that which is 'reasonably assured' and 'probable' ore. The latter consists of sections adjacent to or between ore-bodies of known depth and value, and under good surface showings, or favourable situations which have been partly proved by one or more ore-bearing diamond-drill holes.

"Our engineers estimate the amount of 'reasonably assured' ore at 4,523,763 tons, of the following grade: Copper, 1.82 per cent.; and gold 0.013 oz. and silver 0.24 oz. a ton. In addition, there is estimated to be in this same section 1,675,000 tons of 'probable' ore of a similar grade. The 'outlying' ore-bodies show 'reasonably assured' ore to the amount of 405,170 tons, containing 1.54 per cent. copper, and 0.013 oz. gold and 0.14 oz. silver to the ton. The probable ore in this section is estimated at 345,000 tons of a similar grade."

LILLOOET DISTRICT.

LILLOOET MINING DIVISION.

REPORT OF C. PHAIR, GOLD COMMISSIONER.

I have the honour to submit the annual report on the progress of mining in Lillooet Mining Division during the year 1914.

PLACER-MINING.

The Lillooet British Columbia Mining Company of London, England, having recently acquired seven leases at Horse Shoe bend, Bridge river, commenced operations on May 1st and continued during the year with an average force of twenty men. A large dwelling-house for manager and staff and several houses for the men, as well as two powder-magazines, blacksmith-shop, etc., were built.

J. A. Sketchly, M.I.M.M., etc., consulting engineer and general manager of the company, informed me that after a close examination of the property by him it was found that the scheme of operations as suggested to him in London was based upon erroneous data and an entirely new plan had to be evolved.

The physical features of the ground may be divided into four sections.

(1.) The gravel lying on the bed of the river; (2) the gravels forming the banks and benches of the river; (3) the high cliffs of loose gravels forming the precipitous banks of the Horse Shoe bend; (4) the ancient river-channel.

No. 1. These gravels contain a very considerable amount of boulders varying in size from pebbles to rock-masses of many tons weight. So far only the surface of these gravels has been worked in a few isolated patches.

No. 2 comprise the gravels lying between low-water mark and the edges of the steep sides of the river. These have been worked sparingly for many years both by whites and Chinese. Where it was possible to work to water-level these miners obtained good results, the values increasing as depth was reached, but in no case was bed-rock reached owing to the influx of water.

No. 3 consists of a series of horizontal strata of fine gravels interbedded with flat parallel beds of conglomerates or cemented gravels containing a small amount of iron oxide and a little argillaceous matter. These cliffs at the Horse Shoe bend attain an elevation of about 650 feet above high water. They are all of fluviatile or lacustrine origin, probably the upper series of an old river system. They contain gold from the grass-roots.

No. 4 consists of the supposed bed of an ancient river which ran down the valley between the hills now forming the watershed of the Bridge River system. The bed-rocks are serpentines varying in texture from hard crystalline rocks to soft, flaky, decomposed masses which often form the "slide-rocks" of the valley. Here and there are masses of slate often very much contorted and of varying texture; a fine section is exposed opposite the Burkholder bluff. The upper gravels are extremely loose and there is no binding rock to be found in the neighbourhood.

As the gravels, where worked both above and below the Horse Shoe bend, have been proved to be rich, many attempts have been made to work them in the bend itself, but without success. An attempt was made to work down the ridge of serpentine and slate forming the hog-back round which the river flows, by piping down the rock by means of water brought eight miles from Boulder creek. This proved to be futile, as only the superficial loose rock was amenable to the small amount of water available. The object was to cut through the hog-back and divert the river through it, thus leaving the bend dry. When this cutting was found to be impracticable a tunnel was suggested as the best means of diverting the river from the bend and a scheme was propounded carrying out this proposition. The data upon which this was founded was found by Mr. Sketchly to be very incomplete and based upon a very superficial investigation of the property. Mr. Sketchly has made a very exhaustive examination of the property, and has come to the conclusion that it could be worked only by a company possessed of a very large working capital in consequence of the physical character of the mine and the many difficulties attendant upon the development and working of it. There is no water available for working the gravels on the property itself. The nearest point is about four miles and a half above it on the North Fork branch of the river. No definite plan of utilizing this water has as yet been determined upon, as there are very many matters which require special investigation. One of these is the small amount of fall between the intake and the pressure-box unless an enormous dam is put in the river. Another is the very insecure nature of the ground over which the flume would have to be carried, a ditch being out of the question owing to the porous nature of the ground. Meanwhile a tunnel, 25 by 20 feet, has been started on the lower side of the hog-back. It was found as the work proceeded that the slide-rock continued far into the ridge, and, although some thousands of tons of this rock have been removed, no firm rock has as yet been reached.

As it was impossible to carry stores, etc., along the right bank of the river, or from the left bank without making a detour of many miles, a bridge has been constructed over Bridge river near Antoine creek, and is now fast approaching completion. It is over 300 feet long, built on five piers of cribbing and bolted to the bed-rock. It will carry any machinery which will be required for the development of the property.

The Government this year built a wagon-road the greater part of the way from the mouth of Bridge river, and the company has constructed a narrow road the remainder of the way, about eight miles, so that supplies and machinery can now be taken to the mine by wagon and sleigh.

Mr. Sketchly has determined to suspend all operations on the tunnel until he has proved the value of the gravels in the river-bed, as although there is every probability of them being very rich, but being as yet untouched, there is up to the present no positive evidence of this being the case. In order to ascertain the nature and quality of these gravels a No. 3 traction Keystone drill is now being brought to the property, together with a sawmill. A large pontoon will be constructed to carry the drill and a series of test-holes will be sunk along the bed of the bend. If these prove satisfactory the tunnel will be driven as rapidly as possible, but if the results are not sufficiently encouraging to warrant the expense to be incurred, the other gravels will be attacked after further testing.

Leases Nos. 112 and 113 on Alexander creek, owned by J. Edward Sohn, R. J. Archiable, and J. W. Walker, of Cincinnati, were worked during the season with five men. As these leases were not worked for two years, the operations consisted of making preparations for hydraulicking during the coming season. The sluiceway erected a few years ago, which is about 2,000 feet in length, had to be reconstructed, as it was found to be higher than the bed-rock. The error arose on account of the irregularity of the bed-rock.

Golden Dream Mining Company.—C. P. Dam, manager of the company, states: "We commenced work about March 15th, by putting a crew of men to work finishing the dam across the South fork, full date of which was given in our report for the year 1913. This work was completed by May 10th. The water in the South fork began rising about this date and continued until June 17th, when it reached its maximum flood stage for the season. At the highest stage the water came within 2 feet of the top of dam. Our mining operations were confined entirely to prospecting and preliminary development-work. As soon as we turned the water from the East channel of the South fork of Bridge river we started a drain-ditch near the mouth of the South fork and extended it up the river-bed for a distance of 600 feet. Owing to many heavy boulders in the stream-bed encountered during this work we installed a derrick capable of handling any boulder up to 2 tons weight. This facilitated excavation materially. At the upper end of the drain-ditch we put a crosscut into the east bank to rim-rock, and a prospecting-shaft was put down along the rim to a depth of 15 feet. At this depth, seepage-water coming in beyond the capacity of our pump, work was stopped here and another drain-ditch was started some 1,500 feet farther up the river and extended about 200 feet, and another shaft was put down 14 feet. During the progress of this work a large portion of the gravel excavated was sampled and run through sluice-boxes, and generally showed satisfactory results. After this work we ground-sluiced some 7 or 8 acres near the north-east boundary of our leases near Sucker creek, and later put about 1,000 yards of gravel through sluice-boxes, but owing to a limited head of water we did not reach bed-rock in any part of this cut. For our next season's work we have completed 3,000 feet of ditch and have purchased 2,500 feet 11-, 9-, and 7-inch hydraulic pipe and other hydraulic equipment. This material is now being hauled to the South fork over the snow, so as to have it ready for installation as soon as work can be started in the spring. During October we put in a sawmill, 5,000 feet daily capacity, and have sawed an ample supply of lumber for next season's mining operations."

MINERAL CLAIMS.

Coronation Mines. The work done consists of a winze sunk to a depth of 62 feet and drifting 88 feet on the *Countless*. One hundred and twenty tons of ore was milled, giving a total value of nearly $5,000. The tailings have an assay value of between $5 and $6 to the ton. Work was suspended on August 2nd. Eight men were employed.

Wayside. The operations on this property were confined chiefly to the erection of a small milling plant, procuring water for same, and making preparations for milling during the coming season. Five men were employed.

Pioneer. A tunnel 150 feet was driven on the ledge and a shaft sunk to a depth of 40 feet below the level of the drifts. The ledge proved richer at the bottom of the shaft than at the drift-levels.

Broken Hill M. & M. Co., Ltd. This company owns the *Mineral Wonder*, *McLeod*, *Silver Standard*, *Standard No. 1*, *Standard No. 2*, and *Golden Boulder* mineral claims. Henry J. Pollard, consulting engineer for the company, wrote to me as follows: "Regarding the work carried out during the past year on the Broken Hill Company's group of claims located on the Bridge river, I desire to state that 475 feet of tunnelling and crosscutting has been done on the *Mineral Wonder* claim. A tunnel has been driven for a distance of 100 feet into the face of the large surface outcrop exposed through the watercourse of Sebring creek, having cut the ore-body at right angles, showing it to be nearly 100 feet across and fully 70 feet in height from the creek-level. Seventy-five feet of crosscutting has been done along these workings. This development-work returned an average assay value from the ore of $13.67 to the ton in gold, silver, and copper. At 450 feet

from the outcrop lower down the creek, No. 2 tunnel was started in June last with the object of reaching the ore-body at the intersection in deeper ground. This tunnel has been driven 300 feet in a northerly direction. After 100 feet had been driven a vein 4 feet in width was passed through, which gave an average assay of $27 to the ton in gold and silver. At several places farther on the course of this tunnel rich stringers have been cut, and it is believed that during the next 60 feet the main ore-body will be encountered. Work was again started at the mine on January 1st of this year (1915), a contract having been let to James B. Campbell for extending the tunnel a further distance of 100 feet."

Spokane Group. The owner, Dr. H. A. Christie, informed me that the work during the season has been confined to a series of open-cuts on the surface of the main ledge which have proved the continuation of the ledge for a distance of over 2,000 feet. In one of the cuts the ore-body was found to be 15 feet in width and having well-defined walls. Another ledge was discovered on the property, and the part uncovered showed it to be about 50 feet in width. A sample of the ore assayed 3.4 per cent. copper, and 40 cents in gold to the ton.

McGillivray Mountain Mines, Ltd. The main crosscut was extended to a total length of 135 feet. The foot-wall of the vein was broken through at a point 107 feet from the adit; the tunnel then continued 28 feet to the hanging-wall and a drift extended westerly along the foot-wall for 75 feet. There is at present 6 feet of quartz in the face of this drift. It is the intention of the company to drive this tunnel about 200 feet farther to intersect the main ore-shoot, which outcrops on the summit of the ridge 534 feet above the adit of the tunnel.

As W. M. Brewer, M.E., fully reported in 1913 on the mines in this Division, which report was published in the Annual Report of the Minister of Mines for that year, and as the conditions are unchanged since then, it is unnecessary for me to refer to several mines which have had little more than assessment-work done during the year.

The *Lorne* and some other companies did not do much work, awaiting the advent of the Pacific Great Eastern Railway—which will have steel laid to Lillooet early in the spring—in order to bring in machinery and to cheapen supplies before operating on a larger scale.

OFFICE STATISTICS—LILLOOET MINING DIVISION.

Free miners' certificates issued	234
Mineral claims recorded	123
Certificates of work recorded	132
Placer claims recorded and rerecorded	9
Placer and dredging leases in force	37
Conveyances, etc., recorded	63

Revenue.

Free miners' certificates	$1,262 25
Mining receipts, general	3,109 95
Tax, Crown-granted mineral claims	393 50
Total	$4,765 70

CLINTON MINING DIVISION.

REPORT OF E. C. LUNN, GOLD COMMISSIONER.

I have the honour to submit the annual report of the Clinton Mining Division of Lillooet District for the year ending December 31st, 1914.

I regret to say that there is very little activity in the mining industry in this Division, although, as shown by the office statistics given below, the business was considerably more than during last year.

The Pacific Great Eastern Railway is not in operation in this Division; therefore the mining industry has not yet received the benefits that it must necessarily obtain from better transportation facilities.

Owing apparently to the small amount of funds available, and to the financial condition arising out of the present war, very little capital has been expended in prospecting or developing claims during the past year. The Taseko (Whitewater) River portion of the district is practically the only location that has shown activity from a mineral-staking point of view.

Two placer claims which were staked in the vicinity of Big Bar, on the Fraser river, have given satisfactory results.

OFFICE STATISTICS—CLINTON MINING DIVISION.

Free miners' certificates (individual)	44
Mineral claims recorded	80
Placer claims recorded	2
Certificates of work issued	18
Conveyances, etc., recorded	1

VANCOUVER ISLAND AND COAST.

ALBERNI DISTRICT.

ALBERNI MINING DIVISION.

JOHN KIRKUP, GOLD COMMISSIONER.

I have the honour to submit the annual report on mining in the Alberni Mining Division during the year ending December 31st, 1914.

Practically no mining was done in this district during the past year, with the exception of the annual assessment-work on a few claims as shown on the accompanying statistics.

OFFICE STATISTICS—ALBERNI MINING DIVISION.

Mineral claims recorded	24
Certificates of work	23
Certificates of improvement	4
Bills of sale, etc., recorded	5
Free miners' certificates (individual)	53

CLAYOQUOT MINING DIVISION.

REPORT OF WALTER T. DAWLEY, MINING RECORDER.

I have the honour to submit the annual report on mining operations in the Clayoquot Mining Division for the year ending December 31st, 1914.

Assessment-work recorded as follows:—

New Crow Group.—Further development-work has been done, consisting mainly of an open-cut on each claim 17 feet by 7 feet wide by 7-foot face. These claims are owned by J. A. Drinkwater, of Alberni, B.C.

Syoutl and Hamatsa.—These two claims adjoin the *Kalappa* group on Mears Island and are owned by Mrs. E. A. Chesterman. Tunnel-work 15 feet by 7 feet by 5 feet; one open-cut 10 feet in width by 12 feet in length and 7 feet high at face; one open-cut 8 feet by 5 feet by 5 feet deep; both open-cuts in soil and rock.

Lucky Jim and Archibald.—Owned by J. D. McLeod, of Vancouver, B.C. Surface cuts in the ledge, exposing the vein, and other prospecting-work has been done.

Rose, Mamie, Sadie, and Maggie.—Owned by Anthony Watson and Clarence Dawley. During the year the survey of these four claims has been duly recorded and steps taken to obtain Crown grants.

Chieftain and Iron Mountain.—Owned by Rose Angeles Dawley. The surveys of these claims were duly recorded during the year and the necessary notice posted to obtain certificates of improvement with a view to securing Crown grants.

Ptarmigan Mines, Bear River.—Owing to the declaration of war, work was suspended seven weeks after the working season commenced. During this short period six tunnels were started on these claims, and the total distance driven amounts to 106 feet 9 inches, the uppermost opening being at an elevation of 5,290 feet.

One and a quarter miles of difficult road was completed to join up the two sections from $3\frac{1}{2}$ to $4\frac{3}{4}$ miles, and to do this a considerable amount of rock-work was necessary.

A large trussed-timber bridge has been built over the Bear river at the 5-mile crossing; this is 50 feet above the water and the centre span is 73 feet. All the remaining bridges are completed to the 7-mile post; from thence a horse-trail has been built to the 9-mile post.

The wages paid during the season amounted to over $13,000.

Leora Group.—This group has been bonded by W. W. Gibson. A new shaft was started to tap the vein which was struck at a depth of 40 feet; this was then sunk on the vein for another 20 feet. At the bottom of the shaft a drift was driven for a distance of 80 feet.

About 100 tons of ore was stoped out and put through the mill. A shipment of 8 tons of the ore taken out of the shaft was sent to the Tacoma smelter and brought $880; 100 tons of the ore stoped out of the drift yielded $900 in bullion. Returns of concentrates have not yet been received.

The mill was designed and built by Mr. Gibson. A 36-inch water-wheel, designed also by Mr. Gibson, furnishes the power. This also drives an air-compressor which supplies the power for one air-drill, and also drives a pump which drains the shaft.

OFFICE STATISTICS—CLAYOQUOT MINING DIVISION.

Free miners' certificates	32
Mineral claims recorded	47
Certificates of work recorded	18
Certificates of improvement recorded	4
Payments in lieu of assessment-work recorded	8
Surveys recorded	7
Powers of attorney, transfers, etc., recorded	13
Other receipts issued	17

Revenue.

Free miners' certificates	$ 126 25
Mining receipts (general)	1,058 00
Total	$1,184 25

CLAYOQUOT MINING DIVISION.

NOTES BY PROVINCIAL MINERALOGIST.

B.C. Wonder Group.

This group of claims is situated on Tofino inlet, some two miles and a half by trail from salt water and at an elevation of 1,500 feet. In 1912 a mining engineer was sent by this Bureau to inspect the property; he could not find that any material development-work had been done on the claims for many years—as far as could be learned, for some ten years—and that whatever surface workings there may have been were so obscured through years that he could find but few showings visible for his inspection, and his report was therefore rather meagre.

General James M. Ashton, of Tacoma, Wash., who is interested in the property, feels that the report mentioned was incomplete, so he submits to this Bureau a report on the property made for him (General Ashton) in 1910 by G. D. B. Turner, a mining engineer whose address was then New York. From this report the following statements as to the development found by Mr. Turner are taken :—

Geological Conditions.—The formation in the vicinity consists of a highly metamorphosed complex of sedimentaries and eruptives considered to be mainly of Triassic age.

Occurrence of the Ore.—Ore-bodies are found in a contact zone between a body of crystalline limestone and a zone of eruptives consisting of diabase and diorite. The limestone along contact zone has been greatly altered by replacement with formation of garnetite and epidote, in which occur chambers or lenses of magnetite associated with chalcopyrite in an epidote and garnetite-rock gangue. As exposed on surface these have a length of from 50 to 75 feet.

Development.—The following particulars of development are given :—

Iron Duke.—Several good surface showings; principal one on contact shows 9 feet of magnetite and 1 foot of chalcopyrite assaying 8 per cent. copper. Tunnel, 85 feet, still in country-rock, has not cut vein.

American Wonder.—30-foot tunnel; 9 feet magnetite with little chalcopyrite, 3 feet chalcopyrite ore averaging 8.4 per cent. copper. "As little development has been done, I was unable to ascertain length of ore-shoot or chamber, but, as the showing is good, I recommend further development."

General Jas. M.—Some good surface showings. Tunnel 120 feet, "but it is quite evident that the man in charge of work did not understand conditions and consequently work done on tunnel was fruitless." Contact on surface shows mineralization over 11 feet, of which 10 feet is magnetite iron ore and 1 foot is chalcopyrite ore assaying 8.40 per cent. copper.

"The copper-mines of *B.C. Wonder* group are in an undeveloped condition, and the question naturally arises as to whether or not they will develop favourably. . . . from a general geological point of view, the character of rocks . . . are most favourable as regards an opportunity for nature to have deposited the material necessary to the making of great mines."

In order to determine the value of the property Mr. Turner recommends that a number of crosscut and drift tunnels should be run to prove the continuity of the lenses of ore.

QUATSINO MINING DIVISION.

REPORT OF O. A. SHERBERG, MINING RECORDER.

I have the honour to submit the annual report on the mining operations in the Quatsino Mining Division for the year ending December 31st, 1914.

The mining situation has been practically the same as last year up till the last few days of December. It was stated in last year's report that a group of twenty mineral claims had been taken over on a bond by C. & F. R. Wolfle, of Spokane, Wash. Since then they have rebonded fourteen of these claims to W. Bacon, of Spokane, Wash.—namely, the *Old Sport* group, *Shamrock* group, *Idaho* group, and *Black Jack Fraction.*

The results of the diamond-drill work done last winter, and also of the open-cuts and stripping, etc., done during the summer with only a few men, were sufficiently encouraging to cause further development, and so on December 26th work was started with the object of thoroughly prospecting the property.

Thirty men are now on the pay-roll, and the present work is chiefly road-making to permit machinery being taken to the property. A 5-drill air-compressor is already on the way. The work is under the management of William Clancy.

The British Columbia Pottery Company worked a small gang of men this season, and has shipped 1,416 tons of shale for pottery-making from its property, situated on Kokshittle arm of Kyuquot sound.

Besides some development-work done, the San Juan Mining and Manufacturing Company has shipped 75 tons of natroalunite ore from its property, situated on Kyoquot sound, and has now 250 tons ready for shipment.

With few exceptions the several claim-owners have kept up their annual assessment-work.

The *Quatsino King*, *Paramount*, *Hill Side*, *Alexander*, and *Eros* mineral claims, owned by the Teta River Mining Company, have been Crown-granted this year.

OFFICE STATISTICS—QUATSINO MINING DIVISION.

Mining claims recorded	79
Certificates of work recorded	68
Certificates of improvement recorded	5
Bills of sales, agreements, etc., recorded	24
Free miners' certificates issued	75

NANAIMO DISTRICT.

NANAIMO MINING DIVISION.*

REPORT OF GEORGE THOMSON, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report on the mining operations in the Nanaimo Mining Division for the year ending December 31st, 1914.

Mining operations on Texada island for the last six months of the year have quietened down owing possibly to the tightness of the money market. The *Cornell*, *Copper Queen*, and *Maud Adams* are the principal claims that were operated during the year.

Marble Bay.

The *Marble Bay* mine shipped very little ore during the latter half of the year, having reduced the working force to less than one-half. The management is confining the work to development and sinking the main shaft. This shaft is now down 250 feet, and intended to be continued 250 feet farther, which when completed will bring the shaft to the fifteenth level. The diamond-drill is being run sixteen hours a day, testing new ground with, it is said, satisfactory results.

Other claims in the central part of Texada island are showing up fairly well. On the *Aladin* the owners have installed a 6-horse-power gasolene-hoist, have sunk down to 140 feet and drifted 45 feet at the 70-foot level, and have a galena-showing in both shaft and drift.

A large amount of development has been done on the *West Gate* and *R.A.M.*, owned by Lee & McDonald, who have succeeded in opening up a large body of low-grade copper ore, which runs ½ to 2 per cent. copper. The shaft is down 42 feet, and two tunnels, each 30 feet in length, have been driven.

On Valdes island development-work has been general and reports are very favourable.

OFFICE STATISTICS—NANAIMO MINING DIVISION.

Free miners' certificates issued	231
Special free miners' certificates issued	1
Mineral claims recorded	131
Certificates of work recorded	262
Conveyances	44

Revenue.

Free miners' certificates	$1,068 50
Mining receipts, general	1,651 50

* *See also* Report of J. W. Astley, M.E., which follows.

NANAIMO MINING DIVISION.

REPORT OF J. W. ASTLEY, M.E.

TEXADA ISLAND.

On June 15th, 1914, I proceeded from Vancouver to Vananda, on Texada island, and from that point, as headquarters, was able to visit all the mines and prospects that are now being worked, or that have been recently.

Marble Bay.

On June 16th and 17th the *Marble Bay* mine was visited and examined. This mine is owned by the Tacoma Steel Company, and is situated on the north-west side of Texada insland, at the town of Vananda. The ore consists of bornite and chalcopyrite in a gangue of felsite, tremolite, and calcite, and is closely associated with garnetite, although very little ore is actually found in the garnetite. The ore occurs as a replacement of the limestone in a zone of brecciation in a north-and-south direction, with the ore-bodies pitching to the north.

Most of the development-work has been confined to the brecciated and altered limestone in the vicinity of the diabase dykes. From the surface down to the 260-foot level, the ore occurred in a series of detached pockets or lenses, but from that level down to the 900-foot level the ore was continuous, and from the 360-foot to the 900-foot levels was confined to one continuous shoot. At a point about 15 feet below the 900-foot level the ore was practically cut off, or very poor, and very little ore was stoped between the 900- and 1,000-foot levels. From the 1,100-foot to the 1,250-foot levels the stope was continuous. At the 1,250-foot level the ore disappeared, but was picked up again 60 feet north. Between the 1,200- and 1,300-foot levels a large ore-body has been stoped. The larger part of this ore-body was some 15 feet above the level, lying flat, and did not come down to the level. It went up at one point 60 feet above the level, but would average 40 feet in height. This stope is the biggest in the mine, with a maximum length of 200 feet, and from 30 to 60 feet wide. At the north-east end of this stope a winze shows the ore to be continuous for 50 feet down and pitching at a flat angle to the north. The winze is continued in the limestone to the 1,400-foot level. At the face of the north drift, 1,300-foot level, three flat diamond-drill holes, each 196-feet, failed to find ore. A hole put down at an angle of 65 degrees, pointing south-west, 200 feet deep, struck ore 16 feet down, and from that point to 180 feet the core showed more or less ore in garnetite and felsite. The second hole, at an angle of 45 degrees north-west, struck ore at 30 feet and continued in ore, graduating from mineralized gangue to bunches of solid ore, and was still in ore at 106 feet (the depth of the hole on June 17th).

The mine is worked through a shaft and winzes. The main (or No. 1) shaft is down 860 feet vertical, but, owing to the levels being less than 100 feet apart, and there being ten levels, the bottom one has become known as the "1,000-foot level," and is recognized as such in this report to prevent confusion.

At a point about 200 feet northerly on the 1,000-foot level, a winze has been sunk 300 feet and is known as the "No. 2 shaft." This brings us down to the 1,300-foot level, and at a point 350 feet north another winze has been sunk 112 feet. A drift is now being driven to undercut the ore-body located by the two diamond-drill holes referred to.

The bottom level, known as the "1,400-foot level," is actually 1,260 feet vertical depth.

Most of the ore-body over the 1,300-foot level occurred on the west side of the dyke, the dyke forming the foot-wall to the ore-body, and I believe this has been the case on the levels above, but at the north end of the stope the ore also occurs and has been stoped on the east or underlie side of the dyke.

Although there is very little ore actually blocked out at the present time, the winze is in ore for 50 feet and shows the ore to be continuous as far as followed, and two diamond-drill holes prove the ore to be more than 100 feet below the bottom stope. Altogether I consider the indications favourable for a continuation of the ore-bodies in depth.

Shipments of ore for the first six months of 1914 were as follows:—

	Tons.
First class	1,115
Second class	9,060
Total	10,175

At the time of my visit the manager was away and I was unable to get the value of shipments.

The average number of men employed is fifty white men, with sixteen Chinamen on the surface sorting ore and doing other work.

The production of ore, and development also, is handicapped by not having the main shaft down to the bottom levels.

The mine superintendent, Charles Mead, is an experienced miner, and the mine is worked in miner-like fashion.

Cornell.

In the morning of June 18th the *Cornell* mine was visited, and the 460- and 560-foot levels and stopes examined. The mine is situated about a mile south-west of Vananda. The ore occurrence is similar to that of the *Marble Bay* mine. The ore is usually bounded on three sides by limestone, the diorite dyke forming one wall, except in the case of small bunches or kidneys of ore which may occur in the tremolite or felsite, some distance from the dyke. The ore consists of bornite and chalcopyrite in a gangue composed of felsite, tremolite, and calcite. The ore has a general strike east and west with the dyke. All the known ore has been stoped out down to the fourth level.

At the fifth level a fair-sized body of ore has been stoped up 60 feet, and is still being carried up in a fair-looking ore, although not as solid as it was at the level. A large amount of drifting and crosscutting has been done on this level, following the main diorite dyke. Small lenses and kidneys of good ore have been found along the dyke, or in the felsite near the dyke.

Crosscuts at several points on this level have partially penetrated the dyke, but, owing to a flow of water being tapped where the dyke was penetrated on the fourth level, these crosscuts were discontinued, so that very little is known of conditions north-east of the dyke. There may be just as good ore-bodies on the other side of the dyke, and this appears to me to be very favourable ground for exploration.

On the sixth (the bottom) level vigorous prospecting is being carried on, and various drifts and crosscuts have followed up favourable indications, and in some cases bunches of ore have been found in the brecciated areas, usually in the tremolite, but nothing so far of any appreciable size. Favourable indications, and some ore, have been located at a point a little east of the ore stope located on the level above, and further development will probably prove this to be the same ore-body. Altogether the developments on the sixth level look favourable, although there is not much ore actually in sight.

The conditions are very similar to the *Marble Bay* mine, althouth the ore-bodies are not as extensive. There is good reason to expect the ore to continue down to correspond with the depth of the *Marble Bay* mine.

Since August, 1912, the present leasers, Embleton & McLeod, have shipped 2,200 tons of ore. Eighteen white men and five Chinamen are employed.

Copper Queen.

The *Copper Queen* mine was visited the afternoon of June 18th. This property has been under lease and bond to the Granby Company since April, 1913. Some drifting was done on No. 2 level and a small body of ore located, from which 150 tons of ore was shipped. At the bottom of the shaft, the 600-foot level, some crosscutting was done, and ore found in small bunches, but, I was informed by the management, nothing of commercial importance.

Three thousand feet of diamond-drilling has been done, but nothing so far discovered of commercial value. The ore is bornite and chalcopyrite in garnetite and tremolite, and, as at the *Cornell* mine, a diorite dyke forms one wall of the ore-bodies.

I understand that most of the diamond-drilling was done horizontally with the object of prospecting the ground between this mine and the *Little Billie* mine, a distance of about 1,700 feet.

Two short holes were put down at angles of 45 and 75 degrees, and found some mineralization, but not enough ore to indicate a workable body.

Little Billie.

This mine is situated near the shore of Malaspina strait, half a mile east of Vananda bay. The shaft is 260 feet deep and is located near the contact of the granite and limestone. The ore is similar to that of the other mines of the district and follows the strike of the diorite dykes. Considerable magnetite occurred in a flat lens near the surface.

The Granby Company did some prospecting on the property during the early part of this year, but it has been shut down since March.

Maud Adams.

I visited this mine on June 19th. It is situated about three miles south of Vananda. The property is operated by the British America Mining Company. The shaft is sunk 130 feet in blue limestone. At 70 feet down a short drift was run, from which a small pocket yielded a few tons of copper ore, which is now on the dump. The ore is chalcopyrite and iron pyrites in a very siliceous lime gangue. There is no other indication of ore on the property or in the shaft.

The management proposes to sink the shaft 300 feet, when it is expected to reach the contact with diabase which outcrops the other side of a small creek or swamp. The prospect of finding ore does not appear to me to be encouraging.

Nut Cracker.

The *Nut Cracker* claim is a prospect showing free gold, and is situated about three miles and a half south of Vananda. No work is being done on it at present, and as the showing of free gold was under water I did not go out to it.

The lime-quarries were not being worked.

VALDES ISLANDS.

VALDES COPPER CO.'S MINES.

I moved to Campbell River on June 19th and made that place my headquarters. From Campbell River I went by launch to Steep island, in Gowland harbour, where the Valdes Copper Company has its camp. I stayed there till June 25th, and from that point made my trips of examination of the district.

VALDES ISLANDS.

The Valdes islands are a group of islands lying between the Mainland and Vancouver Island, and are situated on the east side of Discovery passage. This being the route of the principal Coast trading steamers, transportation by water can be easily made.

The formation in which the ore is found is a series of flat-lying ash-beds or flows, with a slight dip generally to the south or south-east. These beds or layers vary in texture from a porous amygdaloidal structure to a fine-grained compact rock. It is in this formation that the ore occurs along zones of shearing or faulting.

The development has been mostly carried on in the crushed or brecciated areas on either side of these zones of weakness. It is chiefly in the more porous beds or layers, when outcropping on the surface, that the development-work has been done. This superficial development discloses large irregular areas of copper-stained and copper-bearing rock.

The mineralization, mostly as chalcocite, is disseminated in small particles through the rock, varying in quantity according to the porous nature, or otherwise, of the different beds or layers, and in a more concentrated form as replacement-filling of the amygdaloidal cavities of the more porous beds.

The copper occurs chiefly as chalcocite, but azurite, malachite, and the red and black oxides of copper are also present, and this is more noticeable at or near the surface. Chalcopyrite only occurs in very small quantity.

All the development-work done is superficial. Shallow cuts and openings have disclosed large irregular areas of copper-stained and copper-bearing rock and ore on the surface, but very little depth has been attained. The deepest cut is only 16 feet, and most of the openings have only penetrated the surface 2 or 3 feet. For this reason nothing can be said with any degree of certainty as to how the mineralization will hold out at depth. Whether it will be more or less continuous in the vicinity of the crushed zones, or if it will be found to be confined to certain beds or layers, remains to be proved by deeper development. Many of the showings warrant a system of vigorous development.

The Valdes Copper Co., Ltd.—The offices of this company are at No. 1122 Government street, Victoria, B.C. This company owns a group of ten claims on Quadra island, known as the *Copper Mountain* group, and one claim on Steep island. The names of the claims are as follows: *Copper Flat, Copper Mountain, Copperopolis, Ingersoll, Senator, Ingersoll No. 2, Y.Z., Copper Bluff, Copper Dyke, St. Lawrence*, and *Bluebird.*

Steep Island.

Steep island is situated in Discovery passage at Gowland harbour.

Bluebird. This claim is situated on the south end of the island. Numerous cuts and shallow pits covering an area about 600 feet long by 100 feet wide have disclosed a zone of copper-bearing rock, as already described. The bed or layer on which the development has been done is considerably broken up by slips and faults.

An average sample was taken with moil and hammer from both sides of the last cut at the south end of Steep island; the cut was sampled at about right angles to the ore-zone for 35 feet, with the following assay result: Gold, trace; silver, trace; copper, 1.5 per cent.

At a point about 600 feet north-west of last sample an average sample was taken along 14 feet of a shallow stripping, and assayed as follows: Gold, trace; silver, trace; copper, 1.1 per cent.

Owing to the ore being somewhat broken up by slips on this island, a certain amount of selecting can be done to raise the grade of the ore. Preparations are now being made to ship some of this surface ore. An open-cut is now being driven for this purpose at a convenient point for landing scows. A shipment was made from this claim in 1909 to the Tyee smelter, with the following result: Copper, 3.06 per cent.; silver, 0.44 oz.

The smelter settlement for copper and silver was:—

Copper	12.56c. a lb.
Less smelter deductions	3.00c. "
Net	9.56c. "
On this basis of settlement the total value was	$6.06 a ton.
Less treatment charges	1.50 "
Leaving a net return of	$4.56 "

QUADRA ISLAND.

The *Copper Mountain* group of ten claims, owned by the Valdes Copper Company, Limited, is situated on Quadra island, about a mile and half north-east from the *Copper Cliff* mine, on the southern slope of the hill rising up from Ingersoll bay in Discovery passage. The claims are located on a copper-bearing zone in a general direction north-west and south-east, and rise from an altitude of 350 feet at the south-east end to 700 feet at the north-west end. The claims are more fully described as follows.

Copper Mountain. Near the line of division of the *Copper Flat* and *Copper Mountain* claims, at an altitude of 700 feet, a shallow open-cut has been made 75 feet long by 15 feet wide in a zone of copper-bearing rock. The cut has not reached the extremities of the ore-body in either direction.

An average sample taken of all the material broken from the cut and piled up at the side assayed as follows: Gold, trace; silver, 0.5 oz.; copper, 5.2 per cent.

Copper Flat. On this claim three shallow openings 12 x 15 feet, 19 x 4 feet, and 10 x 15 feet, at distances of 50 feet, 125 feet, and 150 feet respectively from the 75-foot cut, disclose the same character of ore, but do not indicate the boundaries of the ore-bed.

An average sample taken of all material broken from these three cuts assayed as follows: Gold, trace; silver, 0.3 oz.; copper, 3.3 per cent.

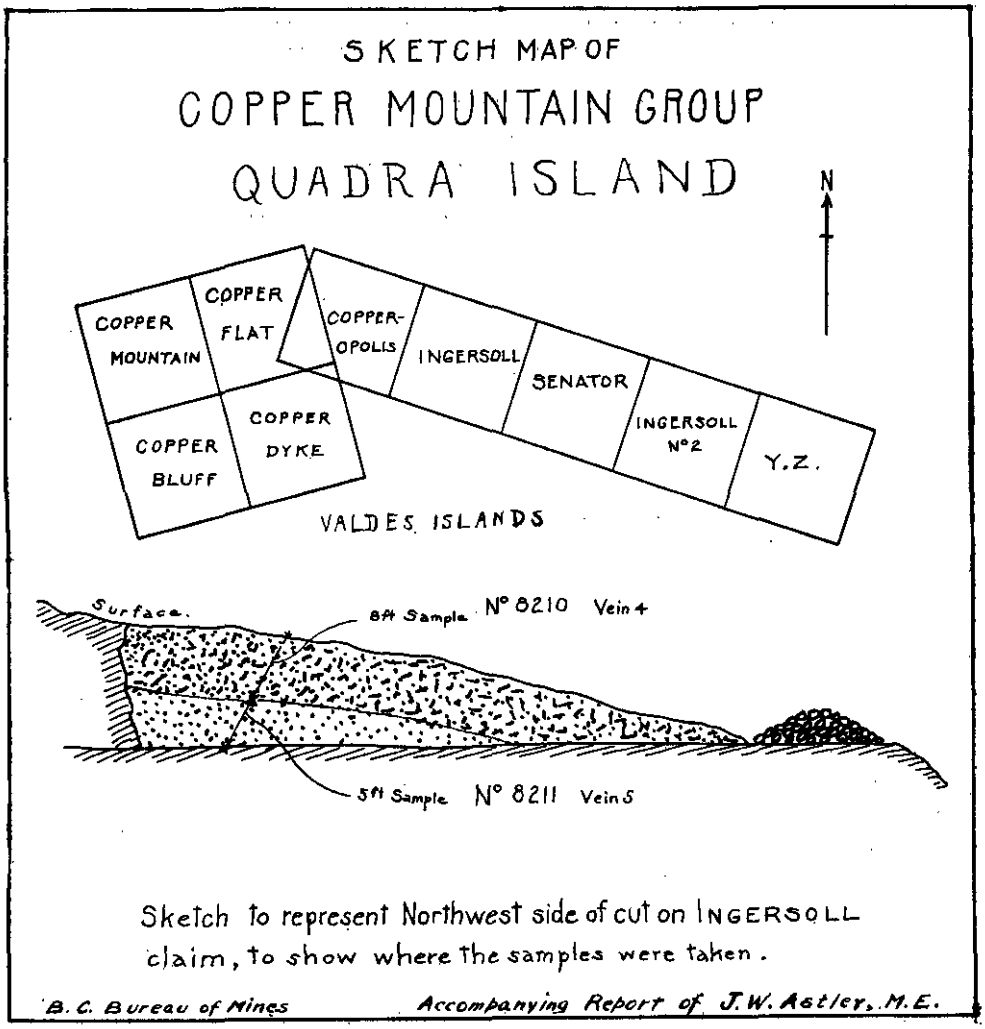
Copperopolis. The next claim to the south-east and down the hill is the *Copperopolis*. Numerous shallow strippings show similar mineralization.

Ingersoll. The next claim to the south-east of the last-mentioned claim is the *Ingersoll*. On this claim, at an altitude of 540 feet (by barometer), stripping has been done for a distance of 375 feet along a fault-zone and shows the rock to be more or less impregnated with small specks of chalcocite for about 30 feet on either side of the fault-plane, the position of which is indicated by veinlets of quartz and calcite and slickensided faces. A cut has been run some 50 feet along one of these quartz veins and an open-cut 80 feet long crosses the mineralized zone. Most of the rock broken at or near the surface is highly copper-stained and also shows the red and black oxides of copper. The 80-foot open-cut more fully demonstrates the formation to be in layers or beds. The end of the cut is 15 feet deep and shows the upper 8 feet to be more mineralized than the underlying bed, with a distinct line of demarcation. The underlying layer is also more dense in composition.

An average sample was taken with hammer and moil from the north-west side of the 80-foot cut and near the face, representing the upper layer of ore 8 feet thick. The assay result was as follows: Gold, trace; silver, 0.2 oz.; copper, 3.5 per cent.

A sample was taken in the same way of 5 feet, representing the second or underlying layer in the cut. This layer of rock is much closer in composition and is not so well mineralized. The assay result was as follows: Gold, trace; silver, trace; copper, 1.5 per cent.

A sketch of the cut, indicating the layers sampled, is herewith attached.



Senator.

The next claim to the south-east and down the hill is the *Senator*. Some stripping and shallow openings show the same general mineralization.

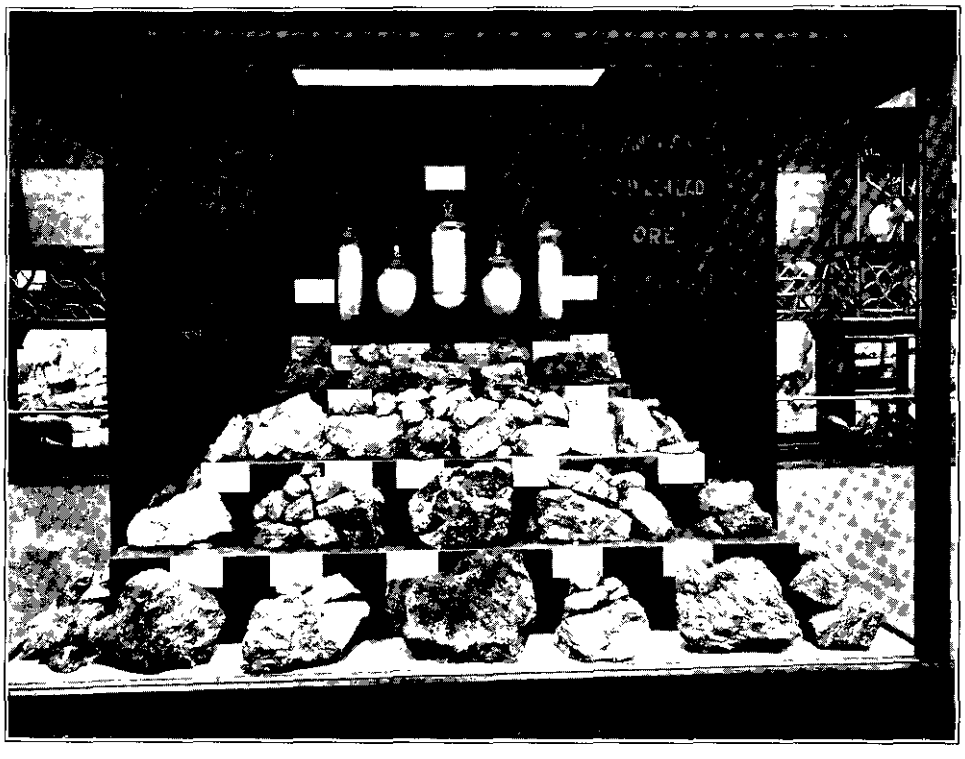
Ingersoll No. 2.

The next claim down the hill, in the direction of the bay, is the *Ingersoll No. 2*. On this claim, at an altitude of 450 feet above tide-water, numerous long cuts and strippings have been made from 2 to 4 feet deep and covering an area 70 x 95 feet, all of which is in a zone of copper-bearing rock similar to the other claims.

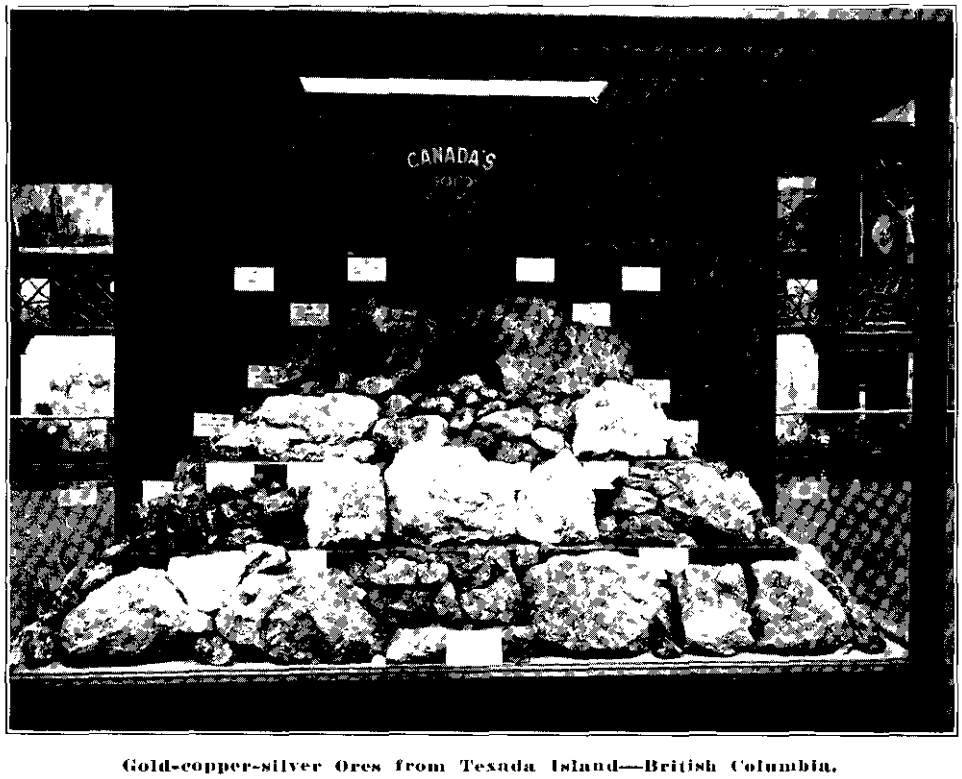
An average sample of all the rock broken over this area was taken, with the following results: Gold, trace; silver, 0.2 oz.; copper, 1.6 per cent.

The work done so far is so superficial that all that can be said with certainty is that there is a very extensive showing of copper-bearing ore on the surface exposed by extensive shallow openings on most of the claims. Average samples taken by the writer from the different claims varied from 1.5 to 5.3 per cent. copper.

The surface showings on this group of claims warrants a system of vigorous development, more especially to determine the ore-bodies at depth.



Ores from Skeena and Portland Canal Mining Divisions—British Columbia, Panama-Pacific Exposition.



Gold-copper-silver Ores from Texada Island—British Columbia, Panama-Pacific Exposition.

Copper Cliff.

The *Copper Cliff* mine-workings were visited on June 24th, and are situated on the face of a steep cliff overlooking Discovery passage on the west shore of Quadra island. Most of the work done is along the face of the cliff, and consists of a tunnel driven 92 feet in a north-east direction and some short openings on the face of the cliff along the strike of the copper-stained beds.

The occurrence of ore and conditions are similar to the *Copper Mountain* group. The development shows beds or layers of mineralized country-rock alternating with closer-grained layers having little or no mineral.

The dip of the bedding is about 20 degrees to the south-west. The copper-stained bed can be seen from a boat along the side of the cliff dipping from the tunnel near the top of the bluff down to the water's edge. Judging from the excavations in the tunnel, the layer mined was about 8 feet thick. About 800 tons of ore has been shipped altogether from this mine.

An average sample was taken by the writer from the face of the 92-foot tunnel. The sample was moiled from top to bottom and represents 5 feet taken through the ore-bed. The assay result was as follows: Gold, trace; silver, trace; copper, 2.8 per cent. A typical sample of the ore assayed: Gold, trace; silver, 0.3 oz.; copper, 3.3 per cent.

Other cuts and shallow pits about 600 feet east of the tunnel disclose the same condition of bedding with slight mineralization.

The mine is owned by William Hall *et al.*, and is not being worked at present.

Slavin Group.

On June 25th this group of claims was visited. It consists of four claims situated on the west coast of Quadra island, at Gowland harbour, and about two miles south-east of the *Copper Mountain* group. The mineralization and occurrence of ore is the same where exposed, but the exposures of ore are limited to a few openings, mostly on the *White Hope* claim, the centre one of the group.

The development consists of a 10-foot opening on the side of the cliff and a few shots put into the rock-exposures near by. Three samples were taken by the writer, as follows:—

1. An average sample of the ore exposed in the 10-foot opening: Gold, trace; silver, 0.1 oz.; copper, 1.5 per cent.

2. A typical sample of the best-looking ore: Gold, trace; silver, trace; copper, 1.8 per cent.

3. Average sample of rock broken from shallow openings: Gold, trace; silver, trace; copper, 1.2 per cent.

I returned to Vancouver on the boat leaving Campbell River on June 26th.

The following analyses have been made to indicate the adaptability of the ores to a smelting process:—

Sample No. 8226.—This is made up of equal portions of samples from Steep island. Nos. 8213 and 8214, and representing an approximate average of the ore at that place.

Sample No. 8227.—This is made up of equal portions of Samples Nos. 8210, 8212, 8217, and 8218, taken from the Valdes Island Copper Company's claims on Quadra island, and representing an average of analysis of ore on these claims.

	Sample No. 8226.	Sample No. 8227.
	Per Cent.	Per Cent.
Silica	46.4	47.8
Iron oxide (Fe_2O_3)	13.4	14.0
Alumina	21.0	18.0
Lime (CaO)	10.6	8.2
Copper (calculated)	1.3	3.4
Silver (calculated)	Trace.	0.3 oz.

VICTORIA DISTRICT.

VICTORIA MINING DIVISION.

REPORT OF HERBERT STANTON, GOLD COMMISSIONER.

I have the honour to submit the annual report on the mining operations in the Victoria Mining Division for the year ending December 31st, 1914.

There is very little actual mining being done in this Division at any time, and this past season the financial stringency which foreshadowed the war, and the war itself, proved a deterrent to any serious development-work necessitating the employment of capital.

Fewer new mineral claims were staked this season, only about half as many as in the preceding year, but it is to be noted with satisfaction that the statutory assessment-work is being kept up on claims previously staked, the number of records of such work being greater this year than it was last year.

The mineral product of this Division has been confined this year to such products as are used in building operations, such as cement, lime, brick, tile, stone, sand, and gravel. The gross value of these products for the year 1914 amounted to approximately $1,799,000.

PLACER-MINING.

The hydraulic placer-gold leases located at the mouth of the Sombrio river, and at the south end of the Island, have not been actually operated, but the deposits have been under investigation by hydraulic operators with a view of determining if they would justify the investment of the capital necessary to complete the equipment of a plant capable of handling the gravels in an economical way. The financial situation towards the end of the year stopped, for the time being at least, all further work.

LODE-MINING.

In the Mount Sicker camp, which a few years ago was a large producer of copper ores, there has been no mining done this past year, nor has there been reported any new developments which would indicate any renewal of operations.

On the Koksilah river, where last year the King Solomon Copper Mining Company was prosecuting active development, there has been little, if anything, done this year, and no information has been obtainable as to the results obtained from the work already done, nor as to whether the work is to be continued.

The iron-ore (magnetite) properties in the general vicinity of Port Renfrew have had no work done on them; the majority of these have been Crown-granted and are so held idle.

The trouble with the iron-ore mines seems to be that there is no market for the ore, as there seems to be serious commercial difficulty in the organizing and operating of an iron-smelting industry on the coast.

The mines have been repeatedly reported on by competent experts, and the quality of the ore seems to be satisfactory.

The copper properties near Sooke have had no work done on them this past year, but it was reported at the close of the year that a local syndicate, stimulated by the present high price of copper, had negotiated a working bond, and would make some trial shipments of ore from the dumps while carrying on some further development of the deposits.

CEMENT.

The cement industry as represented by the Portland-cement plants at Tod inlet and at Bamberton have both felt seriously the depression in the building trade and allied industries, causing a diminished demand for cement.

The Vancouver Portland Cement Company, of Tod inlet (R. P. Butchart, president, Board of Trade Building, Victoria), is credited with an output this year of approximately 360,000 barrels of cement, worth about $560,000. This output is the limit of the market that has been available and is much less than the plant is capable of producing.

The Associated Cement Company, with plant at Bamberton, on the opposite side of the Saanich arm from Tod inlet, made a product this past year valued in the neighbourhood of $300,000.

These two are the only cement plants operating in the Province.

The Rosebank Lime Company (W. F. McTavish, manager), Esquimalt, made lime to the value of between $13,000 and $14,000, and also produced from its quarries about $125,000 worth of riprap used in harbour improvements.

The Sir John Jackson Company mined at Albert head some $475,000 of riprap for use in the breakwater being constructed by the Dominion Government at Victoria.

Of sand and gravel there was produced about $117,000 worth; $110,000 by the Producers Rock and Gravel Company and $7,000 by the Mount Tolmie Sand and Gravel Company.

Of pottery, tile, etc., there was produced in this Division this past year about $95,000 worth, of which the British Columbia Pottery Company, with works at Victoria West, is to be credited with over $80,000.

Red building-brick is extensively made in this vicinity, the value of the product for this past year being about $93,000, chiefly produced by the Victoria Brick Company, the Sidney Island Brick and Tile Company, and the Baker Brick and Tile Company.

OFFICE STATISTICS—VICTORIA MINING DIVISION.

Free miners' certificates issued	669
" " (special)	4
Mineral claims recorded	37
Certificates of work issued	56
Bills of sale recorded	3

Revenue.

Free miners' certificates	$3,795 50
Mining receipts, general	1,003 85
	$4,799 35

VANCOUVER MINING DIVISION.

REPORT OF A. P. GRANT, MINING RECORDER.

I have the honour to submit the following report of mining operations in the Vancouver Mining Division, from August 1st to December 31st, 1914:—

The following list gives the number and localities of the recorded claims in this Division:—

MINERAL CLAIMS.

South valley	11
Princess Royal reach	4
Britannia mountain and valley	14
Britain river	4
Sechelt peninsula	5
Bowen island	2
Potlatch creek	4
Furry creek	9
Hotham sound	18
Nelson island	1
Staamish valley	2
Cypress creek	12
Seymour creek	24
Indian river	25
Trail islands	1
Cheakamus valley	15
McNab creek	2
Lynn valley	3
Jervis inlet	8
Total	164

PLACER CLAIMS.

Seymour creek	26

The Baramba Mining Company, Limited, has acquired a group of six claims on Hotham sound, about twenty miles north from Pender harbour, and in the past year has run about 265 feet of tunnel. Mr. Underwood, vice-president of the company, gives the following particulars:—

"Two assays from the ore of main tunnel showed a value of $12 a ton. Camps, blacksmith-shop, etc., have been established on the property. The work nearest the camp is an open-cut showing a vein of brecciated matter 5½ feet wide. At a point 250 feet from this cut a tunnel has been run 150 feet to crosscut the ore-zone, which is stated to have a width of 800 feet. On the floor of this tunnel is a showing of some ore of higher-grade copper than is usual so far as development has gone.

"An open-cut at a point about 125 feet above the tunnel exposes for a length of about 40 feet the same mineralized zone, crosscut in the tunnel, and there are about 60 tons on the dump from this cut.

"Being close to tide-water, with water-power close at hand and plenty of timber, the situation is very convenient in every particular."

The Bowena Copper Mines, Limited (N.P.L.), whose property is situate on Bowen island, about two miles south of Snug cove, expects to have the claims Crown-granted shortly.

Newton W. Emmens, M.E., has kindly given me the following information with regard to the work carried out at the *Bowena* mines during the past year:—

"The main adit was advanced 45 feet on the vein. At 111 feet a quartz-porphyry dyke was passed through, which outcrops at surface in front of the No. 2 cut. This dyke proved to have a width of 16.5 feet, and cuts the ore-bearing formation without, however, faulting it. Next to the dyke the vein is somewhat altered and a little more siliceous, but is improving in mineral contents as the drift advances.

"A series of concentration tests was carried out on the low-grade ore from the drift with satisfactory results. The ore tested assayed: Gold, 0.02 oz.; silver, 0.88 oz.; copper, 2.1 per cent.; and iron, 13.1 per cent. This yielded a concentrate assaying: Gold, 0.04 oz.; silver, 2.96 oz.; copper, 7.3 per cent.; and iron, 20.5 per cent.; with a concentration ratio of 4.6 tons crude ore to 1 ton of concentrates. Subsequent tests gave better results, and, in practice, the copper contents will be increased to 12 per cent. and the iron to 31 per cent., with a corresponding increase in the gold and silver contents.

"Development-work is being continued on the property, and a contract has recently been let for 500 feet of drifting and crosscutting on the vein, which has a width, as determined by the crosscutting previously done, of from 8 to 10 feet."

The opening of the Pacific Great Eastern Railway has given a chance for the development of the Cheakamus valley, which will be taken advantage of in the near future.

Brew Group.

The following is a list of assays taken from a group of eight mineral claims on the Cheakamus river, about sixty miles from Vancouver:—

	Gold.	Silver.	Copper.	Value.
	Oz.	Oz.	Per Cent.	
No. 1	0.015	....	....	$ 0.30
" 2	0.04	9.2	....	5.68
" 3	0.02	....	2.0	5.60
" 4	0.02	....	....	0.40
" 5	0.01	1.0	1.5	4.63
" 6	0.025	....	....	0.50
" 7	0.10	2.0	5.0	16.06
" 8	0.01	....	1.5	4.10
" 9	0.015	....	1.0	2.90

According to the owners, the ore on which these assays were made was taken from a ledge 25 feet wide, which can be traced for a distance of 4,500 feet. An assay taken from the schist before striking into the ore-body gives a result of 0.26 oz. gold; value $5.20 a ton.

This is called the *Brew* group, and is situate near the station of that name on the Pacific Great Eastern Railway.

It is understood there are some very promising iron-deposits in this vicinity, and a report on same was expected before this.

In the Indian River district the owner of the *London* group has run a prospect surface tunnel for about 50 feet. The ore is low grade. It is proposed to extend this tunnel to crosscut a strongly mineralized dyke about 100 feet wide, which is very prominent, as it crosses the country with a strike of F. 75° W. (mag.).

The mineralization in this dyke and in the greenstone consists of molybdenite, arsenopyrite, pyrite, and chalcopyrite. A great deal of float is seen in the creeks crossing the property. About 2,000 feet south-east of the tunnel, where the dyke crosses the river, several open-cuts have been made. The ore here is higher grade, although rather stringy. Picked samples assayed: Gold, trace; silver, 2 to 2.5 oz.; copper, 4.5 to 12 per cent.

The Indian River district is one of the promising localities in this Division, and as soon as a proper outlet is made this will become quite a busy section.

I am indebted to E. J. Donohue for the following report on the operations of the Britannia Mining and Smelting Company, Limited, of Britannia Beach, Howe sound. The figures given are actual, being based on the final returns, which were only received on the 3rd instant:—

"The tonnages for the year 1914 were was follows: Mined, 239,174; trammed, 239,179; milled, 240,272. The production amounted to 38,630 tons of crude ore and concentrates, with gross contents of: Gold, 213 oz.; silver, 68,515 oz.; copper, 11,841,232 lb.

"Considerable development-work was done during the year in the nature of drifts, raises, crosscuts, and so forth.

"The present status of the constructional improvements now in progress is as follows:—

"*Transportation System.*—The *Britannia* crosscut tunnel (2,200-foot level), driven at an elevation of 1,196 feet below the lowest (1,050-foot level) workings in the *Fairview* mine, has dimensions of 9 x 12 feet in the clear, and is now in a total distance of 4,336 feet, all laid with 45-lb. track of 3-foot gauge, and in the near future will form the main outlet from the mine—at which time the present aerial tramway will be used for auxiliary purposes.

"The working-shaft, which is being raised vertically from this 2,200-foot level at a distance in of 3,922 feet, to connect with the present productive workings above, has outside measurements of 10 x 20 feet and contains two 6- x 7½-foot hoisting compartments and one 3- x 7½-foot manway; it is now within 217 feet of completion; in addition to which considerable work has been done on the stations at intermediate levels and in crosscutting to connect with the rock-raise, also coming up from the 2,200-foot level. This will form the chute and storage-bin for the ore, is 8 x 12 feet and 1,268 feet in length, and was holed through on October 24th, when further work was suspended until the completion of the shaft. As soon as that occurs the installation of the machinery, which is now on the ground, will be taken in hand; this consists of a 20,000-lb. double-drum electric hoist, which will be stationed on the 1,050-foot level for the operation of the shaft, and a Gates crusher, which will be placed in the rock-raise at a height of 200 feet above the tunnel.

"From the mouth of this tunuel (which is situated 2,100 feet above sea-level) the ore will be transported by electric locomotives over three miles and a half of side-hill railroad, which has been constructed, having a maximum grade of 3 per cent. and leading to the head of an incline at an elevation of 1,600 feet. During the year the grading and track-laying on this railroad was practically completed, and the incline, which connects it with the mill-bins at the Beach, was graded through with the exception of a cut at the upper end. This incline, which is 5,500 feet in length and of an average grade of approximately 30 per cent., will be standard-gauge double-tracked with 56-lb. rail, and operated by means of 20-ton skips which will convey the ore from bins at the head of the incline to the concentrators at the Beach.

"*Milling.*—The framing and roofing-in of the first 1,000-ton unit of the new 2,000-ton mill is completed and the machinery (most of which, for the full plant, is now on the ground) has been placed under cover. In addition, the grading and excavation for the second unit is also completed. The storage and handling of the various products from the new and present 800-ton mills have been greatly simplified by the driving of a tunnel underneath the site, from which three 6- x 10-foot raises were driven for the passage of the concentrates. An electric railroad is operated through this tunnel and connected by a trestle with the new wharf bunkers.

"*Power.*—As the first step towards the provision of additional power for the larger operation, the company is supplementing its present 500-kw. auxiliary steam-turbine with a 2,000-kw. unit of the Fraser & Chalmers type, the arrival of which has been delayed until early in the

spring. In the meantime the balance of the installation, consisting of two 500-horse-power Babcock & Wilcox high-pressure boilers, was completed in December, the necessary arrangements having been made in the way of stack and breeching for the addition of a third at an early date.

"During the summer the company also greatly increased the capacity of their 'Utopia' storage-dam at the head of Britannia creek, to which recourse is had for the supplying of the Tunnel and Beach hydro-electric plants during periods of natural water shortage.

"*Miscellaneous.*—Amongst the miscellaneous improvements made during the past year may be enumerated the construction of new concrete tanks for handling slimes and Hancock jig and Minerals Separation concentrates from the old mill; the installation in the latter of further new equipment, including Hardinge pebble-mills, an Allis-Chalmers tube-mill, Butchart tables, slime-pump, water-wheels, etc.; the erection of eleven new five- and four-roomed dwellings for employees, as well as a large bunk-house at the Beach, together with the painting of all houses throughout the property; the completion of an up-to-date electrically-operated laundry run in connection with the Britannia stores; the purchase of modern fire-fighting equipment and three pulmotors; the building of a new wagon-bridge over Britannia creek; the provision of a roller-skating rink and dance-hall for employees at the Beach, etc.

"*Conclusion.*—The demoralization of the copper market during the past year resulted in the curtailment of the operation by 50 per cent. about the middle of August, as well as a suspension of construction-work; but as soon as conditions become propitious the *Britannia* will be back on its former basis."

There are a few localities for placer-mining in this district; the only locations in standing at present are two leases on Jervis inlet, which have been renewed, and twenty-six new locations on Seymour creek.

Although there has been a falling-off in the number of locations, I am pleased to state there has been much more development-work done this year than previously.

OFFICE STATISTICS—VANCOUVER MINING DIVISION.

Free miners' certificates issued	1,286
Special free miners' certificates issued	11
Quartz claims recorded	164
Placer claims recorded	26
Certificates of work issued	467
Receipts issued for money in lieu of work	7
Surveys recorded as work	129
Quartz claim conveyances recorded	124
Placer claim conveyances recorded	28
Placer powers of attorney	4
Quartz abandonments	5
Quartz grouping notices filed	31
Placer grouping notices filed	3
Certificates of improvement recorded	56
Crown grants applied for	34
Placer rentals renewed	2

Receipts.

Free miners' certificates	$ 9,435 50
Mining receipts	3,174 65
Total	$12,610 15

NEW WESTMINSTER MINING DIVISION.

REPORT OF IRVING WINTEMUTE, MINING RECORDER.

I have the honour to submit the following report of mining operations in the New Westminster Mining Division for the year ending 1914:—

Mining conditions in this district generally remain unchanged. I regret, however, to say that the office statistics show a slight falling-off of free miners' certificates, although the record of mineral claims and certificates of work remain practically the same. This would indicate that old locations are still being exploited, while some new locations are still being made.

The mineral claims recorded during the year were distributed as follows:—

Fraser Mills	12
Pitt lake	31
Kanaka creek	1
Stave lake	1
Hatzic lake	9
Chilliwack and vicinity	27
Harrison lake and vicinity	10
Total	91

OFFICE STATISTICS—NEW WESTMINSTER MINING DIVISION.

Free miners' certificates issued (individual)	156
" " (company)	2
" " (special)	2
Mineral claims recorded	91
Certificates of work issued	123
Conveyances, etc., recorded	33
Notices filed	13

Revenue.

Free miners' certificates	$1,144.75
Mining receipts	1,357.10
Total	$2,501.85

NEW WESTMINSTER MINING DIVISION.

DRILLING FOR OIL AT PORT HANEY.

REPORT BY J. D. GALLOWAY, ASSISTANT MINERALOGIST.

In accordance with instructions, I visited, on December 28th, the property of the Port Haney Oilfields Company, and now beg to submit the following brief report:—

DESCRIPTION OF PROPERTY.

I was accompanied on my inspection by Messrs. Paterson, Elmer, and Morton, who are the principal stockholders in the company. We were driven out to the property by Mr. Tait in his motor-car.

The property of the company is situated on the south-east corner of Section 15, New Westminster District, about four miles up the Fraser river from Port Haney. Drilling operations were started in October, 1914, and one hole has been sunk to a depth of 200 feet. The site of the drill-hole is in the bed of Kanaka creek, a short distance above where it joins

the Fraser river, and about one mile from the Dewdney trunk road. At this point Kanaka creek has cut a channel from 50 to 75 feet deep down into sandstones and shales; the bed of the creek being floored with gravel and large boulders, but with the bed-rock plainly in evidence along the banks.

The light churn-drill in use, capable of driving to a depth of 500 to 600 feet, was installed to make a preliminary test for natural gas before going to the expense of installing a standard oil-drilling rig.

The hope of finding natural gas was based on a reported occurrence of gas in a diamond-drill hole put down twenty-five years ago by the Canadian Pacific Railway. This previous drilling was done to find coal, but without success. It is said, though, that at a depth of 600 feet a pocket of gas was struck which blew out with considerable violence and continued flowing for some time. The present drill-hole is located about 100 feet from where the old hole is supposed to have been put down. It was considered that, if the small drill showed the presence of a true natural gas, this would be a sufficient indication of oil to warrant putting up a standard rig and sinking a deep hole.

The present hole goes through gravel for 14 feet and then enters the bed-rock; through the surface gravel the hole is cased, but below that no casing has yet been put in. At a depth of 193 feet a small flow of gas is said to have been encountered and the hole was then deepened to 200 feet. At the time of visiting the property, drilling was not in progress and had not been for some days previous. A small stream of water was flowing steadily out of the hole and a nearly continuous stream of small gas-bubbles was rising to the surface of the water in the hole. Sufficient gas was coming off to keep an ordinary gas-jet alight. The gas is colourless, odourless, and tasteless, and burns with a nearly invisible flame, which at night is seen to be a pale-bluish colour. The flame is not very hot and is non-smoky. By means of a large inverted funnel, fitted with a rubber tube and stop-cock, the gas can be collected as it rises from the well, and either burned in the burner or collected in bottles.

A sample of the gas was collected in the usual manner by displacing the water in an inverted bottle held with the mouth under water. This was submitted to G. S. Eldridge & Co., Vancouver, for analysis, with the following result:—

	Per Cent.
Oxygen	7.5
Carbon dioxide	1.2
Olefines	0.5
Paraffins (methane, etc.)	22.5
Nitrogen	68.3
	100.0

Commenting on the above analysis, G. S. Eldridge & Co. say: "The results show that there is a considerable excess of nitrogen over the 30 per cent. necessary to form an air mixture with the oxygen present. We are therefore of the opinion that the sample is a marsh-gas and not a natural gas."

No record or log of the hole was seen, but it was evident that the drill had been in sandstones and shales all the way.

GEOLOGY OF THE DISTRICT

The region from Agassiz westward along the Fraser river to the Pacific Coast is known geologically as the Fraser River delta. Topographically this region is generally low-level ground with an average elevation ranging from sea-level to 400 feet above, but occasional hills rise to 1,000 feet above the sea. This strip of country, which extends south for a short

distance into the State of Washington, forms the dividing line between the Coast and the Cascade ranges and represents the old valley of erosion of the Fraser river which existed at the beginning of the Tertiary age. This large preglacial valley was eroded out of older formations, composed of the Coast granites and other igneous or highly altered sedimentary rocks, which underlie the more recent formation now covering this old valley. This latter formation belongs to the Eocene period—the commencement of the Tertiary age; it consists of, geologically speaking, very recently formed rocks, found to be lying comparatively flat and but little disturbed since its deposition. Remnants of Lower Cretaceous rocks form some of the hills, as at Sumas, but these are so limited in area as to be almost negligible.

In considering this territory as a possible oil or gas region, it will be seen that, disregarding the Cretaceous rocks as being quite unimportant, there are but two rock formations to be dealt with. Of these, the older and underlying Coast Range granite and associated metamorphics could neither be the source of nor contain oil, so that we are reduced to one possible source—namely, the sedimentary beds of Eocene age.

Chas. Camsell, speaking of the Tertiary deposits of the Fraser delta, says: "Virtually the whole of the delta, with the exception of those parts covered by the Cretaceous remants, is believed to be floored by stratified rocks of Eocene age which are referred to in the literature as the Puget group. They consist of little disturbed beds of conglomerate, sandstone, and shale which were laid down by the ancient Fraser river in an estuary of the sea. They have a thickness of about 3,000 feet in Canada, but are much thicker in the State of Washington. They contain a variety of plant remains and some small seams of lignite." *

The sandstones and shales which are exposed on Kanaka creek, where the drilling is being carried out, are typical of the Eocene rocks throughout the delta. The formation at this place consists of rather coarse fragmental sandstones, shales, conglomerates, and a few thin seams of lignite. Fossil shells occur in places, but are not very common. The conglomerates and sandstones give evidence of having been formed mainly from the eroded detritus of the Coast granite. Both sandstones and shales are soft and crumbly, the rocks having apparently not been subjected to sufficient pressure to consolidate them very thoroughly. As a rule, they lie flat and have evidently not been disturbed much since their deposition. The seams of lignite are generally only a few inches thick; none of them being of commercial value.

The Formation of Oil and Gas.

The theory explaining the formation of oil or petroleum (in rock formations) which is almost universally accepted is that it is a product of the partial decomposition of organic remains, effected in the absence of oxygen. The majority of geologists hold that animal organisms were the main source of natural oils, but a few consider that vegetable matter also played an important part. The first requisite, therefore, for the production of oil is a sedimentary formation which carried abundance of living matter (animal or vegetable, or both) at the time of deposition.

The origin of natural gas is also ascribed directly or indirectly to the decomposition of organic matter, but much wider divergence of opinion is found than is the case with oil. Some writers maintain that natural gas is a distillation product from underlying petroliferous strata, while others contend that natural gas is first formed from decomposing organic matter, and that later condensation of this natural gas gives rise to petroleum. In this connection it may be stated that nearly all productive oilfields are overlain by natural-gas fields, but the latter exist where oil has not been found. In these instances, though, it may be that the oil-

* Guide Book No. 8, Part II., page 272: Excursions International Geological Congress.

field, of which the gas forms the upper zone, may exist at depths greater than have been attained by the boreholes. It is probable that the truth lies midway between the above theories, and that very often both oil and gas are formed from decomposing organic matter.

It will be necessary now to distinguish between and point out the similarity between "natural gas" and "marsh-gas." Nearly all present-day swamps are giving off small quantities of gas which is undoubtedly formed from the decomposition, under cover, of the vegetable matter in the swamp. This gas is called "marsh-gas" and is found to consist mainly of methane (CH_4), together with small and widely varying percentages of higher hydrocarbons, oxygen, hydrogen, carbon dioxide, nitrogen, etc. The gas which is occluded and stored up in coal-seams is sometimes also called marsh-gas, as it is practically identical in composition with the swamp product. This is the gas which, when mixed with air, forms the explosive gas in coal-mines.

It will be seen, then, that marsh and natural gas are formed in very much the same way, and it would therefore be expected that their composition would be similar. A comparison of the analyses of typical samples of these gases shows that such is the case, and that their essential constituent is the same—viz., methane. Practically, then, the only distinction between marsh and natural gas is that the former is a present-day, modern product, while the latter is a gas given off from a solid rock formation, and hence was formed in some earlier geological period. The main distinction by analysis between marsh-gas and natural gas is that the former usually contains from 3 to 6 per cent. of free oxygen, while the latter rarely contains more than 0.5 per cent., and often none at all. The presence or absence of oxygen in a gas, however, must not be taken as decisive evidence of its nature, but simply affords some indication, and must be considered in conjunction with other data. The absence of oxygen in a natural gas is to be expected, as, in the course of ages of time, any free oxygen would be extracted from the gas by the oxidation of surrounding material.

Analysis shows, further, that marsh-gas sometimes, but rarely contains percentages of nitrogen up to 50 per cent., and also that natural gas sometimes contains considerable percentages of olefines (higher hydrocarbons). These instances must be looked on as exceptions and as being unusual.

The gas given off from coal, which is also called marsh-gas, is in part stored up in the coal, but is probably to some extent being continually formed from the breaking-up of the hydrocarbons in the coal.

It is therefore to some extent a modern product and will generally contain some free oxygen; further, it in some instances contains a high percentage of nitrogen. It would seem, therefore, that if a gas can be classed as a marsh-gas either from chemical or geological evidences (or both), then it follows that it cannot be considered to be necessarily evidence of an underlying oil reservoir.

Summing up, it may be said that: (1) A true natural gas may or may not be an indication of oil; (2) a true marsh-gas is no indication of oil; (3) a gas given off from coal or strata containing thin coal-seams does not necessarily indicate oil.

RETENTION OF OIL AND GAS IN ROCK STRATA.

When a sedimentary rock is being formed, the formation of some oil or gas, or both, from the organic matter contained therein is to be expected. In most cases the actual amount formed will be small, but in exceptional instances, where the strata contain vast amounts of organic life, large quantities of oil may be produced. Under ordinary conditions this oil would escape to the surface and become lost to the earth's crust, but under certain structural conditions the oil may be retained and accumulated. These conditions are: First, that either

the formation in which the oil originates, or one above it, must be sufficiently porous to act as a reservoir; and, second, this porous formation must be capped by an impervious cover which will prevent the accumulated oil from escaping. The formation of large deposits of oil depends as much upon the presence of suitable strata to receive and retain it as upon an adequate source of supply.

An anticlinal structure of the containing strata tends towards an accumulation of the oil in the domes and arches of the anticlines; so that where the strata are folded the most likely place to bore is along the crest of an anticline. The reason for this is that the oil, being lighter than water, is forced upwards into the highest points by the water underneath.

A theory sometimes held in regard to petroleum, which is, however, quite erroneous, is that it flows in channels underground like water; a much truer analogy is that petroleum is held in porous rock in very much the same way as water is held in a sponge.

PROBABILITY OF OIL AND GAS AT PORT HANEY.

It has been already shown that the only possible source of oil and gas at Port Haney is in the Eocene rocks. Besides being the source, this formation must necessarily also supply the rock reservoir and impervious capping essential to a commercial oilfield.

A study of the character of these rock formations leads to the conclusion that, at the time of their deposition, vegetable life was of much more frequent occurrence than animal life since. They were formed in an estuary of the sea from the deposition of sands and silts; such conditions would be suitable to the development of aqueous vegetation, but the shallow, muddy, silted waters would be unfavourable for the propagation of extensive marine animal life. This conclusion is borne out by the absence of any considerable amount of fossiliferous animal remains. On the other hand, extensive vegetation is proven by the thin coal-seams found in the formation.

From these facts, then, it must be concluded that, as animal life was scanty in the formation, and as the hydrocarbons from the vegetable matter formed coal instead of oil, a probable source for any considerable quantity of oil in these rocks does not exist. Furthermore, while these rocks are sufficiently porous to act as a reservoir of either oil or gas, it is doubtful if there is any shale which is dense enough to act as an oil-tight cover.

The analysis of the gas collected from the well at Port Haney tends to indicate that it is of the marsh-gas type and not a true natural gas, and this origin for it is substantiated by the geological evidences. There seems little doubt that this gas is being generated and given off from the small coal-seams throughout the formation, and if this explanation is correct, then this gas is no indication of an underlying reservoir of oil; nor is it likely that any large reservoirs of gas will be encountered in drilling this formation, as the rocks are too porous to make this probable.

CONCLUSION.

"The time at my disposal for the purpose of investigating the possibilities of oil in the region of Port Haney was not sufficient to enable me to make as thorough an examination as would be desirable. But from the information I have been able to obtain, I would say that in my opinion it is unlikely that this region will be found to be underlain by a productive oil-field. Further, the amount of gas found, whether it be marsh or natural gas, will probably never be sufficient to be of commercial value."

INSPECTION OF MINES.

REPORT OF THOMAS GRAHAM, CHIEF INSPECTOR.

I have the honour to submit my third annual report as Chief Inspector of Coal and Metalliferous Mines.

The reports of the District Inspectors, covering the production of coal and coke, the number of persons employed, and list of accidents and prosecutions, also a brief description of the mines in the several inspectorates, are hereto appended.

During the year you were pleased to appoint Dudley Michell as Instructor in First Aid to the Injured, with the view of establishing permanent classes in this work at all operating coal and metalliferous mines in the Province.

PERSONNEL OF STAFF OF INSPECTORS AND INSTRUCTORS.

The personnel of the staff of Inspectors and Instructors is as follows:—

Inspectors.

Thomas Graham, Chief Inspector, Victoria.
James McGregor, Inspector, Nelson.
* Evan Evans, Inspector, Fernie.
Robert Strachan, Inspector, Merritt.
John Newton, Inspector, Nanaimo.
T. H. Williams, Inspector, Fernie.
Henry Devlin, Inspector, Nanaimo.

Instructors, Mine-rescue Stations.

* George O'Brien, Instructor, Mine-rescue Station, Fernie.
J. D. Stewart, Instructor, Mine-resue Station, Nanaimo.

Instructor, First Aid to Injured.

Dudley Michell, Victoria.

Provision was made in the Estimates for an additional Inspector of Mines to cover the developments in the Northern Interior of British Columbia, opened by the Grand Trunk Pacific Railway and the Northern Coast developments of the Granby Company at Anyox, but owing to the falling-off in mining development through the war this appointment was not made.

QUARTERLY STATEMENT ON FATAL ACCIDENTS.

During the year there was issued a quarterly statement on mine fatalities, with tables showing the number of fatal accidents and a comparison with the same months of the previous year, the colliery or mine where the accident occurred, and the fatalities classified according to the cause. These quarterly statements were sent to the leading daily papers and mining journals in the Province, and to the Inspectors of Mines for distribution in their respective districts. They seem to be filling a long-felt want in getting official information on fatal accidents to the public much earlier than was possible through the Annual Report of the Minister of Mines.

* Evan Evans was killed in a Coal Creek mine on January 2nd, 1915, and George O'Brien was appointed in his place, while Charles O'Brien was appointed Instructor at Mine-rescue Station, Fernie.

The statement deals with the numbers and causes, leaving the detailed explanation to be given in the Annual Report as heretofore.

FATAL ACCIDENTS IN COAL-MINES.

During the year there were fifteen separate fatal accidents, which caused seventeen deaths; this is a decrease of nine in the number of fatal accidents, and a decrease of ten in the persons killed, compared with the previous year.

There were 5,732 persons employed in and around the coal-mines, being 939 less than in 1913, making the ratio of fatal accidents to the 1,000 persons employed 2.97, the ratio for the previous year being 4.05; the average for the ten-year period was 3.96.

The tonnage produced during the year was 2,166,428, being 404,332 less than produced in 1913. This reduction was mostly in the collieries of the East Kootenay District, and was due to the closing-down of the smelters at Grand Forks, Greenwood, and points south of the International Boundary-line after the outbreak of the European war.

The following table shows the collieries at which the fatal accidents occurred:—

Canadian Collieries (Dunsmuir), Limited, Cumberland	6
Western Fuel Company, Nanaimo	4
Crow's Nest Pass Coal Company, Limited, Coal Creek	3
Crow's Nest Pass Coal Company, Limited, Michel	1
Canadian Pacific Railway, Natural Resources, Coal Department, Hosmer	3
Total	17

The following table shows the various causes of the fatal accidents and their percentage of the whole, and corresponding figures for 1913:—

Cause.	1914.		1913.	
	No.	Per Cent.	No.	Per Cent.
Falls of roof and rock	2	11.76	11	40.74
Falls of coal	3	17.66	7	25.93
Haulage	6	35.30	5	18.52
Shafts	2	11.76	2	7.405
Explosives	2	11.76	..	.....
Electricity	1	5.88	..	.....
Mine surface	1	5.88	2	7.405
Totals	17	100.00	27	100.00

There is a marked decrease in the fatalities from falls of roof and coal compared with 1913, the percentages of these accidents to the whole being 29.42 per cent., as against 66.66 per cent. for 1913 and 32.14 per cent. in 1912.

Fatalities from mine-cars or haulage show a large increase, being 35.30 per cent., as against 18.52 per cent. in 1913 and 32.14 per cent. in 1912.

SYSTEMATIC TIMBERING.

In my last annual report mention was made of a new special rule covering systematic timbering and giving the rule as finally adopted. The rule went into effect January 1st, 1914, at every colliery in the Province, except the Wellington Colliery of the Canadian Collieries (Dunsmuir), Limited, situated at Extension. The management and the Department were unable to agree upon the sizes of timber required, and the question is still under discussion; but an early settlement is hoped for.

The efforts to enforce the rule met with the hearty co-operation of the great majority of the officials and workmen, and a rigid enforcement of the rule will, I believe, do much to reduce the number of accidents from falls of roof and coal at the working-face. Whilst there is a large reduction in this class of accidents for the year, as already noted, no claim is made that this is due to the establishment of systematic timbering, as it is preferable that the operations of the rule should cover a longer period of time before any claims are made for it.

HAULAGE.

This class of accident shows a large increase over the previous year; three of the six accidents from this cause occurred in one mine in the last month of the year. One accident caused the death of two persons, a rope-rider and bell-boy, who were riding on an empty trip descending a slope, when a car in the trip left the track, knocking out several sets of timber, the rope-rider and bell-boy being suffocated in the fall of fine coal. An accident of a similar nature occurred in the same district of the same mine, whereby a driver was suffocated by a fall of fine coal through the collapse of a few sets of timber.

There seems no reason why the bell-boy should be permitted to ride to and fro with a rope-rider. The riding of a trip is a hazardous occupation, and personally I am of the opinion that in many instances the work done by the rope-rider could be equally well performed without any person riding the rope.

I regret to say that out of the seventeen fatal accidents during the year, only six, or 35.3 per cent., were what might be termed unavoidable and therefore due to the hazards of the business, whilst eleven, or 64.7 per cent., were avoidable. Of these eleven, two, or 11.76 per cent., were due to faulty conditions or equipment, and nine, or 52.94 per cent., due to violations of regulations, rules, or orders, and to carelessness on the part of the persons injured.

METALLIFEROUS MINES.

There were fourteen separate fatal accidents, causing the deaths of nineteen persons, in and around the metalliferous mines of the Province during the year, being an increase of six deaths, or 31.6 per cent., over 1913.

The production of ore in tons was 2,175,971, being a decrease of 487,838 tons from the previous year, due mostly to closing-down of the larger producing mines in the Boundary District after the outbreak of the European war.

There were 4,174 persons employed in and around the mines, showing a decrease of 104 persons from the figures of 1913.

The ratio of fatal accidents per 1,000 persons employed was 4.55, compared with 3.04 for 1913 and 2.10 for 1912. The average for the last ten-year period was 4.38.

The mines at which fatal accidents occurred were:—

Rambler-Cariboo, Sandon	1
War Eagle, Rossland	1
Hidden Creek, Anyox	3
Jewel Denero, Greenwood	2
Centre Star, Rossland	1
Rawhide, Phoenix	2
Monarch, Phoenix	1
Granby, Phoenix	4
Golden Horn, Ymir	1
Britannia, Britannia Beach	2
Nickel Plate, Hedley	1
Total	19

The following table gives the causes and percentages to the whole of the fatal accidents, with corresponding figures for 1913:—

Cause.	1914.		1913.	
	No.	Per Cent.	No.	Per Cent.
Picking or drilling into unexploded powder	1	5.26	4	30.77
Premature blasts	5	26.32	..	....
Returning to unexploded shot	1	5.26	..	....
Falls of ground	6	31.58	3	23.08
Mine-motors and haulage	1	5.26	2	15.38
Suffocation or gassed with powder-fumes	3	15.80	1	7.6925
Falling into chutes	1	5.26	1	7.6925
Falling off ladder	..	....	1	7.6925
Falling off trestle	..	....	1	7.6925
Aerial tramway	1	5.26	..	....
Total	19	100.00	13	100.00

Three of the fatalities from falls of ground occurred in one accident, and were due to a slide off the face of the glory-hole at the *Granby* mine, Phoenix; over 1,000 tons of rock slipped off the quarry-face, burying the men.

Explosives in one form or another account for ten, or 53.63 per cent., of all the fatal accidents, an increase of 15.16 per cent. over 1913. There is a notable decrease in the accidents from picking or drilling into unexploded powder, but an increase in the fatalities from premature blasts and suffocation from powder-fumes. All these accidents were avoidable, and denote an alarming lack of discipline and disregard of the dangers attending the use of high explosives.

Of the nineteen fatal accidents, only seven, or 36.84 per cent., were in the unavoidable class and therefore due to the hazards of the business, whilst twelve, or 63.16 per cent., were avoidable and due to violations of regulations, rules, orders, lack of discipline, or carelessness on the part of the persons injued.

There were thirty-six fatal accidents in all classes of mining for the year 1914, as compared with forty for the year 1913, a decrease of four, or 10 per cent.

The number of persons employed in and around the mines of the Province was 9,906, a decrease of 1,043 as compared with 1913.

The ratio of fatal accidents to the 1,000 persons employed in both coal and metalliferous mines was 3.63, as compared with 3.65 for 1913.

The fact that twenty-three of the thirty-six fatalities, or 63.9 per cent., were in the avoidable class provides a field, rich with possibilities, for every one interested in the reduction of mine accidents.

FIRST AID TO THE INJURED.

For years first aid to the injured has been taught in and around the coal-mines with varying results, and nearly every coal camp in the Province contains a large number of men who are qualified to render such aid in case of accident. Early in May the Department appointed Dudley Michell as an Instructor in First Aid, with a view to working up interest in the movement in and around the metalliferous mines of the Province. Mr. Michell started his duties about the middle of May and worked in the field during the remainder of the year. He met with much encouragement in the work, as will be noted by his report, which is appended hereto.

I regret to say that, owing to the outbreak of the European war and the closing-down of many of the larger metal-mines, much of the organization effected by Mr. Michell was rendered useless. However, as Mr. Michell is to remain permanently at the work, the field will again be covered during the year 1915.

MINE-RESCUE WORK.

No notable additions have been made to the equipment of apparatus at the coal-mines during the year. The number of apparatus remains the same, being ninety-two sets of all types, as in 1913.

I am pleased to say that during the year the Consolidated Mining and Smelting Company of Canada, the Granby Consolidated Mining, Smelting, and Power Company, and the Britannia Mining Company entered the field of mine-rescue work.

The Consolidated Mining and Smelting Company of Canada purchased and installed eight sets of 2-hour Fluess mine-rescue apparatus and six Draeger pulmotors. The Granby Consolidated Mining, Smelting, and Power Company purchased and installed three sets of 1-hour and one set of ½-hour Draeger mine-rescue apparatus and four Draeger pulmotors. The Britannia Mining Company purchased and installed three Draeger pulmotors. The Consolidated Mining and Smelting Company of Canada built a mine-rescue station at Rossland, in which, under the instruction of Dudley Michell, sixteen of the employees took a course of training and were granted certificates of competency by the Department.

I look forward to a large extension of this work in the metalliferous mines during 1915.

In addition to the sixteen certificates of competency issued to the metalliferous mines, eighty-one certificates were issued to employees in and around the coal-mines, making a total of 199 certificates issued by the Department.

There are maintained at the coal and metalliferous mines of the Province 104 sets of mine-rescue apparatus and twenty-eight pulmotors, making one set of apparatus for every sixty-eight persons and one pulmotor for every 252 persons employed underground. One out of every thirty-six persons employed underground is the holder of a certificate of competency in mine-rescue work. The number of persons trained in this work during the year fell below our expectations.

The regenerative cartridge used in the Draeger type of apparatus consists of granulated potash, and as the German Government controls a very large per cent. of the world's production of potash, the effect the war would have upon the supply of potash was unknown; so in order to conserve our available supply for emergency use, all training was immediately suspended. I am pleased to say that the stock on hand is ample to cover large emergency calls.

There were thirty-six prosecutions for violations of the "Coal-mines Regulation Act" and special rules, and one inquiry under section 48 of the Act. The general results, whilst showing some little improvement over the previous year, are far from satisfactory.

LEGISLATION AND SUPERVISION.

The "Coal-mines Regulation Act" now in force is admitted as one of the best extant. The ratio of Government Mine Inspectors to mine-workers—one for every 1,651 persons employed in and around the mines—and the frequency of inspection, at least once each month, is not surpassed in any country.

The number of certificated officials under the "Coal-mines Regulation Act" amongst the underground employees will bear comparison with any Province, State, or country, in evidence of which I give the following data taken from the returns of 1914:—

There were thirteen companies producing coal, operating thirty-two mines. In these thirty-two mines, employing 4,267 persons underground, there were 224 certificated officials on

duty—sixteen mine managers, thirty overmen, and 178 firebosses and shotlighters holding certificates of competency as such—making 5 per cent. of the persons employed.

This makes one certificated official of all classes for every twenty persons employed, and one official of the third-class type as fireboss and shotlighter for every twenty-five persons employed, and approximately one official for every 50 tons of coal produced.

These facts, compared with the figures showing that 64.7 per cent. of the fatal accidents in the coal-mines were in the avoidable class, forces the writer to the conclusion that mere legislation, however stringent, or supervision, however effective, will not alone prevent mine accidents.

In the great "safety first" movement which during the past few years has been so prominently before the public, there is room for more than the 5 per cent. of the mine-workers who form the supervising staff; there is room for 100 per cent. of the mine-workers; and just as long as the "safety first" movement is confined to this small percentage of those employed, there can be no hope for much improvement in mine-accident statistics.

Some means must be found for educating the mine-worker to protect himself and to impress upon him that the "safety first" movement is essential to such protection, and cannot be successful unless he becomes an active worker in the movement.

There are many obstacles to overcome in the work, not the least of which is the widely taught doctrine that there is not, and never can be, anything in common between the employer and the employee. Whether this doctrine, that success can only be obtained in an industry when the elements composing the industry are at war with one another, be true or false, lies beyond the scope of this report; but surely any movement having in view the conservation of the lives and limbs of our great industrial army, whether employed in the mines or elsewhere, should present some neutral ground where the employer and employee could meet in common and co-operate for the general welfare of all.

Much can be done in the educational line by the supervising officials. When making their daily rounds, they can instruct and advise in methods of performing the work safely and in keeping with good mining practice, enforcing compliance with rules and regulations, and thus maintaining a discipline now foreign to some operations.

The worker, by a cheerful compliance with such instructions and regulations, can do much to safeguard himself and assist in eliminating 50 per cent. of the fatalities.

Perhaps the formation of a safety committee from the workmen, who would periodically meet with the officials of the mine, forming a sort of advisory board on questions relating to discipline and safety, when suggestions for coping with dangers, known and prospective, might be discussed.

I am pleased to note the forward movement through the Educational Department to provide opportunities for technical education at the coal-mining centres, and trust that these educational facilities may be extended to embrace the metal-mining centres.

MINE INSPECTORS' CONVENTION.

Under instructions from the Department, I attended the Seventh Annual Convention of the Mine Inspectors' Institute of the United States of America, held in the city of Pittsburg, Pa., on June 9th to 12th, 1914.

I left Victoria on the night of May 31st, travelling over the Canadian Pacific Soo Line via St. Paul and Chicago, and thence via the Pennsylvania lines to Pittsburg. A stop of two days was made at Chicago, and Pittsburg was reached on the morning of June 8th.

The Convention was held in the lecture-room of the Engineering Society of Western Pennsylvania, situated on the twenty-fifth floor of the Oliver Building.

At 10 a.m. on the morning of the 9th the Convention was called to order by Thomas K. Adams, a Past President of the Institute and the Dean of the Pennsylvania Mine Inspection Staff.

Mr. Adams, on behalf of the Bituminous Mine Inspectors of Pennsylvania, extended a hearty welcome to the members of the Institute. Further addresses of welcome were made by Charles A. O'Brien, who represented Mayor Joseph G. Armstrong, and by D. P. Black, President of the Pittsburg Chamber of Commerce. David J. Roderick, President of the Institute, made a suitable reply.

The Convention then listened to the able annual address of the President, the discussion of which was laid over until the afternoon session, and before adjournment the various committees were appointed.

The afternoon session was devoted to discussion of the President's address; in the evening the members and the guests enjoyed a steamboat ride on the Monongahela river. The trip extended up the river to McKeesport, and afforded an excellent view of the immense steel-works that line the river and make the "Smoky City" the centre of the greatest manufacturing district in the world.

Wednesday morning session was marked by a very interesting paper, contributed by John Dunlop, a former Mine Inspector of Illinois, and entitled "The Booster Fan." This paper raised considerable discussion amongst the members present, the general opinion being that the use of a "Booster Fan" might be advantageous under certain conditions in a mine, in tunnel-work, or making connections between districts by single opening, but that its use should be restricted to emergency cases, and that the use of a "Booster Fan" in a mine for ventilating a coal-producing section of such mine was in itself an evidence of defect in the main ventilating system of such mine.

The afternoon session was devoted to a paper by P. J. Moore, Anthracite Mine Inspector, Carbondale, Pa., entitled "First Aid to the Uninjured." Mr. Moore's paper was a very valuable contribution, pointing out the necessity for devoting more time to the education of the mine-worker, with a view to enabling him to protect himself against accident, rather than teaching some one to render him aid after the accident had occurred.

A banquet in the evening was largely attended by the members of the Institute and guests at the Monongahela House, and addresses were delivered by Dr. H. M. Wilson, of the United States Bureau of Mines, and David Ross, former Commissioner of Labour, Illinois, and the following papers were read: "Uplift Work," by W. L. Affelder, General Manager of the Bessemer Coke Company; "Coal-mining in the United States—Past, Present, and Future," by Samuel A. Taylor, Consulting and Mining Engineer; "Sensible School-work in a Mining Community," by Professor E. E. Back, Superintendent, Sociological Department, Ellsworth Collieries; "Mining Legislation," by W. E. Fohl, Mining Engineer; and "Service and Discipline," by W. R. Crane, Dean of the School of Mines, Pennsylvania State College.

Thursday forenoon was devoted to a visit to the Testing Station of the United States Bureau of Mines at Fortieth and Butler streets, where a number of very interesting experiments were made, *re* the explosibility of coal-dust by certain classes of explosives and the behaviour of safety-lamps in known quantities of gas and air travelling at known velocities.

The afternoon was spent at the Bruceton mine of the United States Bureau of Mines, where an explosion was witnessed by the members present.

The last day of the Convention two papers were read, namely: "The Value of Organized Effort in Increasing Safety in Mines," by Isaac G. Robey, Inspector of Mines, Pa., and "Some Recent Experiments Pertaining to Control of Mine Explosions," by George S. Rice, Engineer of the Bureau of Mines.

Officers for the following year were elected as follows: President, John Dunlop, Peoria, Illinois; First Vice-President, Joseph B. McDermott, Helena, Montana; Second Vice-President, George E. Sylvester, Nashville, Tennessee; Third Vice-President, Thomas Graham, Victoria, B.C.; Secretary, James Paul, Pittsburg, Pa.; Assistant Secretary, R. S. Wheatley, Salinville, Ohio; Treasurer, Joseph Knapper, Dravosburg, Pa.; Editor-in-Chief, James T. Beard, New York City. St. Louis, Mo., was selected as the next place of meeting.

The city of Pittsburg and the surrounding country present features that make it an ideal place for a convention of men interested in coal-mining. It is the centre of the great steel industry of the United States; this industry was built upon the vast bituminous coal resources tributary to the city, the output from which totalled 170,000,000 tons in 1913. In addition to this, the United States Bureau of Mines has located its large Testing Station at the old Arsenal, Fortieth and Butler streets, and at Bruceton, twelve miles from the city, the Bureau owns a mine, which is used exclusively for experimental purposes.

A large staff of scientific workers is employed by the Bureau, and a wide range of research-work is being carried on under the able supervision of Dr. Joseph A. Holmes, Director of the Bureau.

The entire corps of workers at this plant assisted in carrying out an elaborate programme for the benefit of the visiting Mine Inspectors. At no other place on the continent could such a programme have been carried out, and much credit is due the Director of the Bureau and his able staff for the exceedingly interesting and instructive programme so successfully staged.

The programme of the Testing Station consisted of a ten-minute talk by H. M. Wilson on "Things of Interest at the Testing Plant and what the Bureau is doing."

(1.) Ballastic Pendulum Test.

(*a.*) Firing a charge of ½ lb. of 40-per-cent. nitro-glycerine dynamite. (This test was fully described in Report of 1912.)

(2.) Gas and Dust Gallery No. 1.

(*a.*) Firing a charge of permissible explosive equivalent in strength to ½ lb. of 40-per-cent. nitro-glycerine dynamite in the presence of 120 lb. of dry bituminous coal-dust—20 lb. on horse and 100 lb. on shelves full length of gallery. No flame was seen and no explosion of dust resulted from the test.

(3.) Lamp-testing Gallery No. 1.

(*a.*) Testing a modern safety-lamp in a current of air containing 8½ per cent. natural gas, at a velocity of 2,500 feet a minute. The lamp used was a "Koehler," made by the Koehler Manufacturing Company, Marlboro, Mass., and is essentially patterned after the Wolf lamp so much used in this Province. The lamp stood the test.

(*b.*) Testing an unbonneted "Clanny" safety-lamp in a current of air containing 8½ per cent. natural gas, at a velocity of 1,500 feet a minute. This lamp failed to stand the test, an explosion occurring in about ten seconds.

(*c.*) Testing a "Davy" safety-lamp in a current of air containing 8½ per cent. of natural gas, at a velocity of 700 feet per minute. This lamp also failed to stand the test, an explosion occurring in about 40 seconds.

Lamp-testing Gallery No. 3.

(*d.*) Exhibition of different types of miners' safety-lamps in presence of 2 per cent. natural gas. Spectators passed through a dark room and examined the effect

of the gas upon the flame of the lamps. The lamps used were the "Koehler," "Wolf," and "Davy." The Koehler and Wolf lamps showed a gas-cap of about ½ inch in height. The Davy lamp did not show any gas-cap.

(*e.*) Exhibit of different types of miners' safety-lamps (flame).

(*f.*) Exhibit of different types of miners' portable electric lamps, both hand and cap types.

(4.) (*a.*) Exhibition of breathing apparatus for mine-rescue work.

(*b.*) Training with breathing apparatus in an air-tight room.

(5.) Gas and Dust Gallery No. 1.

(*a.*) Firing a charge of 1 lb. of black blasting-powder in the presence of 120 lb. of bituminous coal-dust—20 lb. on horse and 100 lb. on shelves full length of gallery. This experiment was in the same gallery as Exhibit No. 2, where a charge of permissible explosive was fired and failed to ignite the dust, and no additional dust was placed in the gallery after Exhibit No. 2; the firing of this charge caused an explosion of the dust, flame extending along the entire length of the gallery.

(*b.*) Men wearing breathing apparatus entered the gallery and rescued a supposed victim.

(*c.*) Rendered first aid and treatment, including artificial respiration and dressing for burns, wounds, and fractures.

(6.) Inspection of testing-machines for determining the strength of various materials, including mine supports.

The afternoon was devoted to a visit to the Bruceton experimental mine, where an explosion of coal-dust was staged for the benefit of the visiting Inspectors.

The programme was as follows:—

(*a.*) Inspection of mine by visitors.

(*b.*) Black-powder charge fired from a cannon at face of the main entry, igniting dry coal-dust and starting a mine explosion; retarding and intercepting the explosion by means of stone-dust.

(*c.*) Inspection of mine by Bureau of Mines certificated mine foreman and fireboss.

(*d.*) Inspection of the mine by the visitors.

The following description of this coal-dust explosion is taken from *Coal Age*, and was written by George A. Rice, Chief Mining Engineer of the Bureau of Mines, Pittsburg, Pa., and L. M. Jones, Assistant Engineer, Bureau of Mines, Pittsburg, Pa., the engineers in charge of the test:—

"*Coal-dust Explosions at the Mine Inspectors' Institute Meeting.*

"*Synopsis.*—A mild explosion was staged at the experimental mine, the mixture of rock-dust with coal-dust being almost sufficient to make the explosion impossible. Under these conditions the Rice barriers proved effective. The explosion was more violent toward the intake and more speedy toward the return. However, neither difference was sufficient to establish any conclusions.

"Test known as No. 120 of the series now being made at the Bruceton experimental mine was conducted in the presence of many members of the Mine Inspectors' Institute of America, who were assembled from various parts of the United States and Canada on June 11th, 1914. Some operators and miners were also present. The purposes of the experiment were several. The most important was to determine the efficiency of various forms of rock-dust barriers in stopping the propagation of a dust-explosion; another feature of great interest to many of the members was the employment of a strong ventilating-current prior to and at

the time the explosion was started. The main entry was the intake and the air-course the return. The loading of coal-dust in the two entries was made as nearly alike as possible, and since the igniting shot was fired in an offset at the middle of the inmost crosscut, the conditions in the two entries were identical, except for the air-current intaking on one and returning on the other entry.

"*Conditions of Test.*—The explosion was caused by a blown-out shot of 4 lb. of FFF black powder, tamped with 3 lb. of clay stemming, discharged from a cannon at the face of a 20-foot offset, on the north side of the 1,250 crosscut at a point equidistant from entry and air-course. The offset and 1,250 crosscut were loaded with pure coal-dust; that is, coal-dust not mixed with other material. The distance from the cannon through the crosscut to the centre of either entry was about 50 feet.

"From opposite the 1,250 cut-through the entry and air-course were each loaded on sides and cross-shelves with a mixture of 60 per cent. coal-dust and 40 per cent. shale-dust at a rate of 3½ lb. per foot. The amount of coal-dust per foot of entry-way was 2 lb., which is equivalent to about ½ oz. per cubic foot of entry-space. This loading extended for 550 feet outby from the crosscut. The mixture had an ash percentage of about 38 to 40 per cent.

"*Concentrated Rock-dust Barrier.*—At the end of this zone on the entry there was installed a Rice concentrated barrier loaded with 2½ tons of rock-dust. The principal features of the barrier are as follows:—

"It has two-hinged platforms, 7 x 7 x 1 feet, near the roof of the entry. The floor-planks of the platform are not attached to the side-boards, which are fastened to timber cross-bars, but are hinged at one end to the cross-bar of a timber set between the platforms. The other ends of the planks of each platform are supported by an angle-iron, which in turn is held up by one of a system of levers.

"There are vanes hung from the roof 100 feet distant inby and outby the barrier, so arranged that when an explosion-wave causes one to swing, the movement is reversed by a pully and chain and a pull transmitted by wire to a trigger which trips a system of levers, causing the dropping of the angle-irons supporting one end of each platform. Alternate planks then fall about 9 or 18 inches, depending on the length of chains fastening them to an overhead timber or to the roof. The side-frame of each platform, however, is still held in position.

"On release, the dust, which has been placed on the platforms, falls from the planks in a shower into the entry, blanketing the flame of the explosion as soon as it reaches the barrier. Should the advance-vane operating arrangement fail, another vane near the barrier, by means of a hinged bumping-block attached to it, pushes the trigger, causing the barrier to act.

"*Box Rock-dust Barriers.*—At the end of the mixed-dust zone on the air-course were installed a set of six Rice box barriers, spaced 10 feet apart from centre to centre, each containing from 600 to 700 lb. of crushed shale-dust. These boxes are 7 feet long, 21 inches wide inside, and 9 inches deep. They are built so that two bottom boards rest upon narrow bottom strips fastened to the box-frame.

"This frame is supported by four eye-bars, the eyes resting on hooks projecting from the roof. When the explosion-wave reaches the box, it causes the latter to swing in the direction the wave is travelling until the side of the box knocks two hanging bars off the hooks, whereupon the frame falls, pivoting about the supporting hooks on the other side of the box, to which the other two eye-bars are still attached.

"The bottom boards do not fall with the box-frame, but drop a few inches, when they are caught by supporting chains. More or less of the dust on these shelves either falls off as they swing or is blown off by the explosion-wave. With a light, preliminary wave, considerable dust may remain on the shelves, which is a measure of protection against a following explosion-wave.

"*Coal-dust loaded beyond Barriers.*—Outby from both the concentrated barrier and the box barriers were arranged 200-foot zones of pure or unmixed coal-dust to furnish fuel for continued propagation of the explosion, should it get through the stopping devices. These zones were intended to determine if the barriers just described performed their duties effectively. At the end of these coal-dust zones were placed Taffanel barriers to check the explosion should the coal-dust become ignited.

"*First Right Butt.*—Across the mouth of this entry was built a rock-dust stopping which consisted of board sides with a compartment between them, 18 inches wide, filled with 2½ tons of shale-dust. The sides were braced just sufficiently to withstand the pressure of the dust-filling, but not enough to give much additional strength. Coal-dust was placed for 100 feet inby from the stopping to test its efficiency.

"*First and Second Left Butts.*—In these entries, 15 feet in from the air-course, were built rock-dust protected ventilating-doors. These doors had compartments at each side and above them containing rock-dust. The door-frame held the boards of the compartments in place. When an explosion-wave struck the door, the frame, not being strongly braced, would tend to become displaced and the rock-dust would be launched into the entry. The door in No. 2 butt opened outward, while that in No. 1 butt opened inward.

"Unmixed coal-dust was distributed in both butt headings to determine the efficiency of the stopping devices. To obtain symmetrical conditions in the air-course and entry, no door or curtain was placed across the air-course between the butts.

"*Ventilation and Humidity.*—An air-current with a velocity of about 850 feet per minute was intaking on the main entry and returning on the air-course. It was thought that the symmetrical loading on the two headings would permit the observers to compare the relative violence and extent of the explosion in the face and opposing an air-current of high velocity, which gave in this case a volume of 46,000 cubic feet per minute.

"The mine was wet throughout, and in places the bottom was muddy, while the packed clay floor was everywhere slightly sticky. The roof was studded with beads of moisture.

"*Recording Instruments.*—Recording pressure manometers were placed in stations E-1150, 750, and 550; A-1150, 750, and 550. Flame circuit-breakers were placed at all stations in the mixed-dust zone, and others at intervals outby. Wires were connected to the stopping devices, terminating the mixed-dust zones, to determine the relation between the time of their operation and the passage of the flame. Matches and guncotton tufts were installed every 25 feet throughout the mine.

"*Explosion appeared Mild at Mine-mouth.*—When the igniting shot was fired by the pressing of a button in the observatory, slight puffs of dust were noticed at the main entry and air-course, accompanied by a muffled report. Shortly afterward more dust came from the entrances, particularly from the air-course, and issued for some length of time. Externally the evidences of the explosion were not very marked. When the ventilating-current was turned on after a cloud of rock-dust had been expelled, the after-damp, accompanied by an extensive cloud of black smoke, attested to a considerable explosion in the interior of the mine.

"*Extent of the Explosion.*—The flames of the explosion extended in the main entry and in the air-course to the respective rock-dust barriers, which were placed at points 550 feet from the outside of the mine or 700 feet from the origin in each case. The barriers in each case operated, and flame was not communicated to the pure coal-dust zones beyond or outby the barriers.

"The ventilating-door in the second butt was evidently thrown down by the shock-wave from the cannon, as indicated by the elapsed time as recorded on the chronograph. When the flame reached it about 4 seconds later, there had been sufficient time to permit the rock-dust

to settle, so that the flame passed overhead and ignited the coal-dust beyond, with the result that there was quite a strong inflammation at the head of the butt entries, sufficient to break the track and throw down shelving.

"This indicated that the door-frame had not been built with sufficient strength, because, for the proper operation of the rock-dust device, the frame should not have been thrown down until reached by the main explosion. This was the case with the first left butt ventilating-door, probably because this door opened inward. The barrier surrounding this first left butt door was thrown down apparently by the main explosion, although it is not perfectly clear from the time records whether it may not have been thrown down by the explosion which came around from the second butt. In either case there was apparently sufficient rock-dust launched into the air to quench the strong explosion coming out of the butt headings.

"*Pressures produced by the Explosion.*—The pressures as recorded by the different manometers showed that the explosion was light, partly due to the dust being mixed, and perhaps also due to the wet condition of the mine.

"The maximum pressure at E-1150 was 2.4 lb.; at E-750, 5 lb.; and at E-550, 0 lb. The pressures at E-750 and 550 show the effect of the concentrated barrier in extinguishing the flame. In the air-course the pressure at A-1150 was 1.4 lb. and at A-750 1 lb. This latter pressure, in view of the considerable development of force at the head of the butt entries, is rather surprising, and indicates that the ventilating-door barriers in the butt entries, if they did not stop the explosion on entering, did so on the return wave. At A-550, outby from the box barrier, the pressure was zero.

"*Velocity of Explosion.*—The velocity of the explosion was slow; one of the slowest that has been recorded. It required 3.2 seconds to traverse a distance from the origin to the station at E-1150 in the entry, a distance of 150 feet, and 2.9 seconds to the Station A-1150 in the air-course, also 150 feet from the origin. The explosion required 6.5 seconds to reach Station 750 in the entry and 5.1 seconds to reach the corresponding station in the air-course. The average velocity of flame between stations on the return air-course, 182 feet per second, was greater than the average velocity of flame between stations on the intake entry, which was 131 feet per second.

"*Effect of Ventilation Current.*—It would not appear from the pressure and velocity records that the high velocity of the air-current had much influence on the development of the explosion. About the only variation in the action of the explosion in the two entries was that the velocity of flame on the return side was somewhat greater than that on the intake side. While this may have been an effect of the ventilating conditions, it was probably more a matter of chance than an effect of the air-current, since the explosion was so slow.

"*Concentrated Barrier.*—As the explosion was light, the concentrated barrier in the entry was not broken up or injured. The shelves had dropped until the supporting chains were taut and about 80 per cent. of the dust had fallen from them, the remaining 20 per cent. being still retained on the planks. The barrier operated 5.44 seconds after the shot was fired, while the flame reached it about 7 seconds after the shot; the rock-dust that sifted down apparently made a sufficient curtain of dust to extinguish the flame.

"*Box Barriers.*—The box frames were found lying on the floor of the entry, only one being damaged to any great extent. The bottom boards were all suspended from the chains and only one had been broken. All the dust had fallen from the boards, which were supported at a tilted position. The boxes operated after 4.9 seconds, while the flame reached the boxes about 5.5 seconds after the shot. The rock-dust was well distributed along the air-course.

"*Rock-dust Stopping.*—The record indicated that this stopping had been blown down at least partially when struck by the shock-wave from the igniting shot at a period of 0.473 second after the shot. The stopping was probably built unnecessarily light. It operated effectively, for no flame passed it.

"*Rock-dust-protected Ventilating-doors.*—The door in No. 2 butt had been thrown down by the shock-wave at period 0.429, while flame reached this point, it is estimated, after a period of about 4 seconds. The dust compartment of No. 1 left door fell, according to the time of rupture of the wires, after a period of 4.9 seconds, the flame reaching this point possibly a little before.

"It is probable that the flame passed into No. 2 butt over the dust-pile, which had fallen possibly enough in advance so that much of the dust in the air had settled. The flame may or may not have passed through No. 1 butt barrier.

"The woodwork of both doors had been broken to fragments by the return wave from the butts and the fragments thrown out to the air-course, and lay in that heading both outby and a short distance inby from the butt heading.

"The failure of No. 2 butt door was undoubtedly due to the frame being braced too lightly. It should not have gone out with the shock-wave. Also it would have been better to hang some of the boards from the roof by chains, as in the case of the box barriers, in order to retain some of the dust for delayed flame.

"*Taffanel Barriers.*—All but one shelf of the Taffanel barrier in the mine entry were thrown down by the explosion. All the shelves of the Taffanel barrier in the air-course remained in place, and about two-thirds of the rock-dust was still on the shelves. Owing to the concentrated barrier and box barrier having stopped the flame, the Taffanel barriers were not brought into action.

"*Conclusions.*—The results are valuable as showing the effectiveness of the concentrated barrier and the box barrier in a weak explosion. Their method of operation permits a surer and more effective scattering of the dust than does the open-shelf type of barrier, in which the amount of dust blown off the shelves depends upon the strength of the air-current. In a weak explosion the amount blown off might be too small to quench the flame effectively."

On Saturday, the 13th, through the courtesy of Harry J. Lewis, Civil and Mining Engineer, I had the pleasure of visiting the new plant and mine of the Crucible Steel Company at Crucible, on the Monongahela river, seventy miles south of Pittsburg, Pa.

This property is situated on the bank of the river; the seam is reached by two shafts, one for railroad shipments and one for river shipments. The shafts are 180 feet in depth; during sinking and development around the shafts large feeders of water were encountered, and at the time of my visit the pumps were handling about 2,000 gallons a minute. As the development extended away from the shaft-bottoms and the river, the water-zone was passed, and as the life of the property has been estimated at fifty years, it was deemed advisable by the owners to make some effort to control the water in the shafts and shaft-bottoms.

The plan finally decided upon was to line the shafts—which are rectangular in shape—with reinforced concrete and also to put in a circular lining of reinforced concrete in all six openings leading from the shafts, extending out beyond the water-bearing zone, a distance of nearly 600 feet in all.

This concrete lining is at no place less than 2.5 feet in thickness; at the time of my visit the inverts and sides were nearly completed, leaving the upper or roof part to complete. It was proposed to gather and control the water through this by means of pipes, and after completing the roof section, to force a cement grout under high pressure into the openings,

and by this cementation process finally seal off the water. The extent of this work marks it as one of the largest undertakings of its kind in the coal-mining industry of the United States, and the work is being watched with much interest by the mining men in that section of the country.

Summary.

The meeting of the Institute, the papers read, addresses delivered, and the general discussion evoked, brought out much useful information to those present and should be productive of much good.

The experiments of the Bureau of Mines with coal-dust brought home to those present an added sense of the dangers of coal-dust as a propagating agent in a mine explosion.

Experiments at Bruceton by the United States Bureau of Mines and at Eskmeals by the British Home Office would indicate that stone-dust may become an important factor in the control of mine explosions.

The Taffanel and Rice barriers are specially designed to control and check an explosion after its initiation, whilst the distribution of stone-dust in sufficient quantities over the entire area of the mine is intended to prevent the initiation.

Neither of these systems can yet be said to be perfected. The barrier system, operated through zones in a large mine, would appear to be attended with some difficulty in maintaining such barriers at every avenue of possible escape from the unknown initial point, and then it is only a measure of lessening the effect of the explosion after it has been initiated.

The general application of stone-dust has the advantage, inasmuch as it aims at rendering the coal-dust of the mine inert and unable to support combustion even at the initial point of disturbance in the mine atmosphere. This method also has its opponents, claims being made that the application of the general stone-dusting process will, through the effect of the dust on the lungs of the mine-worker, kill more men by slow process than are now killed by our mine explosions.

In any event, the very small quantity of coal-dust required to propagate an explosion throughout a mine once initiated, as demonstrated in Test 120 at Bruceton—namely, $\frac{1}{2}$ oz. a cubic foot of entry-space—and also by the recent tests in Wales following the Senghenydd explosion, where it is estimated that in the Welsh bituminous mines sufficient coal-dust is deposited in two and a half days to exceed the amount calculated by Professor Taffanel to be necessary to propagate an explosion throughout a mine, indicates that the question of controlling and preventing coal-dust explosions in our mines is one that is surrounded by many difficulties, and presents a large field, offering many opportunities for scientific research.

I would, however, urge upon those engaged in the actual operation of our coal-mines the necessity for exercising care to prevent accumulations of coal-dust, to maintain strict discipline in the mine, refusing to fire shots in the presence of dust or to fire shots that are not properly prepared or require an excessive charge of explosives, preventing workmen from entering any place where explosive gas exists, or withdrawing workmen if found working in the presence of explosive gas, and thus minimize the chances of an initial disturbance in the mine atmosphere.

I would again urge the necessity of our Federal Government providing a Testing Station in Canada, where tests of the coal-dust from our various fields may be made, and also afford facilities for sampling our mine atmospheres from time to time.

I have to thank, for courtesies extended, the Bituminous Inspection staff of the State of Pennsylvania; the staff of the United States Bureau of Mines; H. H. Morris and H. E. Metcalf, of the Draeger Oxygen Apparatus Company; and Harry J. Lewis, of Pittsburg.

LIST OF CERTIFICATES OF COMPETENCY IN MINE-RESCUE WORK ISSUED DURING 1914.

Date.	Name.	Station.	No.
Jan. 26th	Newton, John	Nanaimo	103
" 26th	Devlin, Henry	"	104
" 26th	Graham, Thomas	"	105
" 26th	Stewart, John D	"	106
" 26th	Stobbart, Jacob	"	107
" 26th	Morton, Robert	"	108
" 26th	Weeks, John	"	109
" 26th	McGuckie, John	"	110
" 26th	Neave, William	"	111
" 26th	Yarrow, George	"	112
" 26th	Radcliffe, Joseph	"	113
" 26th	Beck, Alexander	"	114
" 26th	Perry, James	"	115
" 26th	Bradshaw, George	"	116
" 26th	Coomb, Alexander	"	117
" 26th	Seggie, Robert	"	118
" 26th	Jeanson, James	"	119
" 26th	Guinness, Matthew	"	120
May 5th	Tully, Matthew	Fernie	121
" 5th	Tully, Thomas	"	122
" 5th	Martin, Henry	"	123
" 5th	Ainsworth, Edward	"	124
June 1st	Moore, William H	Nanaimo	125
" 1st	McArthur, William	"	126
" 1st	Wallbank, John W	"	127
" 1st	Dickenson, Clifford	"	128
" 1st	Barton, Joseph	"	129
" 1st	Hamilton, Robert	"	130
" 1st	Jardine, Alfred	"	131
" 1st	Hemer, Herbert	"	132
" 1st	Parkinson, Thomas	"	133
" 1st	Freeman, Henry N	"	134
" 1st	Hamilton, John	"	135
" 1st	Reid, Robert	"	136
" 1st	Gray, George	"	137
" 1st	Williams, Watkin	"	138
" 1st	Carson, George	"	139
" 1st	Tipton, William C	"	140
" 1st	Dickson, James	"	141
" 1st	Knowles, James E	"	142
" 1st	Hesketh, Edward	Fernie	143
" 1st	Miscisco, Nicholas	"	144
" 1st	McLachlan, James	"	145
" 1st	Watkins, William	"	146
" 1st	Wilson, Daniel R	"	147
" 1st	Clarke, William G	"	148
" 1st	Griffiths, John	"	149
" 1st	Corlett, William D	"	150
July 1st	Bell, John	"	151
" 1st	Poxon, Samuel	"	152
" 1st	Duncan, James	"	153
" 1st	McCourt, John	"	154
" 1st	Teahan, Denis	"	155
" 1st	Monks, John	"	156
" 1st	Arbuckle, John	"	157
" 1st	Beveridge, James	"	158
Aug. 1st	Johnstone, Robert	"	159
" 1st	Martin, David (Jr.)	"	160
" 1st	Crichton, Robert	"	161
Sept. 1st	Sherwin, Edward	"	162
" 1st	Hunter, William	"	163
" 1st	Kinsman, Alexander D	"	164
" 1st	Caufield, Edward	"	165
" 1st	Caufield, Bernard	"	166
" 1st	Gregory, William	"	167

LIST OF CERTIFICATES OF COMPETENCY.—*Concluded.*

Date.	Name.	Station.	No.
Oct. 1st	Shelledy, Rowland B	Fernie	168
" 1st	Cullinana, James	"	169
" 1st	O'Brien, Melbourne	"	170
" 1st	Harrison, Albert E	"	171
" 1st	Montgomery, Edgar	"	172
" 1st	Murphy, David	"	173
Nov. 1st	Stephens, Roy	"	174
" 1st	Kilburn, George	"	175
" 1st	Roberts, Thomas D	"	176
" 1st	Barnes, James	"	177
" 1st	Crosscombe, James	"	178
" 1st	Brown, Edward	"	179
" 1st	Bridgeman, George	"	180
" 1st	Lindsay, William	"	181
" 1st	Foran, John	"	182
" 1st	Hawkins, John	"	183
" 1st	Jackson, Thomas R	Nanaimo	184
" 1st	Rowan, Alex	"	185
" 1st	Green, Francis	"	186
" 1st	Nimmo, James	"	187
Dec. 1st	Touhey, James	Fernie	188
" 1st	Spruston, Robert L	"	189
" 1st	Ball, Benjamin	"	190
" 1st	Heyes, Edward	"	191
" 1st	Cunliffe, Thomas	"	192
" 1st	Frew, Andrew	"	193
" 1st	Mason, Joseph	"	194
" 1st	Phillips, Thomas	"	195
" 12th	Whitehouse, William	"	196
" 12th	Littler, Matthew	"	197
" 12th	McLean, Michael	"	198
" 12th	Baybutt, Thomas	"	199

NANAIMO MINE-RESCUE STATION.

The following is the report of J. D. Stewart, Instructor at the Mine-rescue Station, Nanaimo, for the year ending December 31st, 1914:—

This station was erected by the Provincial Government in the early part of the year 1913, and was taken over by the Department of Mines in August of the same year.

It is situated on Farquhar street in Nanaimo, close to the No. 1 shaft of the Western Fuel Company. It is about seventy miles by rail or water from the mines of the Canadian Collieries (Dunsmuir), Limited, in the Comox District, seven miles from that Company's mines at Extension, six miles from the mine of the Pacific Coast Coal Company at South Wellington, five miles from the Reserve mine of the Western Fuel Company, and two miles and a half from the mine of the Vancouver Nanaimo Coal Company at East Wellington.

The building is a wooden structure, 30 x 60 feet, with corrugated-iron sides and roof and concrete foundation and basement, hard-finished inside, and containing a laage work-room with cases for storing apparatus, office for District Inspectors, dressing-room, a large and up-to-date training-room, and a store-room.

The station is equipped with the Draeger mouth-breathing type of apparatus of the 1911 model.

The equipment on hand at the present time is as follows: Eight 2-hour Draeger machines; four ½-hour Draeger machines; twelve storage-cylinders; twelve 2-hour cylinders; twelve ½-hour cylinders; 306 2-hour cartridges; 392 1-hour cartridges; 112 ½-hour cartridges; two

pulmotors with tanks; two oxygen refilling-pumps; nine full oxygen cylinders; one oxygen stretcher; three spare valves for the 2-hour machine; two spare pulmotor reducing-valves; four spare breathing-bags of the 1911 model for the 2-hour machine; six Caeg electric safety-lamps; twelve accumulators; six small Draeger electric lamps; twelve Muller Porox accumulators; six canaries for gas-testing purposes; also a number of spare parts for the apparatus and a full equipment of tools for repair-work.

On January 1st, 1914, there were on hand 314 No. 1 cartridges and 116 No. 2 cartridges. During the early part of the year there was a shipment of 300 No. 1 cartridges and 200 No. 2 cartridges received from the Draeger Oxygen Apparatus Company, Pittsburg, making a total of 614 No. 1 cartridges and 316 No. 2 cartridges.

During the early part of the year the Western Fuel Company and the Vancouver-Nanaimo Coal Company took a very active part in mine-rescue work.

During the latter part of the year after the war broke out, as most of our supplies come from Germany and are now unobtainable, we were forced to suspend training, so as to conserve our supplies for use in any case of emergency that might take place.

The Western Fuel Company had a large number of its workmen and officials trained in rescue-work in its own station. These obtained certificates of competency from the company, and, on the advice of Chief Inspector Graham, twenty of the workmen took a course in the Government station, thus obtaining Government certificates as well.

The Vancouver-Nanaimo Coal Company has sixteen fully trained men in this work, all having obtained certificates at the Government station. There is great credit due this Company for the interest shown in this work.

The Canadian Collieries and the Pacific Coast Coal Mines, I am sorry to say, have not taken the interest in this work that they should have done, as not one of the above companies' men have taken a course at this station.

Forty certificates of competency were issued to the following candidates:—

Thomas Graham, Chief Inspector of Mines; John Newton, Inspector of Mines; Henry Devlin, Inspector of Mines; John D. Stewart, Instructor, Mine-rescue Station.

Western Fuel Company.—Thos. R. Jackson, Geo. Bradshaw, George Yarrow, James W. Jamieson, James Perry, Jacob Stobbart, Robert Morton, Robert Seggie, John Walbank, James Nimmo, Matthew Gunniss, John McGuckie, William Neave, Alexander Beck, Joseph Ratcliffe, John Weeks, Alexander Coombs, Thomas Parkinson, Francis Green, and Alexander Rowan

Vancouver-Nanaimo Coal Company.—H. N. Freeman, James Dickson, Herbert Hemer, John McArthur, Clifford Dickinson, William H. Moore, John Hamilton, Joseph Barton, Robert Reid, George Gray, James Knowles, William Tipton, Albert Jardine, George Carson, Watkin Williams, and Robert Hamilton.

Following is the amount of oxygen and cartridges used in training: 2,842 cubic feet oxygen; 227 No. 1 cartridges; 10 No. 2 cartridges; an average consumption of six cartridges and 71 cubic feet of oxygen a man, at an average cost to the man of $10.15.

Sixteen of these men received a full course of ten sessions of two hours each, at an average cost of $16.50 a man, the remaining twenty-four receiving only two sessions of two hours each.

An apparatus has recently been installed in the station for charging electric lamps, at a cost of $14.10.

Expenses for the Year for the Upkeep of the Station.

Fuel	$	49 25
Electric light		9 90
Gas		6 60
Telephone and tolls		67 50
Water (September, 1913, to December, 1914)		15 50
Total	$	148 75

Supplies.

2,842 cubic feet oxygen @ 5 cents	$	142 10
Repairs to pulmotor and oxygen-pumps		11 50
4 breathing bags		74 00
1 volt-meter		2 75
Sulphuric acid		5 50
4 sacks cement		3 85
½ yard gravel		1 50
Cotton for stretcher		2 00
4 gallons varnish		10 00
½ gallon turpentine		75
1 varnish-brush		1 00
2 tins Brilliant Shine		50
2 tins black enamel		50
1 small brush		25
15 lb. lawn-seed		3 75
1 lawn-mower		8 00
1 pair lawn-clippers		1 25
100 feet garden hose		18 00
200 feet lumber 1 x 12 (rough)		3 00
10 lb. wire nails		50
Pliers		50
Paint		40
Bird-cages		4 35
Bird-seed		1 50
3 cuspidors		1 50
3 boxes W.S. soap		75
4½ bars Castile soap		1 25
1 broom		60
1 tin vaseline		1 50
Total	$	303 05

Expressage, freight, and cartage on supplies, etc., to and from the station, $99.37.

FIRST-AID WORK.

The following is the report of Dudley Michell, Instructor in First-aid Work:—

I have the honour to submit herewith my first report on the work of organizing "first-aid" centres and of training persons in the use of mine-rescue apparatus in the various metalliferous mines of the Province.

Commencing my duties on May 22nd in Victoria, I first attended the meeting of the Western Branch of the Canadian Mining Institute in Nelson on May 28th last, where I met several of the mine managers, and laid before them the proposed policy of the Mines Department.

The following is the result obtained in the work of organizing "first-aid" centres in the West Kootenay and Boundary Districts; altogether there were ten classes formed, distributed as follows: Rossland, 2; Phoenix, 2; *Mother Lode*, Greenwood, 1; *Bluebell*, Riondel, 1;

Silver King, Nelson, 1; Ainsworth, 2; *Molly Gibson* (near Nelson), 1; total, 10. These classes in each case were taught by duly qualified medical men. Classes were also taught at the *Mother Lode* and *Queen* mines on Sheep creek.

While these various first-aid centres have been formed in this district, several of the classes came to a temporary ending owing to the effect of the present war closing down several mines.

In the East Kootenay District a first-aid class was formed at the *Sullivan* mine of the Consolidated Mining and Smelting Company of Canada.

On the Coast a class was formed at the Anyox mine of the Granby Consolidated Mining, Smelting, and Power Company; also two classes were organized at the *Marble Bay* mine of the Tacoma Steel Company, Vananda.

Arrangements were made between the doctors and mine managers of Silverton and Sandon for the formation of first-aid classes when the mines resume operations.

This new undertaking has been looked upon (except in one or two instances) in a very favourable manner by mine operators, doctors, and all who supervise labour, and I have been assured by several mine managers that they will do their utmost to continue the work.

It has been proven in the small mines situated long distances from town that the result obtained by a person lecturing does not meet with success, owing in most part to the large percentage of persons unable to properly speak and understand English, and the remaining number of men do not seem to care about their leisure hours being taken up with first-aid lectures, in the only available place they have for recreation—the bunk-house—where they wish to read, write, etc.

I may add that during my visit to the various mining camps, and meeting several Miners' Union officials and others, they made very plain their desire to have action taken to provide a law in metalliferous mines, the same as in the coal-mines of this Province, with regard to shiftbosses and others in charge of labour having to undergo a course of training, and be qualified and certified to render first aid in case of an accident happening.

The following is a detailed list of "first-aid" classes formed, location, and attendance:—

Location of Class.	No. of Classes.	Doctor's Name.	Attendance, First Lecture.
Rossland	2	Drs. Coffin and Chandler	82
Phoenix	2	" Ritchie and Millar	43
Mother Lode, Greenwood	1	Dr. Maclean	62
Silver King, Nelson	1	" Vigneaux	31
Bluebell, Riondel	1	" Devlin	52
Molly Gibson, Nelson	1	" Borden	35
Ainsworth	2	" Hartin	71
Sullivan, Kimberley	1	" Green	29
Anyox	1	" Cloud	38
Vananda	2	" Marlett	38

Mine-rescue Work.

During my trip I also trained sixteen officials and men of the Consolidated Mining and Smelting Company of Canada in the use and care of mine-rescue breathing apparatus and pulmotor at the company's mine-rescue station at Rossland. This company has a small but complete smoke-room as well as training in actual powder-fumes underground.

It is pleasing to know that practically every official at Rossland (where age permits), both underground and on the surface, is the holder of a certificate of competency in both "mine-rescue work" and in "first aid."

The following is the list of mine-rescue apparatus maintained around the various metalliferous mines:—

Company.	Place.	Type.	Class.	Number.	Pulmotors.
Consolidated M. & S. Co. of Canada.....	Rossland.....	"Proto"	2 hours	4	2
" "	Ainsworth	"	2 "	2	1
" "	*Sullivan*.....	"	2 "	2	1
" "	*Silver King*.....	.....	.....	..	1
" "	Trail smelter....	.....	.....	..	1
Granby Consolidated M., S. & P. Co.....	Phoenix.....	Draeger	1 hour	3	1
" "	Anyox	"	½ hour	1	3
Britannia Mining & S. Co.....	Britannia Beach.	.....	.....	..	3

INSPECTION OF METALLIFEROUS MINES.

WEST KOOTENAY AND BOUNDARY DISTRICTS.

REPORT OF JAMES MCGREGOR, INSPECTOR.

I have the honour to submit my annual report as Inspector of Metalliferous Mines for West Kootenay and Boundary Districts for the year 1914.

ROSSLAND DISTRICT.

The principal mines operating in this district are at Rossland; these have been operated continuously during the year with an increased output from most of them; developing and exploration work has been carried forward on a very large scale and many permanent improvements effected.

I may mention that the large ore-pockets in the *Centre Star* shaft, one of the main hoisting-shafts, which were built of timber, are being replaced by concrete, as are also the shaft timbers. I understand it is the intention of the management to replace all the shaft timbers by concrete.

While the mines in this district have not greatly increased in depth during the year, the workings have been greatly extended. At the present time there are twelve separate electric haulage-lines in the *Centre Star* and *War Eagle* mines. These mines have a total of about sixty miles of underground workings.

Upon the several inspections I have made of these mines during the year I have found the machinery, ropes, cages, skips, and safety-catches in good condition, and the ventilation very good.

The system of timbering is, as usual, the "square-set," all the timbers being framed on the surface by machinery. Large quantities are necessary to square-set nearly all stopes. I have always found it carefully placed. Powder is thawed and handled with care; when thawing is necessary it is closely watched. I learned upon my last inspection that most of the larger mines are now using low-freezing powder. In every respect I have found the management showing a desire to conform to the requirements of the "Metalliferous Mines Inspection Act."

SLOCAN DISTRICT.

For the first seven months of this year there was a marked improvement in mining in this district over the previous year; several of the shipping mines had increased their output and enlarged their forces on developing-work, in many instances meeting with success.

Early in August, owing to the unsettled state of the silver and lead markets, many of the larger mines ceased shipping, except that a few of them continued to ship the zinc concentrates. At present some of the smaller mines are shipping in a limited way, but the larger producers have ceased. The majority of the mines still continue developing, but with a greatly reduced force. Upon my inspections of the several mines of this district I have found them very well kept, the travelling-ways clear and well timbered, and ventilation fairly good. In all respects the "Metalliferous Mines Inspection Act" is being conformed to both below and above ground.

AINSWORTH DISTRICT.

This district produces the same metals as do the mines in the Slocan District; consequently, early in August, for the same cause, the majority of the larger mines closed down and remain closed. A few of the smaller properties are doing development-work on a small scale.

Upon inspection I have found the mines of this district very well attended to; timbering well done; powder carefully thawed and handled; and the "Metalliferous Mines Inspection Act" generally being observed.

LARDEAU DISTRICT.

The number of shipping mines in this district has not increased during the year. Prospecting and developing have been active and continue with good results.

NELSON DISTRICT.

Mining in this District has suffered in like manner as to the north, owing to the low price of metals and general depression which has existed for the last half-year.

There was a very promising outlook for this district during the first half of the year, several properties shipping and many developing with promising results. At present mining-work consists mainly of development. In making inspections I have found these mines in good condition.

YMIR DISTRICT.

There has not been any change in the mining situation in this district during the year. The principal work being carried on at present consists of developing and prospecting.

SHEEP CREEK.

The principal mines in this district are gold-producers which have worked continuously during the year. The few silver-lead mines have also operated almost continuously.

I have found upon inspection the requirements of the "Metalliferous Mines Inspection Act" very well carried out in every respect.

BOUNDARY DISTRICT.

In this district the mines operated to their full capacity during the first seven months of the year, with nearly as large an output as during the previous year. Much development-work also had been in progress during that time with promising results.

About August 8th the Granby Company's mines and smelter closed; about August 20th the British Columbia Copper Company's mines and smelter also closed, and have remained closed. On December 1st the Granby Company again began operating, and now the output is about up to normal.

Upon inspection I have found attention given to the requirements of the "Metalliferous Mines Inspection Act"; special vigilance is exercised in scaling the backs and walls of the large open stopes and travelling-ways which exist in these mines.

Thawing and transporting of explosives has received a great deal of thought, as large quantities are required in the mines of this district. The quantity used daily in the *Granby* mine alone, when running full, is about 1½ tons.

The only gold-producing property in this District has operated continuously during the year. Upon inspection I have found the mine in safe condition, the "Metalliferous Mines Inspection Act" being complied with.

SIMILKAMEEN INSPECTION DISTRICT.

REPORT OF ROBERT STRACHAN, INSPECTOR.

I have the honour to submit my annual report as Inspector of Metalliferous Mines for the Similkameen District during the year ending December 31st, 1914.

The principal metalliferous mine in the district is the *Nickel Plate*, owned by the Hedley Gold Mining Company, and situated at the top of Nickel Plate mountain, or nearly 4,000 feet above the town of Hedley.

During my inspection of the mine I have always found the "Inspection of Metalliferous Mines Act" strictly adhered to, and every indication points to the careful selection of the workmen. In addition to the Act, special rules are provided to give greater safety to the workmen. In spite of all precautions, I regret to have to report one accident in this mine during the year, resulting in the injury of two workmen, one of whom died four days later as the result of his injuries. This accident, like the most of the accidents reported from this mine, was caused by either a premature blast or carelessness in using too short a fuse.

During the year a new cook-house has been erected, and fitted with large dining-room, reading-room, and bath-room containing both hand-basins and shower-baths.

The operations at the mine are under the charge of G. P. Jones, general manager; Wm. Sampson, superintendent; and Wallace Knowles, engineer.

Dividend-Lake View Consolidated Mining Co.—This company's mine is situated on the highway beyond Oroville, Wash., and Penticton, about a mile and a half north of the International Boundary-line, in the Fairview district, and on Kruger mountain. Only a very small force of men was at work during the year, and this only worked intermittently. All the work seemed to be well done, with care taken to secure the greatest safety. John Fisher is superintendent and John Trainer is the foreman in charge of the mine.

COAST INSPECTION DISTRICT.

REPORT OF JOHN NEWTON, INSPECTOR.

I have the honour to submit my annual report of the metalliferous mines in my inspectorate, together with a list of accidents, for the year ending December 31st, 1914.

Britannia Mining and Smelting Co., Ltd.—J. W. D. Moodie, general manager; W. J. Wyllie, mine superintendent. This company's mine is situated up Howe sound, about twenty-eight miles from the city of Vancouver, and is reached by a daily steamer service operated by the Terminal Steamship Company, of Vancouver. Considerable development-work was done during the year, consisting of drifts, raises, crosscuts, and so forth.

The mines are penetrated by six adit levels, with varying distances of from 100 to 200 feet between them—namely the 250-, 500-, 600-, 700-, 850-, and 1,050-foot levels—with crosscuts and raises from these levels, totalling 33,179 lineal feet of workings in operation throughout.

All the ore from the levels above is run down stopes to the 1,050-foot level, whence it is conveyed by a new 7-ton electric motor to the crushers, to be prepared for shipment over an aerial tramway to the Beach.

All the levels are in good order. When I visited this mine in November I found it well ventilated and timbered and in a very safe condition.

TEXADA ISLAND.

The only producing mine on this island is the *Marble Bay* mine; this has ceased operations on all the levels above the 1,000-foot. In August the company started to sink the main shaft down to the 1,400-foot level, and was down to a depth of 1,200 feet.

When I visited this mine I found it well ventilated and timbered up.

Machinery installed.—Two return-tubular boilers, one 84 and one 96 horse-power; two Canadian Rand compressors, one 10- and the other 5-drill; one hoist, 15 x 18 inches; three Lidgerwood hoists, two below and one above; one generator, 7 kw. W. Slater is the mine foreman.

The *Cornell*, *Maud Adams*, *Copper Queen*, and *Little Billie* have shut down.

Forbes Mine.—This mine is situated about five miles south of Vananda. A shaft is down a distance of 80 feet, with two drifts turned off which are in a distance of 20 feet. Only four men are employed. One small hoist has been installed.

Kallappa Mine.—This mine is situated on Meares island, in the Clayoquot Mining Division, on the west coast of Vancouver island. It is opened by three adits tunnels—namely, the 410-, 320-, and 200-foot—with seven raises from these levels, all of which are connected one with the other, with the exception of Nos. 6 and 7, which will be through in a few days.

The ventilation of this mine was fair. There were twenty-seven men employed, seventeen below ground and ten above. No machinery has been installed. G. McCutchen is the mine foreman.

LIST OF ACCIDENTS IN METALLIFEROUS MINES, 1914.

REPORT BY JAMES MCGREGOR, WEST KOOTENAY.

No.	Mine.	Date.	Name.	Occupation.	Details.
1	Rambler-Cariboo	Jan. 10	Kusti Y. Saari.	Miner	Drilled into missed hole and was killed.
2	Le-Roi, Rossland.....	" 20	Frank Isaacson	"	While riding on a timber-truck his foot was caught against the pipe-line and ankle broken.
3	Motherlode, Sheep creek	" 27	I. Spencer	"	Tripped on ladder and fell a short distance, bruising his right side.
4	War Eagle, Rossland...	Feb. 11	Pat'k Driscoll .	"	While hammering on a wedge to loosen a drill a piece of steel flew into his right eye, causing him to lose the sight of that eye.
5	Granby, Phœnix.....	" 19	Carl Franson..	Back brake-[man	Two fingers of right hand fractured when car-door closed on it.
6	Granby, Phœnix.....	Mar. 17	I. Rittenhouse	Miner	Rock from stope fell on him, cutting his head and bruising his body.
7	Granby, Phœnix.....	" 18	B. Bulatovitch.	Mucker.....	Rock from back fell on him, cutting his head and bruising his body and legs.
8	Granby, Phœnix.....	" 20	Alfred Thors ..	"	While barring a rock in chute the bar slipped, throwing him from platform into car; cut around left leg and bruises on body.
9	War Eagle.....	" 23	Jos. Pendray..	Timberman .	Fell down open chute and was instantly killed.
10	Jewel-Denero.....	" 31	Alex. Jordan..	Miner	Killed by premature blast.
11	Jewel-Denero.....	" 31	Thos. Edwards	"	Killed by blast while going to assistance of another man who was killed in premature blast.
12	Le Roi, Rossland.....	Apr. 17	L. De Grangio.	Mucker.....	Slipped on turn-sheet and broke his leg.
13	Centre Star	" 24	John Boyle....	Trammer ...	While travelling on electric locomotive his head struck corner of chute; skull fractured and died five hours later.
14	Granby, Phœnix.	" 24	Antonio Lippa.	Mucker.....	Rock from back rolled down stope and broke Lippa's leg.
15	Granby, Phœnix.....	" 24	Martin Ferri ..	"	Exploded detonating-cap with his own lamp, causing cuts about face and hands and slightly rupturing his right eye.
16	Rawhide.....	May 1	J. McCormick.	Shiftboss ...	Found asphyxiated by powder-fumes.
17	Rawhide.....	" 1	T. Pritchard ..	Blaster	Same accident as previous; asphyxiated.
18	Motherlode, Sheep creek	" 12	R. Henderson .	Mucker.....	Struck by steel falling down raise, and his head was cut and left shoulder and side injured.

LIST OF ACCIDENTS IN METALLIFEROUS MINES, WEST KOOTENAY.—*Continued.*

No.	Mine.	Date.	Name.	Occupation.	Details.
19	Granby, Phœnix.....	May 19	J. Hendrickson	Pipeman....	Pipe fell on his thumb, fracturing the bone.
20	Granby, Phœnix.....	" 19	Dan Povich ...	Head brake-[man	While barring ore he slipped and broke his lower jaw and loosened some teeth.
21	Granby, Phœnix.....	June 2	Adof Johnson .	Boss timber-[man	Went back to examine missed hole; just as deceased arrived blast went off and killed him.
22	Granby, Phœnix.....	" 2	James Logan..	Timberman's [helper	Went back to examine missed hole, which exploded just as he got to it. Loss of left eye; injuries to arms, legs, abdomen, chest, neck, and face.
23	Granby, Phœnix.....	" 5	Amie Rennie..	Barman	Rennie was up a ladder trimming up stope; a rock fell and knocked out foot of ladder, causing Rennie to fall and injure his shoulder.
24	Granby, Phœnix.....	" 12	E. J. Rowlands	"	While barring down after a shot some rock fell on him, causing fractured left arm, lacerated tongue, and loss of four teeth.
25	Mother Lode, Greenw'd	" 12	R. Pavlinac...	Miner	Rock from the face fell on his left leg, breaking it just above the ankle.
26	Motherlode, Sheep creek	" 13	Carl A. Heiber	Mill [mechanic	Had just overhauled compressor and was making the test run; his hand got caught between cross-head on piston and the frame, and two fingers got mangled.
27	Standard, Silverton....	" 18	Geo. Munson..	Mucker.....	Rock fell in stope and crushed his left hand, resulting in loss of one finger.
28	Granby, Phœnix.	" 23	R. Elmgren...	Miner	A piece of steel from a drill hit him in the eye, cutting the eyeball and causing painful injury.
29	Granby, Phœnix.....	" 25	Thomas Fisher	"	While bulldozing in an open stope a rock fell from the back and killed him instantly.
30	Granby, Phœnix.....	July 2	R. O. Vick....	Mucker-boss	Rock from back hit him, causing double fracture of the right humerus, fracture of four ribs, and bruises on back and hip.
31	Granby, Phœnix.....	" 5	Frank Riordan.	Motorman ..	Motorman Riordan, with Shiftbosses McDougall and Tatham, was standing on track near motor, when the whole foot-wall, consisting of many thousands of tons, caved, burying them; killed instantly.
32	Granby, Phœnix.....	" 5	W. A. Tatham	Shiftboss ...	Same accident as previous; instant death.
33	Granby, Phœnix.....	" 5	J. F. McDougall	" ...	Same accident; instant death.

LIST OF ACCIDENTS IN METALLIFEROUS MINES, WEST KOOTENAY.—*Concluded.*

No.	Mine.	Date.	Name.	Occupation.	Details.
34	Motherlode, Sheep creek	July 14	Dan Kelly	Mucker.....	While tramming with empty car he collided with full car; Kelly was jammed between his own car and the side of the tram-shed, causing bruises.
35	Golden Horn, Ymir....	" 17	George Walker	Miner	Premature blast, caused by faulty fuse, killed him.
36	Granby, Phœnix.....	" 19	SteveGalovitch	Mucker.....	Piece of rock entered his eye; did not report to doctor until 25th, when his eye was found to be in bad shape.
37	Granby, Phœnix.....	Dec. 16	Thomas Lloyd.	Chuteman's [helper	Rock at chute struck his left hand, causing loss of one finger and laceration of another.
38	War Eagle, Rossland ..	" 31	Frank Rosso ..	Mucker.....	Rock fell on him, breaking right leg below knee and two ribs.

REPORT BY ROBERT STRACHAN, SIMILKAMEEN DISTRICT.

39	Nickel Plate, Hedley...	May 13	E. Williams...	Miner	Blasted, owing to a quick fuse not enabling him to get far enough away; badly cut and bruised and subsequently died as a result of blood-poisoning.
40	Nickel Plate, Hedley...	" 13	Alex. Axel....	"	Premature blast owing to faulty fuse caused cuts and bruises on head and arms.

REPORT BY JOHN NEWTON, COAST DISTRICT.

41	Granby, Anyox.....	Mar. 26	Gust Carlson..	Miner	Asphyxiated by fumes from blasting; went through drift too soon, although warned.
42	Granby, Anyox.....	June 13	George Dragish	"	Buried by a slide of rock while setting up a machine at the mouth of a stope; killed.
43	Granby, Anyox.....	" 13	Steve Dozich ..	"	Same accident; killed.
44	Britannia	" 21	A. Cretonovitch	Blaster's [helper	Powder exploded while he was loading hole and tamping; killed.
45	Britannia	" 21	James Duggan.	Miner	Premature explosion caused injury to his eyes.
46	Britannia	July 7	J. P. Peddel ..	Electrician's [helper	Caught in tramway bucket at station and badly mangled; instant death.

TABULATED LIST OF ACCIDENTS IN METALLIFEROUS MINES, 1914.

	Cause of Accident.	Extent of Injury.			Total.
		Fatal.	Serious.	Slight.	
A	Blasting	7	2	1	10
B	Defective powder	2	..	1	3
C	Drilling into old holes containing powder	1	..	..	1
D	Powder in muck	..	..	..	..
E	Shafts and cages, accidents connected with	..	..	..	..
F	Falling down shafts or winzes	..	..	1	1
G	Falling down chutes	1	..	1	2
H	Mine-cars	1	1	1	3
I	Rock falling in stopes, levels, etc	6	4	4	14
J	Rock falling down chutes or openings	..	1	1	2
K	Timbering	..	..	..	..
L	Miscellaneous, underground	..	3	4	7
M	Miscellaneous, surface	1	..	2	3
	Totals	19	11	16	46
Accidents for each 100,000 tons ore mined		0.873	0.506	0.736	2.15
Accidents for each 1,000 men employed		4.55	2.63	3.83	11.01

COAL-MINING IN BRITISH COLUMBIA.

BY WM. FLEET ROBERTSON, PROVINCIAL MINERALOGIST.

During the year 1914 there was mined in the various collieries of the Province 2,166,428 tons (2,240 lb.) of coal, a decrease from the preceding year of 404,332 tons, equivalent to 15.7 per cent.

This decrease, while it is considerable, can be accounted for, and the cause is only a temporary one which is gradually disappearing, so that the outlook for normal conditions in the near future seems propitious when the upsetting cause is removed.

The decreased coal-output is undoubtedly entirely attributable to the war—not acting directly, but through the allied industries which serve as consumers for the colliery products, an illustration of the interlocking of the modern commercial businesses.

In the interior of the Province the effect of the war was first felt in the complete demoralization of the metal markets, which are essentially "world markets." This led to the immediate shutting-down of all the larger copper-mines and smelters, thus removing an important factor in the market for coal and coke.

In turn, this reacted upon the volume of freight to be handled by the railways, causing thereby a very great reduction in the consumption of fuel in locomotives.

Since the close of the year the metal markets have recovered from the panic, and, due to the great demand for munitions of war, the prices of most of the metals have risen above the normal, the demands for metal being sufficiently great to justify such increased price. Under these conditions the metal-mines are resuming work, and even striving to make a greater than normal output, which will stimulate the coal production immediately.

In the Coast District the war made itself felt through different channels, as there were no smelters in operation, but the activity of German cruisers so effected transpacific shipping as to greatly reduce the quantity of coal used for this purpose; but, for all this, the Vancouver Island collieries in the Coast District made a slightly increased output, the shortage occurring in the Nicola section of the district.

Production was not interfered with to any extent in any part of the Province, although a strike was nominally in progress in Vancouver Island collieries. In fact, it is claimed that much more coal could have been produced had there been a demand for it.

The following table shows, for the past eight years, the output and the *per capita* production of the various districts:—

Year.	District.	Gross Tons of Coal mined during Year.	Total No. of Employees at Producing Collieries.	Tons of Coal mined per Employee for Year.	Number of Men employed Underground in Producing Collieries.	Tons of Coal mined per Underground Employee for Year.
1907	East Kootenay District	876,731	2,290	383	1,527	574
	Coast District	1,342,877	3,769	356	2,862	469
	Whole Province	2,219,608	6,059	366	4,389	506
1908	East Kootenay District	883,205	2,524	350	1,746	506
	Coast District	1,226,182	3,549	345	2,686	456
	Whole Province	2,109,387	6,073	347	4,432	476
1909	East Kootenay District	923,865	2,427	380	1,737	532
	Coast District	1,476,735	3,991	370	2,976	496
	Whole Province	2,400,600	6,418	374	4,713	509
1910	East Kootenay District	1,365,119	3,111	439	2,374	575
	Coast District	1,774,116	4,647	382	3,529	502
	Whole Province	3,139,235	7,758	404	5,903	532
1911	East Kootenay District	442,057	2,197	201	1,585	272
	Coast District	1,855,661	4,676	397	3,627	511
	Whole Province	2,297,718	6,873	334	5,212	440
1912	East Kootenay District	1,261,212	2,410	523	1,780	708
	Coast District	1,764,497	4,720	374	3,495	504
	Whole Province	3,025,709	7,130	424	5,275	574
1913	East Kootenay District	1,331,725	2,666	500	1,965	678
	Coast District	1,239,035	3,777	328	2,865	433
	Whole Province	2,570,760	6,443	399	4,830	532
1914	East Kootenay District	955,183	2,397	399	1,749	547
	Coast District	1,211,245	3,335	363	2,518	481
	Whole Province	2,166,428	5,732	379	4,267	508

While no figures can be given as to the actual cost of mining in the different fields, the *per capita* production of these fields is of interest, as having a bearing upon the working costs and as indicating the mining facilities existing and the improvement made in these conditions from year to year.

It will be seen from the foregoing table that the production *per capita* increased more or less regularly up to the year 1912, but that the years 1913 and 1914 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.

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 other quarter went to supply the demands of the south-eastern part of the Province—its domestic needs, its railways, steamboats, mines, and smelters.

Coke, a product of the coal-mines, is sold in the same markets, with the difference that the local consumption—chiefly by the smelters of Trail and the Boundary District—takes over 77 per cent. of the product, while 23 per cent. is exported to the States mentioned.

As regards the marketing conditions in this field, the East Kootenay collieries are, however, brought into direct competition with the collieries of Alberta just over the Provincial boundary-line, all these collieries being in the same coalfield, with practically the same grade of coal and working under similar conditions.

This competition has kept the price obtainable for coal at from $2.25 to $2.50 a ton, with little probability of any material increase in price, owing to the facility with which new collieries can be opened up and the very large reserve areas of coal limits in that district; a description of these reserves was given in the Report of this Bureau for the year 1909.

The Coast District may be subdivided into two fields—the Nicola-Princeton field and the Vancouver Island field—in which the markets differ considerably.

In the former 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 demand for coal from the larger coasting steamers and from the railways has in past years diminished, as the Canadian Pacific Railway main line engines are nearly all burning California crude oil, and a large coasting steamer burning coal is now an exception.

Owing to the existing conditions in the Island collieries, prices have been maintained as high or higher than for preceding years; in fact, the high price of coal on the Coast is one of the chief reasons for the marked increase in the use of California oil-fuel. It does not seem at all likely, either, that the present price of coal on the seaboard, of from $4 to $4.50 a ton f.o.b., will decrease for some time.

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 Company, of Nanaimo, and the Canadian Collieries (Dunsmuir), Limited (formerly the Wellington Colliery Company), these last two operating on Vancouver Island.

In addition to these large shippers, very appreciable shipments have been made by the Hosmer Mines, Limited, and the Corbin Coal and Coke Company, in East Kootenay; by the Nicola Valley Coal and Coke Company and the Inland Coal and Coke Company, both of the Nicola Valley; by the Princeton Coal and Land Company, of Princeton; and by the Pacific Coast Coal Mines, Limited, and Vancouver & Nanaimo Coal Mining Company, both operating on Vancouver Island, near Nanaimo.

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 1914 about 60 per cent. of the coal, sold as such by the collieries of the Province, was consumed in British Columbia; and the remaining 40 per cent. was exported to the United States, including Alaska. Of the coke sold, about 77 per cent. was consumed in British Columbia, and the remaining 23 per cent. was exported to the United States.

The distribution of this output of coal and coke is shown in the following table:—

COAL AND COKE PRODUCED, EXPORTED, ETC., BY PROVINCE DURING YEAR 1914.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	864,160		180,167	
" export to United States	602,709		54,313	
" " other countries				
Total sales		1,466,867		234,480
Lost in washing	147,229			
Used in making coke	355,461			
" under colliery boilers, etc.	175,031		3	
Total for colliery use		677,721		3
Stocks on hand first of year	17,504		2,671	
" last of year	39,344		2,765	
Difference added to stock during year		21,840		94
Output of collieries for year		2,166,428		234,577

Coal (used as such), 1,810,967 tons = $6,338,385. Coke, 234,577 tons = $1,407,462.

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	200		92		292	
Whites—Miners	1,954				1,954	
Miners' helpers	253				253	
Labourers	870		501		1,371	
Mechanics and skilled labour	540		449		989	
Boys	60		80		140	
Japanese—Miners	70				70	
Helpers	44				44	
Labourers	9		3		12	
Chinese — Miners	113				113	
Helpers	90				90	
Labourers	64		340		404	
Indians — Labourers						
Totals	4,267		1,465		5,732	

COLLIERIES OF THE COAST DISTRICT.

The gross output of the Coast collieries, including the Nicola valley, for the year 1914 was 1,211,245 tons (of 2,240 lb.) of coal actually mined, while some 18,635 tons was added to "stock," making the actual consumption of coal 1,192,610 tons.

Of this gross consumption 937,390 tons was sold as coal, 107,991 tons was consumed by the producing companies as fuel, and 147,229 tons was lost in washing; no coal was used in making coke. Although no coke was produced, 2,314 tons was taken from stock and sold.

Formerly, in 1902, the Coast collieries exported to the United States 75 per cent. of their coal; in 1910 they exported to there only 24.5 per cent. of their product, 71.3 per cent. of the output being consumed in Canada. In 1911, 76.1 per cent. of the coal sold was for consumption in Canada, 21.6 per cent. was exported to the United States, and 2.3 per cent. to other countries.

In 1912, 71.25 per cent. was sold for consumption in Canada, 21.25 per cent. exported to the United States, and 7.47 per cent. to other countries.

In 1913, 89.8 per cent. was sold for consumption in Canada, and the balance, or 10.2 per cent., was exported to the United States.

In 1914, 77.3 per cent. was sold for consumption in Canada, and the balance, or 22.7 per cent., was exported to the United States.

The following table gives an aggregate summary of the output of the Coast collieries for the year 1914, and shows the dispositions made of such product:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	724,066		2,314	
" export to United States	213,324			
" " to other countries				
Total sales		937,390		2,314
Lost in washing	147,229			
Used under colliery boilers, etc	107,991			
Total for colliery use		255,220		
Stocks on hand first of year	17,115		2,314	
" last of year	35,750			
Difference { * added to / † taken from } stock during year		*18,635		†2,314
Output of colliery for year		1,211,245		*Nil.*

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	137		57		194	
Whites—Miners	1,053				1,053	
Miners' helpers	140				140	
Labourers	618		151		769	
Mechanics and skilled labour	143		232		375	
Boys	37		34		71	
Japanese—Miners	70				70	
Helpers	44				44	
Labourers	9		3		12	
Chinese — Miners	113				113	
Helpers	90				90	
Indians — Labourers	64		340		404	
Totals	2,518		817		3,335	

The following tables show the output of coal, and the disposition made of it in the sub-divisions of the Coast District:—

COAL-OUTPUT, ETC., 1914, VANCOUVER ISLAND SUB-DISTRICT.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	602,613		2,314	
" export to United States	210,719			
" " other countries				
Total sales		813,332		2,314
Lost in washing	146,670			
Used in making coke				
Used under colliery boilers, etc.	93,833			
Total for colliery use		240,503		
Stocks on hand first of year	16,515		2,314	
" last of year	34,994			
Difference { * added to / † taken from } stock during year		*18,479		†2,314
Output of colliery for year		1,072,314		*Nil*

COAL-OUTPUT, ETC., 1914, NICOLA-PRINCETON SUB-DISTRICT.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	121,453			
" export to United States	2,605			
" " other countries				
Total sales		124,058		
Lost in washing	559			
Used in making coke				
" under colliery boilers, etc	14,158			
Total for colliery use		14,717		
Stocks on hand first of year	600			
" last of year	756			
Difference added to stock during year		156		
Output of collieries for year		138,931		

COLLIERIES OF THE EAST KOOTENAY DISTRICT.

The gross output of the collieries of the East Kootenay District for the year 1914 was 955,183 tons (2,240 lb.) of coal actually mined, which, with 3,205 tons added to stock, made the actual consumption of coal, 951,978 tons. Of this gross consumption of coal, 529,477 tons was sold as coal, 67,040 tons was consumed as fuel by the producing companies, while 355,461 tons was converted into coke, producing 234,577 tons, of which 3 tons was used under the companies' boilers, while 2,408 tons was added to stock, making the coke sales for the year 232,166 tons.

The East Kootenay collieries exported to the United States about 73.4 per cent. of the coal sold and about 23.4 per cent. of the coke.

The following table gives an aggregate summary of the output of the East Kootenay collieries for the year 1914 and shows the dispositions made of such product:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	140,094		177,853	
" export to United States	389,383		54,313	
" " to other countries				
Total sales		529,477		232,166
Used in making coke	355,461			
" under colliery boilers, etc.	67,040		3	
Total for colliery use		422,501		3
Stocks on hand first of year	389		357	
" last of year	3,594		2,765	
Difference added to stock during year		3,205		2,408
Output of colliery for year		955,183		234,577

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	63		35		98	
Whites—Miners	901				901	
Miners' helpers	113				113	
Labourers	252		350		602	
Mechanics and skilled labour	397		217		614	
Boys	23		46		69	
Japanese						
Chinese						
Indians						
Totals	1,749		648		2,397	

COAL POTENTIALITIES OF BRITISH COLUMBIA.

In addition to the coal-mines actually producing and whose outputs are included in the foregoing tables, there are a number of important fields which have not as yet reached the producing stage—some of these partly developed and equipped, and others only prospected.

The great unworked and only partly developed coal-seams in the Rocky Mountains coal-field lying to the north of the field now being exploited were fully described by the writer in the 1909 Report, since when no great amount of development-work has been done. Very successful development has been going on in the Flathead Valley.

Near Princeton, in addition to the colliery of the Princeton Coal and Land Company, which shipped this year some 19,535 tons of very good lignitic coal, a new colliery—the United Empire—last year shipped 1,752 tons, but this year did not ship.

In the same section the Coalmont Collieries (formerly the Columbia Coal and Coke Company) has continued development all year with a force of ten men, but has not as yet shipped extensively. The plan of development adopted by the old company did not prove very successful, and the property has been taken over by a Vancouver syndicate, which is conducting the work along different lines.

In the Nicola valley the Pacific Coast Collieries Company has continued development with a small force, and, although only shipping 560 tons, reports indicate that the development has been successful in proving seams of good coal.

The coalfield of the Peace River valley was described in the 1912 Report by C. F. J. Galloway, which indicates that, although the seams are thin, the coal is of exceptionally good quality.

The Groundhog coalfield was visited by the writer during the summer of 1912, an account of which will be found in the Report of that year. The extent of the coalfield proved to be all that was claimed, but the quality of the seams as exposed in the openings seen in the southern end of the field was very disappointing. The field has only been tested in one part, and it seems quite possible that further prospecting may develop cleaner seams of coal; the number and thickness of the seams is all that could be desired.

Some development has been carried out on the Nass watershed, at the southern end of the field, with very encouraging results, samples certainly showing a lower percentage of ash.

The coalfields on the Bulkley, Telkwa, and Zymoetz rivers, near the line of Grand Trunk Pacific Railway east of Hazelton, have all been undergoing development, but it is as yet premature to say how important they may prove to be. An encouraging report on the last-mentioned field will be found on pages 206 *et seq.* of this Report.

On the Queen Charlotte islands, at the southern end of Graham island, on Skidegate inlet, a colliery had been partly equipped, but no output was made; no work was done on the property this past year, the coal not proving satisfactory fuel.

In the interior of Graham island to the east of the coal-outcrops at Camps Robertson and Wilson, systematic boring has been in progress all year; a description of work done will be found on pages 164 *et seq.* of this Report.

Drilling has been going on in the northern part of the island near Masset, but no word has been received of commercial coal-seams having been proved.

No further development has been done on the coal area on Bowron river (formerly Bear river), in the Cariboo District, but reports on the field will be found on pages 67 *et seq.* of this Report.

On Vancouver Island the coalfield on Quatsino sound has been undergoing development in a small way, with as yet no definite results.

The large producing companies have all been quietly doing extensive development-work—the Canadian Collieries, near Campbell river and south of Cumberland, and it is understood much of this has been satisfactory, but details are not available for publication.

The Western Fuel Company has opened a new shaft—the Reserve shaft—which will develop a new and very extensive seam of coal. Two shafts, each 10 x 26 feet inside of timbers and 350 feet apart, have been sunk; no expense or trouble, which would tend to increase the safety or economy of future work, is being spared in opening up this new colliery—a policy for which the present management has already acquired an enviable reputation.

The Pacific Coast Coal Mines, Limited, has continued the development of its Suquash Colliery, and has this year made considerable progress towards the erection of a permanent plant.

That these fields contain a large reserve of coal there is absolutely no doubt, and many of them will be developed and producing as soon as the market demands it and the transportation facilities can be provided.

INSPECTION OF COAL-MINES, 1914.

VANCOUVER ISLAND AND 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, each under the charge of a District Inspector.

The headquarters of the Inspectors of both the Nanaimo and Comox Inspection Districts is 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.

NANAIMO INSPECTION DISTRICT.

JOHN NEWTON, INSPECTOR (OFFICE, NANAIMO).

The collieries operating and producing coal during the year in this Inspection District, including the new mines that have been started, were:—

NANAIMO: The Western Fuel Company—No. 1 shaft, Protection shaft, and No. 4 shaft, Northfield mine, and sinking shafts at Reserve Colliery.

EXTENSION: The Canadian Collieries (Dunsmuir), Limited (formerly the Wellington Colliery Company)—Nos. 1, 2, and 3 mines, all worked from what is known as the No. 1 tunnel, and No. 4 mine, worked by a shaft.

Pacific Coast Coal Mines, Limited—Fiddick Colliery, South Wellington, Cranberry District, Nos. 1 and 2 slopes, and the new shafts at the Morden mine.

Vancouver-Nanaimo Coal Mining Company, Limited—New East Wellington Colliery, Mountain District, Nanaimo, No. 1 slope.

COMOX INSPECTION DISTRICT.

HENRY DEVLIN, INSPECTOR (OFFICE, NANAIMO).

The collieries operating and producing coal during the year in this Inspection District, including the new mines that have been started, were:—

CUMBERLAND: The Canadian Collieries (Dunsmuir), Limited—Nos. 4 and 7 slopes, and Nos. 5 and 6 shafts, and two new shafts at No. 8.

Pacific Coast Coal Mines, Limited—Suquash Colliery, Nos. 1 and 2 slopes, and shaft.

NICOLA-PRINCETON INSPECTION DISTRICT.

ROBERT STRACHAN, INSPECTOR (OFFICE, MERRITT).

The collieries operating during the year in this Inspection District, including the new mines, that have been started, were:—

NICOLA VALLEY: The Middlesboro Colliery of the Nicola Valley Coal and Coke Company, Merritt—Nos. 2, 3, 4, 5, 6, and 7 mines.

Inland Coal and Coke Syndicate, Merritt—One shaft and 3 slopes.

Diamond Vale Colliery Company, Merritt—No. 3 mine.

Pacific Coast Colliery Company, Merritt—No. 1 slope and No. 2 shaft, adjoining the Middlesboro Colliery.

PRINCETON: Princeton Coal and Land Company's Princeton Colliery—No. 1 slope.

United Empire Mining Company—One adit tunnel.

COALMONT: Coalmont Collieries, Limited—Developing only.

MIDWAY: Boundary Mining and Exploration Company—Developing only.

NANAIMO INSPECTION DISTRICT.

REPORT OF JOHN NEWTON, INSPECTOR.

I have the honour to submit my annual report for the year ending December 31st, 1914, on the various coal-mines under my inspection, consisting of the Western Fuel Company, Pacific Coast Coal Mines, and the Vancouver-Nanaimo Coal Mining Company.

A short description is given of each colliery in this district, with names of the certificated officials. Attached is a list of accidents that occurred during the year, amounting to eighteen, four of which were fatal, six serious, and eight slight. Eleven of these, including the four fatal, occurred at the Western Fuel Company's mines, four at the Vancouver-Nanaimo Coal Company's mines, and three at the Pacific Coast Coal Mines.

The causes of these accidents were: Falls of roof, 6, 1 of which was fatal; caught between cars 6; burning by ignition of gas, 1; runaway car, 1; going back on shots, 2; fell from bucket in sinking shaft, 1; injured in sawmill, 1.

In the case of Munroe and McIntosh, rockmen, who were fatally injured by going back on a shot in No. 3 slope, No. 1 mine, of the Western Fuel Company's mine, the deceased persons had no instructions to fire any shots. The night-shift fireboss, T. Mills, in making his examination, asked the men if they had any shots. They said: "No, they had enough to do in getting ready for the morning shift." After the fireboss had proceeded with his examinations, they fired two holes (which they knew to be against the "Coal-mines Regulation Act"). Thinking both shots had gone off, they went back to the face to see if the shots had done their work, and one of the shots went off, killing both men instantly.

James Berry, a fireboss, lost his life by falling off the rim of the bucket in the sinking-shaft at the Reserve mine. In the face of the notices posted up at the pit-head prohibiting any person from riding on the rim of the bucket in the sinking-shaft, this man, an official who was supposed to see these instructions carried out, deliberately violated these instructions, resulting in the loss of his life.

Steve Morris, a loader, was instantly killed in No. 2 slope, No. 1 mine, by a fall of rock. The fireboss, S. Mottishaw, ordered Morris out of the place until he could secure the roof. While Mottishaw was getting a prop for that purpose Morris went back into his place again, and was caught by the rock and killed instantly.

All the fatal accidents in my district were caused by wilful negligence on the part of the injured persons, and could have been avoided if the rules and regulations had been carried out, as laid down in the "Coal Mines Regulation Act," and special rules of the company.

In the face of all legislation that has been passed by the Government for the safety of the workmen, and the careful attention of the officials in charge of the mines, workmen will take these chances, thus endangering their own lives and those of their fellow-men by doing so.

Accidents from falls of coal and roof, I am pleased to report, have been reduced during the present year.

At the beginning of the year the Chief Inspector, in conjunction with the mine managers of the various mines, adopted a special rule whereby a method of systematic timbering has been carried out during the year, which I think can be justly said to have reduced the number of accidents from falls of coal and roof.

MINE-RESCUE WORK.

Regarding this branch of work, I am glad to be able to report that some of the companies in my district, especially the Western Fuel Company, have taken this work up in a manner which reflects a great credit to both managers and workmen.

During the year, the Western Fuel Company appointed Geo. Yarrow in charge of its rescue-station. Mr. Yarrow is the holder of a Government certificate and a second years' St. John Ambulance certificate.

This company has sixty-one men fully trained in mine-rescue work; twenty of these are holders of Government certificates. In addition to this, thirteen are holders of St. John Ambulance certificates, seven first year and six second-year certificates.

At the beginning of the coming year a system of training in mine-rescue work will be adopted. Sixteen men will be in training each month; half will be new men, and the remainder will be fully trained men. This company is the first in the Province to pay their officials and workmen for the time spent in the training-station.

The Vancouver-Nanaimo Coal Company has twenty men fully trained in this work. Sixteen of these are holders of Government certificates, and six are holders of first years' St. John Ambulance certificates. It also has in connection with its mine a fully trained ambulance corps. The company's team took first prize in the competition in Victoria.

The Pacific Coast Coal Mines, Limited, is the only company that has not taken the interest in this work that they should. A small station was erected for this work, but owing to the labour conditions it was used for other purposes, but now the labour troubles are over this company intends to start the training of the workmen as laid down in the "Mines Act."

In connection with this work the Government has a fully equipped rescue-station, situated near the No. 1 shaft of the Western Fuel Company, with J. D. Stewart in charge. This station is within easy reach of all the mines in this district.

The equipment of the companies is as follows:—

Western Fuel Company.—Four 2-hour Draeger apparatus, 1904 and 1909 type; four 2-hour Proto apparatus; three 1-hour Proto apparatus; one pulmotor; one recharging pump; sixteen oxygen storage-cylinders; eight 2-hour cylinders; eight Proto cylinders; five 1-hour Proto cylinders; and a sufficient supply of potash regenerators.

In addition, this company has built a fine rescue ambulance railway-car for any emergency at the Reserve mine. The car is of a standard gauge and of the following dimensions (inside measurement): Width, 8 feet 8 inches; length, 27 feet; height, 8 feet. It is well lighted by electric lights from storage batteries; it is also well supplied with the necessary antiseptic dressings, splints, stretchers, wash-bowls, boiler, and heater.

Vancouver-Nanaimo Coal Company.—Two 2-hour Draeger apparatus, 1904 and 1909 type; recharging-pump, pulmotor, and a sufficient supply of potash regenerators.

Pacific Coast Coal Mines.—Two 2-hour Draeger apparatus, 1904 and 1909 type; recharging pump, pulmotor, and a sufficient supply of potash regenerators.

In addition to those qualified in first aid, all the mines have lessons in first-aid work, taught by Drs. O'Brien and Ingham and examined by Dr. Drysdale.

During the year the coal production was increased, but is not yet up to the conditions of previous years.

The strike which took place on May 1st, 1913, did not terminate until Augnst 19th, 1914.

The Western Fuel Company.

Head Office—San Francisco, Cal.

Capital, $1,500,000.

Officers.	*Address.*
John Lawson, President or Chairman,	San Francisco, Cal,
Jas. B. Smith, Vice-President or Vice-Chairman,	San Francisco, Cal.
D. C. Norcross, Secretary,	San Francisco, Cal.
S. V. Smith, Treasurer,	San Francisco, Cal.
Thomas R. Stockett, General Manager,	Nanaimo, B.C.
John Hunt, Superintendent,	Nanaimo, B.C.
T. R. Jackson, Mine Manager, No. 1 Mine,	Nanaimo, B.C.
Geo. Wilkinson, Mine Manager, Reserve Mine,	Nanaimo, B.C.

The above company has operated the following collieries at Nanaimo during the past year, namely: No. 1 or Esplanade shaft, Nanaimo; Protection Island mine, No. 4 Northfield mine, and the Douglas slope.

The following returns show the combined output of all the company's mines for the past year:—

RETURNS FROM WESTERN FUEL COMPANY'S MINES FOR YEAR 1914.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	133,860			
" export to United States	125,671			
" " other countries				
Total sales		259,531		
Used in making coke				
Used under colliery boilers, etc.	44,642			
Total for colliery use		44,642		
Stocks on hand first of year	522			
" last of year	6,913			
Difference added to stock during year		6,391		
Output of colliery for year		310,564		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	22		17		39	
Whites—Miners	188				188	
Miners' helpers	14				14	
Labourers	246		31		277	
Mechanics and skilled labour	65		67		132	
Boys	26		18		44	
Japanese						
Chinese—Labourers			111		111	
Indians						
Totals	561		244		805	

NANAIMO COLLIERY.

T. R. Jackson, Manager.

No. 1 SHAFT, ESPLANADE.

Geo. Bradshaw, Overman; R. Adam, J. Graham, A. Coombs, T. Parkinson, A. Rowan, J. Richards, W. Johnson, J. W. Jemson, J. Stubbard, J. Wallbank, J. White, W. Neave, E. W. Courtney, T. Mills, R. Seggie, J. Dudley, D. Broom, M. Woodburn, D. John, J. Nimmo, J. Sullavan, G. Jardine, J. McGuckie, J. Shipley, M.Gunnis, A. Smith, T. J. Wood, and R. Cox, Firemen.

No. 1 mine of the Western Fuel Company is situated at the south end of the Esplanade, in the city of Nanaimo, and has been in operation for many years, with good prospects for many years to come.

The present operations are at a depth of 600 to 1,200 feet below the surface, with a large submarine area. This shaft has three openings—viz., the main hoisting-shaft, Protection and Newcastle Island shafts. These shafts are connected and are part of the Douglas and Newcastle seams, all of which are equipped with hoisting apparatus in case of emergency.

Newcastle Seam, No. 1 North Level.

This seam is operated from the North level at a distance of about two miles from the No. 1 hoisting shaft, with slopes tunnelled off at the different points, to the lower or Douglas seam—namely, Nos. 1, 2, and 3 slopes, varying from a distance of 4,000 to 5,000 feet between, and covers a very extensive coal area. These slopes are all connected one with the other, making one continued working-face. The ventilation of this slope is obtained from Protection shaft and is connected with air-shafts to the upper seam.

This seam varies from 3 to 3½ feet in thickness, and is of a very hard nature; it is worked on the long-wall system, to which it is well adapted. Mining-machines of the "pick quick" (or bar machine) and the puncher type, operated by compressed air, are used to undercut the coal to a depth varying from 5 to 6 feet.

At the present time all the coal produced at the mine is hauled out of this North level by electric motors of the trolly type. During the year a new Westinghouse electric motor of the tandem type, 6 tons each, has been installed, which has improved the hauling capacity of this level.

Only pillar-extraction is in operation in this North level and in Protection mine, which is working in a part of the Douglas seam.

The ventilation of this mine is produced by a force-fan of the Guibal type, 9 x 18, and 100 h.-p., rope-driven, running 70 revolutions a minute, producing 100,000 cubic feet of air a minute, with a water-gauge of 2 inches. There is also an emergency exhaust-fan at Newcastle shaft always ready in case of accident.

On my last examination there was 80,000 cubic feet of air a minute passing into this mine, which is divided into three splits.

No. 1 Slope.—There was 10,500 cubic feet of air a minute passing into this section for the use of fifty-one men and eight horses, or an average of 140 cubic feet of air a minute for each unit employed. No explosive gas has been found; the timbering and roadways are in good order.

Upper Seam Pillars.—I examined all parts of these pillars and found them free from gas, and the faces well cogged and timbered up.

South Side of No. Slope.—There was 7,000 cubic feet of air a minute passing into this section for the use of eighteen men and four horses, or an average of 233 cubic feet of air a minute for each unit employed. No explosive gas found; timbering and roadways good.

No. 3 Slope.—There was 9,800 cubic feet of air a minute passing into this section for the use of forty-five men and six horses, or an average of 155 cubic feet of air a minute for each unit employed.

North Side of Main Heading, No. 2 Slope.—There was 12,000 cubic feet of air a minute passing into this section for the use of fifty-two men and eight horses, or an average of 157 cubic feet of air a minute for each unit employed. No explosive gas found; timbering and roadways good.

South Side of Main Heading.—There was 4,000 cubic feet of air a minute passing into this section for the use of twenty men and four horses, or an average of 125 feet of air a minute for each unit employed.

North-east Slope, No. 2 Slope.—There was 4,000 cubic feet of air a minute passing into this section for the use of twenty men and four horses, or an average of 125 cubic feet of air a minute for each unit employed. No explosive gas found; timbering and roadways good.

Protection Shaft.

This shaft is used for the raising and lowering of the workmen on the north side of the mine. Pillars are being extracted, a portion being hauled up by electric winches to No. 1 level, and the other portion, for the use of generating power, for the machinery installed on this island. When I made my inspection in December I found these pillars free from gas, faces well cogged and timbered up.

In the extraction of pillars, only "permitted explosives" are used, fired by electric batteries, and safety-lamps exclusively are in use.

The machinery installed on Protection island is as follows: Two Canadian Rands, one supplying 2,500 and the other 1,800 cubic feet of air a minute for supplying power to the mining-machines and pumps in this district. The air is conveyed through a 7-inch line to No. 1 level, there connecting with a pipe-line of the same size from No. 1 shaft, making a complete circuit.

Douglas Seam, South Side.

This part of the mine forms the deepest workings of No. 1 mine, but has not been in operation since May 1st, 1913, when water was turned in to drown a fire that existed in a portion of this section.

Operations were started on December 17th 1913, to pump the water out again, and have been kept up continually. At the present time the water is nearly out of the Diagonal slope, but it will be months before the water is out of No. 7 section. At the present outlook, the opening of this section will be slow, owing to caves and other troubles that were unforeseen.

The ventilation of this slope is produced by a Sirocco fan, rope-driven, ratio 3½ to 1, size 90 inches, running 250 revolutions, producing 195,000 cubic feet of air a minute, with a 4-inch water-gauge, 225 horse-power.

A second Sirocco fan, in every way modernly equipped, has been installed, and is used alternately with the original Sirocco fan, and is kept under steam for cases of emergency.

South Side Diagonal Slope.—I examined this section and found it free from gas and the ventilation good.

On all the different dates I examined the rope inspector's report-book on all ropes and winches, and found all reported in good condition.

The following are the official returns from the No. 1 shaft and Protection Island collieries for the year 1914:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	133,639			
" export to United States	125,635			
" " other countries				
Total sales		259,274		
Used in making coke				
Used under colliery boilers, etc.	44,201			
Total for colliery use		44,201		
Stocks on hand first of year	259			
" last of year	6,874			
Difference added to stock during year		6,615		
Output of colliery for year		310,090		

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	17	.....	11	.....	28	.....
Whites—Miners	188	3.46 - 7.00	.....	.....	188	.....
Miners' helpers	14	3.02	.....	.....	14	.....
Labourers	229	3.02 - 3.85	9	2.75 - 3.00	238	.....
Mechanics and skilled labour	53	3.02 - 4.29	40	3.00 - 4.50	93	.....
Boys	26	1.21 - 2.66	12	.50 - 1.75	38	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese—Labourers	.....	.....	70	1.50 - 1.88	70	.....
Indians	.....	.....	.....	.....	.....	.....
Total	527	.....	142	.....	669	.....

Description and length of tramway, plant, etc.—North side of mine operated 295 days. Water removed from Diagonal Slope section of south side by December 28th, 1914. Lower part of Main slope and part of No. 7 level still under water from the flooding of August, 1913.

RESERVE MINE.

Geo. Wilkinson, Manager; Robt. Broom, Overman; J. Renny, W. Roper, J. Ovington, and A. Baxter, Firemen.

I examined all parts of this mine and found it free from gas and in a safe condition; ventilation good; roadways good. Only permitted explosives are used, fired by electric batteries, and safety-lamps are used exclusively.

All development-work at this mine was suspended on May 1st, 1913, by the strike called by the United Mine Workers of America.

A start was made to unwater the Main shaft on February 10th, 1914, and all the water was out by March 25th, 1914. A start was made to unwater the Auxiliary shaft on April 7th, 1914, and all was out by April 30th, 1914.

When the strike was declared the Main shaft had reached the coal at a depth of 1,043 feet. After resuming operations this shaft was sunk to a depth of 1,054 feet, to make a sump.

A temporary landing was then made and preparations made to prospect the seam before finally laying out the permanent shaft-bottom landing. From the temporary landing a prospect-slope was driven to the dip in the coal for a distance of 136 feet; then an incline was driven to the raise for a distance of 55 feet. These workings proving the continuity of the seam and also the pitch, it was decided to go up the shaft and locate the permanent shaft landing at 955 feet. At this point a rock tunnel 16 x 8 was started south across the measures on a 1-per-cent. grade to the raise; this tunnel tapped the seam at a distance of approximately 180 feet. Another tunnel was driven north for a distance of 70 feet, making the run-around for the empty cars.

After this work was completed, work was started on the buntons and guides. This work has all been completed and the cages put on ready for hoisting coal.

During the enforced idleness caused by the strike the construction of the permanent pit-head and screening plant at the Main shaft was started. This work has all been completed ready for the handling of coal.

The shaft-bottom landing at the Main shaft has been laid out on the most up-to-date methods for handling of large quantities of coal. All loaded cars will be caged from one side. The shaft landing will be automatic as near as it is possible to make it. The rock tunnel from the shaft to the coal will be the main landing for loaded cars. This will be double-tracked the full length and have diamond cross-over switches, so that cars can be caged from either track to either cage. These tracks are laid with 30 lb. rails and on a grade of 1 per cent. in favour of the loaded cars from the Main level to the shaft, making the car fall gently by gravity to the cages. To take care of the empty cars two separate run-arounds are made, one on each side of the shaft.

After the empty car leaves the cage it runs by gravity for a distance of 45 feet on a 5-per-cent. grade; then runs a short distance up a 10-per-cent. grade, which reverses the direction of the car by back-switching. After back-switching the car runs back along the empty track for a distance of 40 feet on a 1½-per-cent. grade; then 100 feet on a 1-per-cent. grade. At this point it is elevated by power for a distance of 132 feet on a 5-per-cent. grade; then released from this point it runs by gravity back to the main haulage level. When the strike occurred the Auxiliary shaft was down 822 feet; since operations were resumed this shaft has been sunk to a depth of 982 feet.

The shaft landing is started at 948 feet, where a rock tunnel 16 x 8 is driven through the measures and reaches the seam at a distance of 215 feet. The grades and method of handling cars are the same as the Main shaft landing, with the exception of the return empty track, there only being one return empty track. The shaft landings are electric-lighted and are fitted with electric signals and a telephone system.

The ventilation of the two shafts is being supplied by two Sirocco fans. At the Main shaft a 100,000 cubic feet Sirocco is installed temporarily to supply ventilation for this shaft until a connection is made with the Auxiliary shaft, where the permanent fan is installed. The permanent installation is a pair of 90-inch Sirrocco fans connected to a 24 x 30 engine by a rope-drive. 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, now running with an engine-speed of sixteen revolutions a minute, are producing 140,000 cubic feet in the fan-drift. This fan is a very modern installation. The fan and engine are installed on substantial concrete foundations standing 80 feet distant from the shaft, and connected to the shaft by two concrete tunnels with a total area of about 110 square feet.

The drainage of the shaft at the present time is partly by pumping and partly by hoisting. The intention is to hoist all the water from these shafts, and for this purpose a large storage-sump is contemplated which will be between the two shafts in the solid rock; this will be capable of taking care of about forty-eight hours' water and can be enlarged if future conditions require it.

The surface equipment of this mine is of the most modern and up-to-date type. At the Main shaft a tipple building and screening plant is installed. After the loaded cars leave the cage they run by gravity to the tipple, which is the rotary type and holds three cars. After being emptied the car runs by gravity to a back-switch, reverses, and runs to a car-haul, where it is picked up and elevated to a point where it runs back by gravity to the shaft. After the coal is dumped it passes over shaking screens and is screened into various sizes as required. The coal upon leaving the screens passes over a picking-table and into railroad-cars. The tipple building is a very commodious structure and is capable of handling 2,000 tons of coal in nine hours.

The hoisting is accomplished at the Main shaft by a pair of 30 x 60 hoisting-engines, with a drum 14 feet in diameter, and fitted with all the most modern appliances, having steam Post brakes, steam reverse, and automatic overwinding device. The cages are equipped with safety-catches and detaching-hooks.

At the Auxiliary shaft a tipple building of similar design as the one at the Main shaft is under construction.

The hoisting-engine at the Auxiliary shaft is by the same builders as the one at the Main shaft, 24 x 54, with 12-foot drums, and fitted with same appliances as the Main shaft.

The power used underground is compressed air, which is furnished by a Rand cross-compound air-compressor (steam-driven) with a capacity of 2,500 cubic feet of air a minute.

The steam plant consists of four return-tubular boilers 150 horse-power each; the foundations are laid for two more. These when completed will give a steam plant of 900 horse-power. There is a thoroughly equipped machine-shop with all the latest appliances.

Other buildings consist of offices for the manager and clerk and a large store-room; also a wash-house with tubs and showers and a dry-house, carpenter-shop, two large Chinese bunk-houses, and concrete lamp-house, with requisites capable of handling 750 lamps.

All the buildings are steam-heated and electric-lighted, the power for lighting being furnished by two generators D.C. 120 amperes, 250 volts full load; these are belt-driven by a 14- x 4-inch Robb Armstrong high-speed engine. An auxiliary lighting set which consists of a D.C. high-pressure turbine is also installed in the power-house.

The water for the plant is obtained from Nanaimo river, and is pumped into two water-tanks with a capacity of 30,000 gallons each, and standing at an elevation of 70 feet; this also furnishes water with sufficient pressure for a fire system.

Six seven-roomed houses of a very high-class finish have been built for the official staff.

The following are the official returns of the Reserve Colliery for the year ending December 31st, 1914:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada				
" export to United States				
" " other countries				
Total sales				
Used in making coke				
Used under colliery boilers, etc.	435			
Total for colliery use		435		
Stocks on hand first of year				
" last of year	39			
Difference added to stock during year		39		
Output of colliery for year		474		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	5	.....	5	.....	10	.....
Whites—Miners	.....	.....	.....	.....	.....	.....
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	17	4.00 - 4.40	18	2.75 - 3.30	35	.....
Mechanics and skilled labour	12	4.50 - 5.50	26	3.34 - 4.00	38	.....
Boys	.....	.....	6	0.50 - 1.75	6	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	37	1.50 - 1.76	37	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	34	.....	92	.....	126	.....

Description and length of tramway, plant, etc.—Unwatering of shafts and development-work from March 1st, 1914, to December 31st, 1914, a total of 260 working-days. Main shaft sunk to a depth of 1,068 feet and a Landing level turned off at 953 feet. Counter-shaft sunk to a depth of 982 feet and a Landing level turned off at 949 feet. Employees are based on average number during ten months of operating.

NORTHFIELD MINE.

This mine has been closed down since the strike in May. In the meantime it was decided by the company to pull out what rails and pumps that could be obtained and abandon the mine for the present.

The following are the official returns of the Northfield Colliery for the year ending December 31st, 1914 :—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	221	.....	.....	.....
" export to United States	36	.....	.....	.....
" " to other countries	.....	.....	.....	.....
Total sales	.....	257	.....	.....
Used in making coke	.....	.....	.....	.....
Used under colliery boilers, etc	6	.....	.....	.....
Total for colliery use	.....	6	.....	.....
		263		
Stocks on hand first of year	263	.....	.....	.....
" last of year	.....	.....	.....	.....
Difference taken from stock during year	.....	263	.....	.....
Output of colliery for year	.....	*Nil.*	.....	.....

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 assistanee			1	3.50	1	
Whites—Miners						
Miners' helpers						
Labourers			4	3.00	4	
Mechanics and skilled labour			1	4.00	1	
Boys						
Japanese						
Chinese			4	1.50 - 1.65	4	
Indians						
Totals			10		10	

Description and length of tramway, plant, etc.—Mine not in operation during year and has been temporarily abandoned owing to labour troubles of 1913.

REPORT BY INSPECTOR DEVLIN.

Canadian Collieries (Dunsmuir), Limited.

Head Office—Victoria, B.C.

Capital, $15,000,000.

Officers.	*Address.*
Sir William Mackenzie, President,	Toronto, Ont.
A. D. McRae, Vice-President,	Vancouver, B.C.
R. P. Ormsby, Secretary,	Toronto, Ont.
A. J. Mitchell, Treasurer,	Toronto, Ont.
C. F. Compton, Asst. Secretary,	Victoria, B.C.
J. R. Lockard, General Manager,	Cumberland, B.C.

The Canadian Collieries (Dunsmuir), Limited, during the year 1911 acquired all the holdings of the Wellington Collieries Company, Limited, and during the past four years has been operating the following mines:—

The Extension Colliery, in the Cranberry District (Extension); J. H. Cunningham, manager.

The Comox Colliery, in Comox District; R. Henderson, J. H. McMillan, T. A. Spruston, managers at the several mines.

NOTE.—This latter colliery is in the Comox Inspection District, in which report will be found a description of the property and the details of production.

The following table shows the combined output of all this company's collieries during the past year:—

RETURNS FROM THE CANADIAN COLLIERIES MINES FOR YEAR 1914.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	300,011		2,314	
" export to United States	63,356			
" " other countries				
Total sales		363,367		2,314
Lost in washing	126,338			
Used under colliery boilers, etc.	24,035			
Total for colliery use		150,373		
Stocks on hand first of year	11,148		2,314	
" last of year	21,355		*Nil.*	
Difference { *added to / †taken from } stock during year		*10,207		†2,314
Output of colliery for year		523,947		*Nil.*

By-products—Clay, 937 tons.

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	75		13		88	
Whites—Miners	446				446	
Miners' helpers	94				94	
Labourers	200		54		254	
Mechanics and skilled labour	53		73		126	
Boys	4		4		8	
Japanese—Miners	70				70	
Helpers	44				44	
Labourers	9		3		12	
Chinese—Miners	113				113	
Helpers	90				90	
Labourers	64		156		220	
Total	1,262		303		1,565	

EXTENSION COLLIERY.

J. H. Cunningham, Manager.

The general supervision of all the mines of this colliery are entrusted to J. H. Cunningham, who has an overman in charge of each mine.

No. 1 OR TUNNEL MINE.

W. James, Overman; D. Gordon, J. Davidson, E. John, J. Watson, A. Watson, J. Barclay, O. Dabs, H. Winstanley, J. J. Jones, W. Bradley, and A. McLachlan, Firebosses.

At the Extension mines during the first part of the year operations were still being carried on under abnormal conditions owing to the unsettled labour conditions prevailing in the district.

It was not until the middle of the year that any great improvement was shown in this regard. In No. 1 mine the daily production was increased from 200 tons at the first of the year to 400 tons at the last.

The entire mine is worked on the long-wall system, and hand-mining is employed. In order to meet the increased production, an additional split has been introduced in the ventilating-current, and the quantity of air circulating through the mine has been doubled by increasing the fan-speed.

When I made my last inspection I measured 46,500 cubic feet of air a minute passing into this mine, divided into three splits.

In the East side split there was 16,500 cubic feet of air a minute passing for the use of forty-two men and four mules, or an average of 305 cubic feet of air a minute for each unit employed.

In the West side split there was 17,000 cubic feet of air a minute passing for the use of forty men and five mules, or an average of 309 cubic feet of air a minute for each unit employed.

In the split on the West side of the Main tunnel there was 2,500 cubic feet of air a minute passing for the use of four men and one mule, or an average of 379 cubic feet of air a minute for each unit employed. No explosive gas was found in this mine; timbering was good and the roadways in fair order.

No. 2 MINE, EXTENSION.

Thomas Strang, Overman; W. Cosier, J. Glen, H. Davidson, and J. Nimmo, Sr., Firebosses.

In No. 2 mine the operations were light, and were confined to ground adjacent to the Main slope—namely, Nos. 1 and 2 levels on the West side, and No. 2 level on the East side. The headings in No. 2 West level were the only places driving in the solid, all other work being done was splitting and skipping pillars.

At the first of the year a new pump was installed near the bottom of the slope, of the following description: A five-stage turbine 60-horse-power Mather and Platt patent, motor-driven, direct-coupled, capable of delivering, at 1,400 R.P.M., 360 gallons a minute against a 360-foot head.

During my last inspection I measured 15,450 cubic feet of air a minute passing into this mine, divided into two splits.

In the West side split there was 13,240 cubic feet of air a minute passing for the use of thirty men and five mules, or an average of 292 cubic feet of air a minute for each unit employed.

In the East side split there was 2,210 cubic feet of air a minute passing for the use of seven men and one mule, or an average of 221 cubic feet of air a minute for each unit employed.

No explosive gas was found and the timbering and roadways were in fair order. Safety-lamps of the Wolf type are used exclusively in No. 2 mine, and all blasting is done with permitted explosives, fired by electric battery.

No. 3 MINE, EXTENSION.

James Strang, Overman; H. Mitchell, G. Smith, P. Malone, D. Fagan, T. Taylor, and J. Nimmo, Jr., Firebosses.

In No. 3 mine operations in Nos. 4 and 5 West levels were discontinued after the completion of the rock heading through the fault. The Slope district was again opened up. Considerable repair-work was necessary in this district after the prolonged shut-down. The production in this district at present is 200 tons a day.

The ventilation has been considerably improved by the installation of a 5-foot Stine fan, disk type, used as a "Booster" This fan is motor-driven and runs at a speed of 600 R.P.M., passing 35,000 cubic feet of air a minute at a 1-inch water-gauge.

Safety-lamps of the Wolf type are used in this district, and all blasting done with permitted explosives, all shots being fired by electric battery.

During my last inspection I measured 20,200 cubic feet of air a minute passing into this part of the mine, divided into two splits.

In the Slope district split there was 11,200 cubic feet of air a minute passing for the use of thirty-eight men and six mules, or an average of 200 cubic feet of air a minute for each unit employed.

In No. 5 West split there was 9,000 cubic feet of air a minute passing around the workings.

I found a small quantity of explosive gas in the face of Gourley's level, all other places being free from gas; timbering and roadways were in fairly good order.

No. 4 MINE, EXTENSION.

Robert Bonar, Overman; W. Wright, J. McMurtrie, W. Gilchrist, S. Davis, and William Wilson, Firebosses.

In No. 4 mine operations were resumed in October, 1914, after being suspended since August, 1912. This mine was in excellent condition considering the period of time it had been closed down, without any work whatever being done underground.

The daily production of this mine is now 300 tons, and can be increased materially whenever desired. All mine-cars have been fitted with Hadfield's self-oiling wheels and axles, Rowbotham's patent.

In the surface plants, both at Extension proper and at No. 4 mine, considerable improvements have been made both in the banking and in the screening arrangements, so that a better grade of domestic fuel is now produced than heretofore. A corresponding improvement has also been made in the grades of washed nut and pea coal produced at the washery at Ladysmith.

During my last inspection in December I measured 27,340 cubic feet of air a minute passing into this 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 forty-seven men and four mules, or an average of 271 cubic feet of air a minute for each unit employed.

In the West side split there was 11,340 cubic feet of air a minute passing for the use of two men.

Explosive gas was not found in this mine; the timbering and roadways are in good condition.

The company has a rescue-station at Extension, of frame construction, 25 x 53 feet, which contains a smoke-room, observation-room, work-room, and dressing-room. The equipment of this station consists of four sets of 2-hour, 1910 model, helmet-type Draeger apparatus, one oxygen-pump, four oxygen-tanks, and four electric safety-lamps (Draeger type). There has been no training at this station during the year owing to the unsettled labour conditions prevailing in the district.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	78,925			
" export to United States	15,137			
" " other countries				
Total sales		94,062		
Lost in washing	23,315			
Used under colliery boilers, and employees	8,350			
Total for colliery use		31,665		
Stocks on hand first of year	741			
" last of year	4,230			
Difference added to stock during year		3,489		
Output of colliery for year		129,216		

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	35	4.00 - 6.00	5	3.50 - 6.00	40	
Whites—Miners	237	3.50 - 5.00			237	
Miners' helpers	12	2.75 - 3.30			12	
Labourers	120	2.47 - 3.00			120	
Mechanics and skilled labour	13	2.75 - 3.00	33	2.75 - 4.40	46	
Boys	2	1.10 - 2.20	1	1.10	3	
Chinese—Labourers	16	1.50 - 1.65	44	1.50 - 1.65	60	
Totals	435		83		518	

Name of seam or pits—Wellington Nos. 1, 2, and 3, and 4.

Description of seams, tunnels, levels, shafts, etc., and number of same—One tunnel connecting Nos. 1, 2, and 3. No. 4 shaft situated one mile south of tunnel.

REPORT BY INSPECTOR NEWTON.

Pacific Coast Coal Mines, Limited.

Head Office—Victoria, B.C.

Capital, $2,000,000.

Officers.	*Address.*
John H. Tonkin, President,	Victoria, B.C.
C. P. Hill, Vice-President,	Montreal.
Talbot Schmuck, Secretary-Treasurer,	Victoria, B.C.
John H. Tonkin, Superintendent,	Victoria, B.C.
J. Foy, Mine Manager,	Nanaimo, B.C.

Value of plant, $501,805.

This company includes in its holdings the Fiddick Colliery at South Wellington; the Morden Colliery on Section 11, Range 8, Cranberry District, two miles east of South Wellington; and the Suquash Colliery on the east coast of Vancouver Island, near Malcolm island. Of these, the Fiddick Colliery was the only one to ship coal during the past year, but at the others equipment and development-work were carried out.

The following are the official returns for the Fiddick Colliery, which are also the full returns for the whole company:

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	79,194			
" export to United States	14,450			
" " other countries				
Total sales		93,644		
Lost in washing	18,853			
Used in making coke				
Used under colliery boilers, etc.	16,999			
Total for colliery use		35,852		
Stocks on hand first of year	1,024			
" last of year	2,173			
Difference added to stock during year		1,149		
Output of colliery for year		130,645		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	4	4.92	10	3.55	14	3.94
Whites—Miners	115	3.80	.....	.....	115	3.80
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	49	2.95	.....	.....	49	2.95
Mechanics and skilled labour	3	3.00	37	3.29	40	3.27
Boys	5	2.15	.....	.....	5	2.15
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	58	1.70	58	1.70
Indians	.....	.....	.....	.....	.....	.....
Totals	176	.....	105	.....	281	.....

Name of seams or pits—Workings on the upper Douglas seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—At the South Wellington mine coal is reached by means of Slopes 1 and 2. At the Morden mine coal is reached by means of shafts: Shaft No. 3, 655 feet in depth; Shaft No. 4, 630 feet in depth. No. 3 is 10 x 18 feet in the clear; No. 4 is 10 x 10 feet in the clear.

Description and length of tramway, plant etc.—At South Wellington mine the plant consists of four return-tubular boilers, 100 horse-power each; one Canadian Rand air-compressor, capacity 500 cubic feet a minute; the Canadian Rand cross-compound air-compressor has been completed and is now in service; two Fairbanks-Morse pumps for supplying water to boilers, 7 x 5 x 12 duplex; one thoroughly equipped machine-shop; double-drum hoisting-engine for hauling coal from slopes, 200 horse-power; one Sheldon fan capable of producing 85,000 feet of air, with $1\frac{1}{2}$ inches of water-gauge; one mine-rescue station containing two 2-hour apparatus and one $\frac{1}{2}$-hour apparatus. The underground plant consists of two winches $6\frac{1}{2}$ x 8, two 5 x 7, and one 9 x 11. Pumps, 300-gallon electric turbine-pump; one 600-gallon Cameron piston-pump; two Fairbanks-Morse pumps, duplex, one $5\frac{1}{4}$ x $3\frac{1}{2}$ x 5 and one 7 x 5 x 7; and three small duplex pumps, one 3 x 2 x 5 and two 4 x 3 x 6; 250 mine-cars and approximately ten miles of narrow-gauge track in mine.

At Morden mine the plant consists of three 150-horse-power return-tubular Goldie & McCulloch 72- x 18-inch boilers, 160 lb. working-pressure; one pair 24 x 36 hoisting-engines equipped with safety overwinding device, steam-reverse and steam-brake; two 10-foot sheaves with collars and boxes and two self-dumping cages; one Gwynnes 5-inch centrifugal pump direct-connected to 250-volt A.C. motor; two 150-kw. electrical generators connected to two Goldie & McCulloch 13 x 20 x 9 high-speed engines; five electrical motors, 400-volt, 1,200 R.P.M.; one Sheldon ventilating mine-fan direct-connected to a 17- x 20-inch Vulcan Iron Works fan-engine; one Marcus screen 65 feet long, one Marcus screen 63 feet long, both with double decks and doors; one Weir feed-pump.

FIDDICK COLLIERY, SOUTH WELLINGTON.

J. Foy, Manager; L. Saville, Overman; F. Hilley, J. Ranaldi, D. Nellist, J. W. Dykes, J. Neen, A. Kerkman, and R. Rollison, Firemen.

This mine is operated by two slopes, Nos. 1 and 2, on the Fiddick and Richardson properties, and is down a distance from 1,200 to 1,400 feet, with levels turned off north and south. The system of working is pillar and stall, and in some places when the coal is low the long-wall method has been adopted.

During the year labour troubles impaired the output of these mines. On May 25th the tipple at this mine was completely destroyed by fire. This tipple has been replaced by a most modern one, electrically driven, and equipped with Marcus screens 60 feet in length. The tipple is of the four-track type and was in operation eleven days after the destruction of the old one.

Machinery installed.—The machinery consists of one Canadian Rand straight-line compressor, capacity 480 cubic feet of air a minute; one Norwalk air-compressor, capacity 707 cubic feet of air a minute; and one cross-compound compressor, capacity 2,100 cubic feet of air a minute. These compressors furnish power for winches and pumps underground. The power-house also contains an electric unit, a 50-kw. generator, 25 horse-power, with a D.C. exciter attached; these are driven by a steam-engine 9 x 16. There are also four return tubular boilers, 286 horse-power, and a new 17- x 26-inch engine has been installed.

The ventilation of these mines is produced by a Sheldon single-inlet reversible fan, 9½ feet in diameter, driven by a 9½ x 14 steam-engine, direct-connected, producing 85,000 cubic feet of air a minute, with a water-gauge of 1½ inches.

No. 1 Mine.—This mine has a slope down a distance of 2,000 feet, with levels turned off north and south in fairly good coal, varying from 3 to 7 feet in thickness. The south levels are driven towards the old *Southfield* property.

No. 2 Mine.—There is no development-work being carried on in this mine, only the extraction of pillars.

In the firing of all shots Monobel powder is used exclusively, fired by electric batteries. These mines are worked by safety-lamps of the Wolf pattern.

When I visited these mines in December I found 14,800 cubic feet of air a minute passing into the No. 1 mine for the use of thirty-six men and four horses, or an average of 308 cubic feet of air for each unit employed.

There was 13,800 cubic feet of air a minute passing into the No. 2 mine for the use of fifty men and four horses, or an average of 222 cubic feet of air for each unit employed.

No explosive gas was found, and the timbering and roadways are in good condition.

I examined the rope inspector's report-book on all ropes and winches, and found all reported in good condition.

MORDEN COLLIERY, SOUTH WELLINGTON.

J. Foy, Manager; L. Lee, Overman; J. Sutherland and J. Donnachie, Firemen.

This is a new mine, operated by the same company, on Section 11, Range 8, Cranberry District, two miles east of the Fiddick Colliery. Two shafts are sunk; the main shaft is 9 x 16 feet and the air-shaft 9 x 12 feet in the clear, and are sunk to a depth of 600 feet.

The sinking of these shafts was completed in 1913, but owing to labour troubles was forced to stand idle until the summer of 1914. During this enforced idleness a most modern plant has been completed, one that is unique in this Province.

The tipple has four tracks, equipped with two Marcus screens, one 64 feet long and 5 feet wide, the other 66 feet long and 5 feet wide. The coal is delivered on a Head-Wrightson jib loader, and from there goes to the railroad-cars. The entire construction of this tipple is reinforced concrete and steel and is absolutely fire-proof. Everything about the tipple is electrically driven.

The head-frame over the hoisting-shaft is built entirely of reinforced concrete and is the first of its kind in this district. From the surface this concrete frame rises to a height of 74 feet 6 inches to the centre of the 10-foot hoisting-sheaves. Each of the main braces contain over 50 tons of concrete, and in the entire tipple and head-frame there is approximately 500 cubic yards of this material.

There are two 24- x 48-inch hoisting-engines at this shaft, made by the Leitchfield Engineering Company, and they are complete with all safety attachments.

The hoisting-shaft is equipped with automatic self-dumping cages, and the plant is designed for a capacity of 1,500 tons in a shift of eight hours.

The air-shaft is 10 x 10 feet in the clear; a head-frame has been erected over it and a pair of 18- x 30-inch engines installed. The shaft is equipped for handling men with a cage, if required.

These engines will also be used to handle the coal in the main slopes, which are at present driven down a distance of approximately 600 feet, in fairly good coal.

The ventilation is produced by a Sheldon double-entry fan 7 feet in diameter, at from 3- to 3½-inch water-gauge, at 250 R.P.M. A 16- x 12-inch engine, made by the Vulcan Iron Works drives this fan, and is built on a reinforced concrete foundation.

The boiler plant at present consists of three 150 horse-power Goldie & McCulloch high-pressure boilers, individual settings connected to one 66-inch stack 60 feet high. Foundations are in for duplicate settings of three more. The main base for the two stacks is of concrete, arched through into the pump and heater room. Heater is 1,000 horse-power, Goldie & McCulloch type. Feed-pumps are the vertical type, each capable of taking care of 1,000 horse-power boilers.

Piping of the boilers is in duplicate; main steam consumption can be taken from either setting of three, or any unit can be cut out without interference. In the power-house at present are installed two vertical compound engines, Goldie & McCulloch type, each direct-connected to a 150-kw. generator of the Westinghouse type. All wiring is under the floor in conduits. Switchboards are of slate and the room presents an attractive appearance.

SUQUASH COLLIERY.

During the year 1914 considerable progress has been made along lines leading to the permanent development of the property. A large force of men was kept busy clearing ground for the plant and erection of same.

A new shaft has been started, size 11 x 22 feet in the clear. Work was stopped when war was declared. At the present time the shaft is down 18 feet into solid rock. A concrete collar was put in and all surface water was completely cut off. The landing "keps" or "fans" are set in the concrete in the permanent positions.

The company has installed the permanent engines for this shaft, which are as follows:— A pair of 24- x 36-inch engines made by the Vulcan Iron Works, of Wilkes-Barre, Pa., and a 9-foot conical drum ground for a 1½-inch rope. These engines are equipped with steam-brake, reverse, and Nicholson safety overwinding device.

Two Goldie & McCulloch high-pressure boilers, 150 horse-power each, have been installed, and the foundations are in place for the installation of two more. A Norwalk compressor and complete sinking plant have been installed, and everything is in readiness to proceed with the sinking.

Permanent buildings covering all machinery installed have been erected. The superintendent's residence and a model bunk-house of eighteen rooms have been erected.

Considerable work has been done in the mine from the old shaft. The permanent plan of working calls for the use of the old shaft as an air-shaft, and with this end in view the company has been driving a pair of slopes down to intersect the main level from the new shaft, in order to have the ventilation established and considerable development finished almost as soon as the new shaft cuts the seam.

These slopes have been driven a distance of 790 feet from the old shaft level, and still have approximately 510 feet to go to reach the main level from the new shaft. Levels have been tunnelled from these slopes and the plan will be to lower this coal to the new shaft. The vein is dipping about 3 degrees to the new shaft. The slopes are in a very fine coal, about 7 feet 6 inches and 8 feet in thickness.

The main shaft level in the old shaft has been driven about 800 feet, and on this level a long-wall face about 1,200 feet in length has been in operation. There was 8 feet 6 inches of coal in the face of this entry.

BOAT HARBOUR.

Machinery installed.—Two return-tubular 18 x 20 boilers, 106 horse-power each; one Houston Stanwood washer-engine, 14 x 20; one Houston Stanwood loading-engine, 10 x 14; one elevator-engine, 15 horse-power; one double-drum hoist.

The company operates its own railroad (standard gauge) from the mines to the bunkers at Boat harbour. At present the extension of the docks at Boat harbour is commencing; these will be extended out a distance of 500 feet in order to take care of additional tonnage and enable vessels of any size to be coaled.

The Vancouver-Nanaimo Coal Mining Co., Ltd.

Head Office—Vancouver, B.C.

Capital, $1,000,000.

Officers.	*Address.*
H. W. Maynard, President,	774 Hastings Street, Vancouver, B.C.
J. L. G. Abbott, Vice-President,	525 Seymour Street, Vancouver, B.C.
J. L. G. Abbott, Acting Secretary-Treasurer,	525 Seymour Street, Vancouver, B.C.
H. N. Freeman, Superintendent,	P.O. Box 283, Nanaimo, B.C.

Value of plant, $500,000.

NEW EAST WELLINGTON COLLIERY.

H. N. Freeman, Manager; J. Dixon, Overman; T. Miles, W. J. Moore, J. Bennie, and R. Reid, Firemen.

This mine is situated about two miles from Nanaimo City. The seam is known as the "Old Wellington" seam. It is reached from the surface by two slopes running N. 70° E., and pitching about 35 degrees, down a distance of 1,400 feet. At this point headings are turned off N. 65° E., which are up to the boundary-lines.

The coal varies from 4 to 8 feet in thickness and is worked on the long-wall and pillar-and-stall systems. This coal is of a very hard nature, being free from impurities and is all hand-mined. Monabel powder is used exclusively, fired by batteries. Owing to the depression in the coal trade since the beginning of the war, this mine has not been worked to its full capacity. At the beginning of December the company reduced the staff 60 per cent.

No development-work is in operation. All places have reached the boundary, and are coming back extracting pillars.

At the beginning of February, 1914, this mine was put exclusively on safety-lamps of the Wolf pattern.

During the year a new fan has been installed; engine, 12 x 16, direct-coupled, making 86 R.P.M., and producing 100,000 cubic feet of air a minute. A new lamp-house has been built with a capacity of 500 lamps.

Machinery installed.—One hoist, 12 x 16; three return-tubular boilers, 212 horse-power; Canadian Rand compressor, 700 cubic feet; one sawmill.

When I made my last inspection in December there was 48,000 cubic feet of air a minute passing into this mine, divided into three splits.

No. 1 Split.—There was 5,100 cubic feet of air a minute passing into this split for the use of twelve men and two horses, or an average of 283 cubic feet of air for each unit employed.

No. 2 Split.—There was 12,900 cubic feet of air a minute passing into this split for the use of eighteen men and two horses, or an average of 537 cubic feet of air for each unit employed.

No. 3 Split.—There was 15,000 cubic feet of air a minute passing into this split for the use of twenty men and four horses, or an average of 468 cubic feet of air for each unit employed.

A gas-cap in the counter-heading, No. 4 East level, and a body of non-explosive gas in No. 2 East level was found.

I examined the rope inspector's report-book on all ropes and winches, and found all reported as in good condition.

The following are the official returns from the New East Wellington Colliery for the year 1914 :—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	89,548			
" export to United States	7,242			
" " other countries				
Total sales		96,790		
Coal consumption by workmen	1,479			
Used in making coke				
Used under colliery boilers, etc	8,157			
Total for colliery use		9,636		
Stocks on hand first of year	3,821			
" last of year	4,553*			
Difference added to stock during year		732		
Output of colliery for year		107,158		

* Including 3,902 tons slack.

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		4		19	
Whites—Miners	124	4.62			124	4.62
Miners' helpers						
Labourers	68	3.15	3	3.15	71	3.15
Mechanics and skilled labour	2	3.85	14	3.70	16	3.72
Boys	2	1.50	1	1.50	3	1.50
Japanese—Labourers						
Chinese—Labourers			15	2.00	15	2.00
Indians						
Totals	211		37		248	

NORTHERN DISTRICT OF VANCOUVER ISLAND.

REPORT OF HENRY DEVLIN, INSPECTOR.

I have the honour to submit my annual report as Inspector of Mines for the Northern District of Vancouver Island for the year ending December 31st, 1914, together with a list of all accidents and colliery returns.

Canadian Collieries (Dunsmuir), Ltd.*

COMOX COLLIERIES.

These collieries were formerly operated by the Wellington Colliery Company, but were taken over by the Canadian Collieries (Dunsmuir), Limited, in 1911. The mines are situated in the Comox district, about seventy miles from Nanaimo. A railway about twelve miles in length connects the various mines to a shipping point at Union Bay, over which the whole output is conveyed.

This company is operating in Cumberland mines known as Nos. 4 and 7 slopes, and Nos. 5, 6, and 8 shafts. The new railway has been extended to connect with the various mines in this district, thus doing away with the heavy grade on the old line. These mines have been operated continuously during the year, but with some broken time towards the latter end.

The company has a rescue-station at No. 6 mine, 40 x 24 feet, with smoke, dressing, and work rooms, while a room for teaching "first aid" is attached. The equipment of the station consists of four 2-hour sets, 1910 model, helmet-type, Draeger apparatus; one recharging oxygen-pump; four oxygen-tanks; four electric safety-lamps (Draeger type). There has been very little training done at this station during the year.

In August of 1913 the company turned on the power from the hydro-electric power plant situated on the Puntledge river. The power-house contains two Frances turbines of 6,000 horse-power each, direct-coupled to a 4,000-k.w. generator, generating power at 13,200 volts, 3-phase, 25 cycles. The power is delivered to the various mines and the shipping point at Union Bay through transmission-lines aggregating about thirty miles in length.

At Union Bay the shipping wharves, the machine-shops, foundry, and coal-washing plant are driven and lighted by electricity, and with the completion of the electric plant at No. 6 mine, electricity for power purposes will supersede the use of steam entirely in the Comox field.

The company's hydro-electric plant at Puntledge river has been in continuous operation during the year. The lines have been extended for supplying electric power to Cumberland, Courtenay, Bevan, and Puntledge, as well as considerable extensions to the system at Union Bay.

No. 4 MINE.

R. Henderson, Manager; C. Parnham, Overman; T. Mordy, J. Furbow, J. Dando, J. Comb, S. Horwood, J. Edwards, A. Odgers, J. Reid, M. Brodrick, F. Bell, and H. A. Simms, Firebosses.

This mine is situated about two miles from Cumberland and about eighteen miles from the shipping point at Union Bay.

The ventilation is produced by a Sullivan reversible fan driven by a 350-horse-power direct-coupled motor, running at 245 R.P.M., and capable of delivering 190,000 cubic feet of air a minute, with a 5½-inch water-gauge.

* *See also* page 445.

The conversion of the main haulage-engine at this mine to electrical drive was completed and has proved successful in every way. The completion of this conversion eliminated entirely the use of steam at the mine.

An additional pump has been installed at the manway of a capacity of 2,500 gallons a minute, and driven by a 75-horse-power motor, to take care of the surface water at flood-times.

A 100-horse-power electrical hoist driven by a flame-proof alternating-current motor has been installed in No. 1 slope to replace the old D.C. hoist. Another electrical hoist, duplicate of above, is being installed in No. 2 slope.

The underground pumping system has been remodelled. A borehole was sunk from the surface to the head of the workings approximately 850 feet deep, and a 6-inch pipe installed. A seven-stage turbine-pump constructed entirely of acid-resisting bronze, and of a capacity of 450 gallons a minute at 900-foot head, driven by a 150-horse-power induction-motor, has been installed for pumping the entire mine-water through the borehole.

A four-stage turbine-pump, also of acid-resisting bronze, and of a capacity of 250 gallons a minute at 200-foot head, has been installed for pumping the water over from No. 2 slope to the pump at the bore-hole. These two pumps have replaced nine pumps which were formerly used in relays to pump the water up the slopes to the surface.

A second borehole was sunk to the head of the workings and a 2-inch pipe installed about the same depth as the water borehole, and an electric cable installed to furnish power to the underground workings. This cable is three-conductor No. 0, B. & S. standard, rubber-insulated and double-armoured, and is suspended from a specially designed clamp at the surface mounted on a concrete pillar. The power is supplied at 2,200 volts, 3-phase, 25 cycles. Transformers are installed underground for stepping down from 2,200 volts to 440 volts for supplying the hoists and small motors. Current for lighting is also furnished at 110 volts.

Two Sullivan type C E 7, short-wall, flame-proof coal-cutting machines are being installed in this mine, together with necessary cables, transformers, etc. These machines have self-propelled trucks and operate at 440 volts, 3-phase.

The use of the old direct-current plant at this mine has been discontinued, being replaced by the installation of the borehole cable above noted. Telephones have been installed underground, connecting all principal points and surface.

Safety-lamps of the Wolf type are used exclusively in this mine, all blasting being done with permitted explosives, fired by electric battery.

The coal-seam is reached by two slopes, Nos. 1 and 2, a direct haulage system being in use.

No. 1 Slope.

This slope is down a distance of 7,000 feet, running due north. A diagonal slope, 4,000 feet from the entrance of the mine, running N. 45° E., is down a distance of 3,000 feet, where levels are turned off east and west—Nos. 15, 16, 17, 18, and 19 on the West side, and Nos. 16, 17, 18, and 19 on the East side.

No. 15 West level and Nos. 17 and 18 East levels, are extracting pillars; the other levels are advancing, with the exception of No. 19 East level, which was driven through on No. 17 West level, off No. 2 slope, which makes a connection between the two slopes and is used as a travelling-road.

All the levels are worked on the pillar-and-stall system, and in good coal ranging from 4 to 5½ feet in thickness, with a band of rock running in the centre, from 10 to 12 inches in thickness, and having a fairly good fireclay roof.

During my inspection in December I measured 28,800 cubic feet of air a minute passing into this slope for the use of sixty-four men and eight mules, or an average of 327 cubic feet of air a minute for each unit employed. I found a small quantity of explosive gas in No. 18 stall, No. 17 West level, and No. 11 stall, No. 18 West level; also a slight gas-cap throughout the pillars in No. 15 West level. The timbering is good and the roadways in fair condition.

No. 2 Slope.

This slope branches off No. 1 slope a short distance from the mouth of the tunnel, running N. 45° E., and is down a distance of 8,000 feet, forming the deepest workings of the mine.

This slope, like No. 1 slope, has not advanced any during the year owing to an inrush of water, which the old system of pumping could not cope with, and consequently the lower end of the slope, was filled with water. Levels are turned off this slope east and west—namely, Nos. 15, 16, 17, 18, and 19 on the East side, and Nos. 13, 14, 15, 16, 17, 18, and 19 on the west side. No. 15 on the East side and Nos. 13, 14, 15, and 16 on the West side are extracting pillars; the other levels are advancing in good coal, ranging from 4 to 6 feet in thickness, with a band of rock in the centre from 12 to 15 inches in thickness. The roof is of friable fireclay and requires careful timbering. All the levels are worked on the pillar-and-stall system.

During my last inspection I measured 54,000 cubic feet of air a minute passing into this slope, divided into two splits.

In the East side split there was 18,500 cubic feet of air a minute passing for the use of forty-five men and eight mules, or an average of 268 cubic feet of air a minute for each unit employed.

In the West side split there was 13,250 cubic feet of air a minute passing for the use of forty-five men and seven mules, or an average of 200 cubic feet of air a minute for each unit employed.

I found explosive gas in Nos. 18 and 19 stalls, No. 15 East pillars. Blasting is prohibited in this level.

I also found a small quantity of explosive gas in No. 19 stall, No. 17 West level, and a slight gas-cap in Nos. 14 and 15 stalls, No. 16 West pillars. Timbering is in good condition, with the exception of No. 21 stall, which was ordered to be timbered up. Roadways are in fairly good order.

There was 54,000 cubic feet of air a minute passing into this mine in the main intake in No. 2 slope; the amount passing into the East side split was 18,500 cubic feet a minute, and the amount passing into the West side split was 13,250 cubic feet a minute, making a loss in leakage through doors, stoppings, etc., of 22,250 cubic feet of air a minute.

No. 5 MINE.

J. H. McMillan, Manager of Nos. 5 and 6 Mines; J. Gillespie, Overman, No. 5 Mine; R. B. Gascoyne, Jno. Brown, Jas. Brown, S. Jones, H. Leighton, J. M. Gillespie, N. Bevis, E. L. Saunders, W. C. Jones, R. McNiel, and D. Marsh, Firebosses.

This seam is reached by a shaft at a depth of 600 feet to the Lower seam. Only the Upper seam is being worked at the present time, some 300 feet above the Lower seam, the latter having been abandoned and allowed to fill with water.

The Upper seam is connected by a travelling-road with No. 6 mine, each having a separate intake and return. This shaft acts both as an intake and return, being divided by a strong midwall between the hoisting and upcast shafts.

Nos. 1 and 2 inclines are operating to the rise of the seam, and Nos. 1 and 2 slopes to the dip of the seam.

This mine is worked on the pillar-and-stall system. The seam varies from 3 to 9 feet in thickness, and contains several heavy bands of shale and bone, which makes it very difficult to clean the coal. All blasting is done with Monobel powder, the shots being fired by an electric battery.

Considerable development has been done in this mine during the year. No. 1 slope, situated 1,000 feet east of the shaft, was extended 758 feet and has opened up some good ground. The installation of a 100-horse-power electric hoist at No. 1 slope has been completed, and also a 50-horse-power hoist has been installed at No. 2 slope. Another 50-horse-power electric hoist is on the ground to be installed at the West side of the shaft. All these hoists are driven by alternating-current, flame-proof motors.

A five-stage motor-driven turbine-pump has been installed at the shaft-bottom, capable of dealing with 400 gallons a minute at 360-foot head. A three-stage motor-driven centrifugal pump has also been installed at No. 1 dip, capable of dealing with 75 gallons a minute.

A 100-kw. motor-generator set has been installed in the sub-station at this mine for furnishing electric power at 250 volts D.C. for locomotive haulage underground. The track on the main East level has been partly relaid with 60-lb. steel rails and bonded for locomotive haulage. A 6-ton double motor electric locomotive is on the ground, but not yet installed.

A Sullivan type C E 7, short-wall coal-cutting machine, with self-propelling truck, has been installed, together with necessary cables, etc., which has proved very satisfactory. It is the intention of the management to mine all coal in this mine with machines, and the system of working is being changed with this end in view.

No. 2 slope, situated about 2,000 feet east of No. 1 slope, has been driven about 150 feet. On the west side of the shaft a promising field of coal is being opened up; the seam in this district is 3½ feet thick, and comparatively free from rock. A slope has been started on this side 650 feet from the shaft.

A rock tunnel 340 feet long, 12 feet wide, and 6 feet high has been driven through to the surface. This tunnel acts as a manway to and from Nos. 5 and 6 mines.

The ventilation is produced by an exhaust-fan of the Guibal type, 14 feet in diameter, belt-driven by a 150-horse-power motor running 500 R.P.M., with a liquid controller, and is capable of producing 52,000 cubic feet of air a minute, with a 2-inch water-gauge.

Considering recent developments, the amount of air at present passing will be inadequate in the near future, and arrangements are being made to install a large fan near the entrance to the manway. This fan will ventilate both Nos. 5 and 6 mines, and the shafts in each case will be used as downcasts. The output of this mine has been considerably increased during the year, and at present averages about 900 tons a day. Telephones have been installed, connecting the surface and underground.

When I made my last inspection I measured 49,000 cubic feet of air a minute passing into the mine, divided into four splits.

In No. 1 split there was 12,000 cubic feet of air a minute passing for the use of sixty-four men and eight mules, or an average of 136 cubic feet of air a minute for each unit employed.

In No. 2 split, west side of shaft, there was 10,000 cubic feet of air a minute passing for the use of twenty-eight men and two mules, or an average of 294 cubic feet of air a minute for each unit employed.

In No. 3 split, east side of No. 1 slope, there was 20,000 cubic feet of air a minute passing for the use of sixty-three men and four mules, or an average of 266 cubic feet of air a minute for each unit employed.

In No. 4 split, west side of No. 1 slope, there was 6,250 cubic feet of air a minute passing for the use of twenty-nine men and two mules, or an average of 175 cubic feet of air a minute for each unit employed. No explosive gas was found in this mine; the roadways were in good order and the timbering in fairly good condition.

No. 6. MINE.

H. Sloan, Overman; H. King, J. E. Spicer, J. Thompson, F. Crawford, T. Leeman, and Alf. Jones, Firebosses.

This shaft, like No. 5, is sunk to the Lower seam, but only the Upper seam is being worked. This mine is worked on the pillar-and-stall method. The seam varies in thickness from 3 to 6 feet, and contains several heavy bands of shale and bone.

Very little solid work is going on in this mine, the largest part of the output being got from the pillars on both sides of the shaft. A very promising section is being opened up to the rise of the shaft; the seam is 4 feet thick, and comparatively free from rock-bands. This section is to be worked on the long-wall system, and the mining will be done with two C E 7 type Sullivan electric short-wall coal-cutting machines, with self-propelling trucks.

To the north of the shaft a rock tunnel has been driven 150 feet through a 50-foot upthrow fault, and the indications are that a good field of coal will eventually be located.

The main steam hoisting-engine at this mine is being converted to electric drive. A 250-horse-power motor is being installed to drive the existing drum by means of double helical cut gears. This motor is operated and controlled by means of a liquid rheostat at 2,200 volts, 3-phase, 25 cycles.

A 75-horse-power motor is being installed for driving the existing Guibal fan and replacing the present steam-engine. The picking-table engine is also being replaced by a 20-horse-power motor. Two single-stage motor-driven bronze pumps, of a capacity of 70 gallons a minute at a 100-foot head, are also being installed.

A transmission-line has been erected, connecting with the sub-station at No. 5 mine. This line is being installed to obviate the necessity of a step-down sub-station at No. 6 mine

Telephones and signals are being installed, connecting the pit-head and engine-room with the shaft-bottom. This equipment, when completed, will supersede the present steam plant at this mine.

The ventilation is produced by an exhaust-fan, Guibal type, making 106 revolutions a minute, and producing 30,000 cubic feet of air a minute, with a 1½-inch water-gauge. The shaft is divided by a midwall between the hoisting and upcast shafts. All blasting is done with Monobel powder, and all shots fired by electric battery.

During my last inspection I measured 26,750 cubic feet of air a minute passing into this mine, divided into two splits.

In No. 1 split there was 13,250 cubic feet of air a minute passing for the use of sixty-five men and seven mules, or an average of 148 cubic feet of air a minute for each unit employed.

In No. 2 split there was 13,500 cubic feet of air a minute passing for the use of forty-eight men and seven mules, or an average of 194 cubic feet of air a minute for each unit employed.

No explosive gas was found in this mine, and the timbering and roadways were in good condition.

No. 7 MINE.

T. A. Spruston, Manager; F. Jaynes, Overman; J. Morris, N. Huby, P. Myers, F. Cope, F. Peacock, Geo. Harvie, A. Pickup, and J. Webber, Firebosses.

This mine is situated at the town of Bevan, about five miles from Cumberland and about twelve miles from the shipping point, Union Bay. There has been no extension to the town during the year, which consists of 150 miners' cottages, of four, five, and six rooms, a large store, an up-to-date hotel, and a public school.

This mine is entered by means of two slopes running N. 35° E. and down a distance of 6,500 feet. The method of mining is the long-wall system, the coal ranging from 2½ to 3½ feet in thickness, and is of a very hard nature, being well adapted to this method of mining.

No. 1 Main Slope.

From this slope, levels are turned off east and west—Nos. 3, 5, 6, 7, 8, 9, and 10 on the West side, and Nos. 3, 7, and 9 on the East side.

No. 3 East Diagonal Slope.

This slope is driven off No. 3 East level, at a distance of 500 feet from the Main slope, and a distance of 2,000 feet from the entrance to the mine, running north-east. Levels are turned off on the east side of the slope only, owing to a fault running parallel to the slope on the west side; these levels are in good coal ranging from 2 to 3 feet in thickness.

This mine has been in operation continuously during the year, with the exception of some broken time towards the latter end. The electrical plant at this mine was all completed during 1913, and no additions have been made excepting the installation of one five-stage motor-driven turbine-pump, which replaces three air-driven reciprocating-pumps at the bottom of the air-shaft.

The ventilation is produced by an 8½- x 8½-foot Sirocco fan with a capacity of 270,000 cubic feet of air a minute, against a 5½-inch water-gauge. This fan is driven by a 350-horse-power motor running at 245 R.P.M., and is equipped with an automatic liquid type controller.

The power for the underground pumps and hoists is produced by a 350-horse-power two-stage Rand air-compressor, driven by a 500-horse-power synchronous motor, running at 500 R.P.M. The motor and compressor are connected by a double leather belt 42 inches wide and 116 feet long.

The coal is hauled from the slope by an electric haulage-engine, driven by a 750-horse-power motor running at 245 R.P.M., with a capacity of fifteen cars a trip, at a speed of fifteen miles an hour.

During my last inspection in December I measured 95,760 cubic feet of air a minute passing into this mine, divided into four splits.

In No. 1 West split there was 23,000 cubic feet of air a minute passing for the use of fifty men and four mules, or an average of 387 cubic feet of air for each unit employed.

In No. 2 West split there was 9,000 cubic feet of air a minute passing for the use of thirty-four men and four mules, or an average of 195 cubic feet of air a minute for each unit employed. No explosive gas was found on the West side; timbering good and the roadways in fair order.

In No. 1 East split there was 27,500 cubic feet of air a minute passing for the use of fifty men and five mules, or an average of 422 cubic feet of air a minute for each unit employed.

In No. 2 East split there was 6,750 cubic feet of air a minute passing for the use of sixteen men and one mule, or an average of 232 cubic feet of air a minute for each unit employed.

No explosive gas was found on the East side; the places were well cogged and timbered and the roadways in fairly good order.

The general ventilation was good; but in No. 3 level, off No. 3 East Diagonal slope, it was very slack. The attention of the management was directed to the state of the ventilation in this section, with instructions to have it remedied as quickly as possible.

Safety-lamps of the Wolf type are used exclusively on the West side and in Nos. 7 and 9 levels on the East side, and all blasting is done with permitted explosives, and all shots fired by electric battery.

The total quantity of air passing into this mine in December was 95,760 cubic feet a minute, and the quantity passing into the several splits was 66,250 cubic feet a minute, making a loss in leakage of 29,510 cubic feet a minute through doors, stoppings, etc.

No. 8 MINE.

This mine is situated about a mile and a half east of No. 7 mine and about four miles from Cumberland.

The installation of equipment at this mine, as outlined in 1913, was completed during 1914, and was in successful operation part of the year. On account, however, of the falling-off in the coal trade, it was deemed advisable to temporarily cease operations.

The main shaft is 11 x 22 feet, and the air-shaft, which is 200 feet distant from the main shaft, is 11 x 18 inside the timbers. Two seams were opened in this mine; the Lower seam being reached at a depth of 964 feet, and the Upper seam at a depth of 764 feet.

This mine is just in its development stage, the only work being done underground consisted of three levels driven on each side of the shaft, in both Upper and Lower seams, and in a distance of 650 feet, a connection being made in both seams with the air-shaft.

During the year, to provide the ventilation for this mine, a Stine fan was installed, driven by a 35-horse-power motor, with a capacity of 90,000 cubic feet of air a minute, against a 1½-inch water-gauge. This mine was closed down on August 5th, 1914.

During the year I made fifteen trips to the Comox Collieries, travelling a distance of 2,100 miles. The following are the official returns from the Comox Colliery for the year 1914 :—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	221,086		2,314	
" export to United States	48,219			
" " to other countries				
Total sales		269,305		2,314
Lost in washing	103,023			
Used under colliery boilers, etc.	15,685			
Total for colliery use		118,708		
Stocks on hand first of year	10,407		2,314	
" last of year	17,125		None.	
Difference { *added to / †taken from } stock during year		*6,718		†2,314
Output of colliery for year		394,731		

By-products—Fireclay, 937 tons.

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	40	3.63 - 9.00	8	4.00 - 6.00	48	
Whites—Miners	209	3.30 - 5.50			209	
Miners' helpers	82	3.00			82	
Labourers	80	2.50 - 3.30	54	2.47 - 3.02	134	
Mechanics and skilled labour	40	3.30 - 4.00	40	3.30 - 3.85	80	
Boys	2	1.37 - 2.47	3	1.10 - 1.65	5	
Japanese—Miners	70	3.50			70	
Miners' helpers	44	1.75			44	
Labourers	9	1.75	3	1.40 - 1.65	12	
Chinese—Miners	113	3.50			113	
Miners' helpers	90	1.75			90	
Labourers	48	1.75	112	1.40 - 1.65	160	
Totals	827		220		1,047	

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT OF ROBERT STRACHAN, INSPECTOR.

I have the honour to submit my annual report as Inspector of Coal-mines for the Nicola-Princeton Inspection District for the year 1914.

The principal companies in the Nicola section are the Middlesboro Collieries, Limited (formerly the Nicola Valley Coal and Coke Company, Limited); the Inland Coal and Coke Company, Limited; the Pacific Coast Colliery Company; and the Diamond Vale Colliery Company. The first two operated during the entire year; the Pacific Coast Coal Company did very little active work, other than keeping the mine free from water; while the Diamond Vale Coal Company did not operate during the year.

In the Princeton section the Princeton Coal and Land Company, Limited, operated during the entire year; the Coalmont Colliery Company (formerly the Columbia Coal and Coke Company) continued development during the year, and shipped some coal, hauling it almost five miles to the Great Northern Railway; the United Empire Mining Company, Princeton, operated till May, since when active work has been suspended; the Boundary Mining and Exploration Company suspended mining operations in March.

A brief description of each colliery in the district, with the names of the certificated officials, is given.

Attached is a list of the accidents which have occurred during the year, amounting to ten, none of which, I am glad to report, were fatal. Four of these accidents were serious and six slight; six occurred at the Middlesboro Colliery and four at the Inland Coal and Coke Company's colliery. At the Middlesboro Colliery only two accidents occurred inside the mine and four outside, which seems a remarkable improvement; at the Inland Cole and Coke Company's mine all the four accidents occurred inside the mine. The causes of the accidents

were: One from fall of rock, one from fall of top coal, one due to ignition of explosive gas, two to machinery, four to cars, and one to timber swinging while being unloaded from a railway-car.

The freedom from fatal accidents during the year is due to a great extent to the introduction of "Systematic Timbering"; the improvement of discipline, which is reflected in that there are no prosecutions to report; and the cordial co-operation of the workmen and officials, for which I desire to acknowledge my indebtedness, for it is only through their endeavours that such desirable results can be obtained.

I trust that during the following year, 1915, this co-operation will be continued, and if possible improved on, as a great many of our present accidents are the direct result of carelessness and therefore unnecessary.

MINE-RESCUE WORK.

In this work all the holders of certificates of competency for rescue-work, which includes nearly all the certificated officials and some of the workmen, have maintained their training during the year, and a few who have come since the training was given have also taken an active interest in the work. A branch of the St. John Ambulance Association has been formed here, and during the past summer a competition under its auspices was held in which teams from the various collieries and the town of Merritt competed for the various prizes given. It is anticipated that this is only the first of a series of competitions which should give a healthy stimulus to this desirable work. A fairly large class for "first aid to the injured" is also being taught under its auspices by Dr. C. S. Williams.

The equipment of self-contained breathing apparatus, which is all of the Draeger type, is practically the same as last year, namely:—

Middlesboro Colliery.—Two 2-hour apparatus, with spare oxygen cylinders; one pulmotor, with spare oxygen cylinder; one recharging-pump; 900 cubic feet of oxygen; sixty ½-hour, ninety 1-hour, and 100 2-hour potash cartridges; two electric lamps; and testing apparatus for the Draegers.

Inland Coal and *Coke Co.*—Two 2-hour apparatus, each with spare oxygen cylinder; two ½-hour apparatus, each with three spare oxygen cylinders; one pulmotor, with spare oxygen cylinder; 435 cubic feet of oxygen; nine ½-hour, forty-eight 1-hour, and fifty-five 2-hour potash cartridges; two Wolf electric safety-lamps, each with spare battery; also testing-bag and goggles, as all the apparatus is mouth-breathing type.

Princeton Coal and Land Company.—One 2-hour apparatus, with spare oxygen cylinder; one ½-hour apparatus, with spare oxygen cylinder; one pulmotor, with spare oxygen cylinder; 175 cubic feet of oxygen; one recharging-pump; nine ½-hour and ten 2-hour potash cartridges; two electric Draeger lamps; one water-gauge for testing apparatus.

Coalmont Colliery.—Three 2-hour apparatus, each with spare oxygen cylinder; one ½-hour apparatus, with spare oxygen cylinder; one recharging pump; one pulmotor, with spare oxygen cylinder; 200 cubic feet of oxygen; six ½-hour and twenty-two 2-hour potash cartridges; three electric lamps; also measuring-bag and water-gauge for testing apparatus.

This leaves the smaller collieries, such as United Empire, Pacific Coast Colliery, Diamond Vale Colliery, and the Boundary Mining and Exploration Company, without apparatus, but none of these has done any very active mining during the year.

In addition to the above, we have the apparatus of the Government, which is kept at the mine-rescue station of the Middlesboro Colliery, consisting of: Two 2-hour apparatus, with spare oxygen cylinder for each; two ½-hour apparatus, with spare oxygen cylinder for each; one recharging-pump, which is at the Inland Coal and Coke Company.

All of the apparatus has been kept in fairly good condition, but unfortunately so far none of the companies, with the exception of the Middlesboro Collieries, has seen the necessity of erecting proper training-stations. During the year inspections of the mine on behalf of the workmen have been carried out regularly at the mine of the Inland Coal and Coke Company by two of their number appointed for the purpose as provided for by section 91, Rule 37. At the Middlesboro Colliery, persons were appointed by the Chief Inspector of Mines, owing to the failure of the workmen to make this appointment, and these persons have regularly inspected all of the Middlesboro mines. The reports from these workmen have generally shown the mines to be in good condition, and so far no reports have been sent to me regarding dangerous or apprehended dangerous conditions.

The other collieries in the district are small, and so far no such appointments have been made.

I have regularly attended the examination for coal-miners held at Merritt, and a few times at Princeton, the examination at the latter place being very irregular owing to lack of candidates; and in May and October acted as examiner at the request of the Board of Examiners at the examinations held for first-, second-, and third-class certificates in Merritt.

In office-work, 208 letters were received and 180 sent out, and the distance travelled on duty during the year amounted to 3,216 miles.

Middlesboro Collieries, Ltd.

Head Office—Vancouver, B.C.

Capital, $1,107,700.

Officers.	*Address.*
Clarence M. O'Brien, President,	Vancouver, B.C.
Gordon S. Raphael, Vice-President,	Barnet, B.C.
Thomas Sanderson, Managing Director and Secretary,	Vancouver, B.C.
Robert Fairfoul, Mine Manager,	Vancouver, B.C.

Value of plant, $250,000.

MIDDLESBORO COLLIERY.

Robert Fairfoul, Manager.

The Middlesboro Colliery of the Middlesboro Collieries, Limited (formerly the Nicola Valley Coal and Coke Company, Limited), is situated about one mile from Merritt, and is reached by a branch line of the Canadian Pacific Railway. The colliery consists of the Nos. 2, 4, 4 East, and 7 mines, the first being operated in the Upper or Coldwater Hill series of coal-seams, the others in the Lower or Coal Gully series.

During the past year a considerable amount of development-work has been accomplished, mostly in the Nos. 4 and 7, and what we may call a new mine has been opened in the No. 4 East.

No. 2 MINE.

John McDonald, Overman; Wm. Hallinan, William Strang, and James Fairfoul, Firebosses.

This mine, which has been operated for the past six years, was temporarily abandoned in July, and since that time has not been restarted. This mine is operated by a slope driven on the No. 2 seam, a crosscut tunnel enabling the coal from the No. 3 seam to be hauled to the

same landing. The dip of both seams is 22 degrees to the east. Sections of the seams are here given :—

No. 2 Seam.	*No. 3 Seam.*
36″ coal.	37″ coal.
5″ sandy shale.	15″ bone.
11″ coal.	5″ coal.
2″ shale.	
8″ coal.	

The method of work is by pillar and stall; pillars 40 feet square, stalls 15 feet wide. The coal is all mined by hand, very little blasting being required, and for this purpose Monobel only, a permitted explosive, is used, with electric cable and battery, under the charge of certificated shotfirers. The haulage is by horse from the foot of the chutes to the slope, and then by tail-rope to the surface.

Ventilation is produced by a fan of the Sheldon type, 56 x 36 inches, driven direct by a steam-engine, which was producing at the last time I inspected this mine 32,500 cubic feet of air a minute for the use of thirty-three men and five horses; this fan runs with a speed of 250 revolutions a minute, and a water-gauge of 0.2 inch.

During the time this mine was in operation I always found the ventilation well conducted to the faces; brattice curtains and doors well attended to; the roadways and places were all well timbered and kept well moistened, and the places and roadways free from explosive gas.

Open lights were used in the Upper district and safety-lamps of the Wolf type in the Lower district. The dividing line is well marked with notice-boards and lighted safety-lamps with red glass, as required by Special Rule 75.

Copies of the special and general rules, plans of the mine, and order *re* "Systematic Timbering" are all posted at the mine entrance.

No. 4 MINE.

Thos. Brace, Overman; Alex. Ewart, H. Camamile, and Wm. Hallinan, Firebosses and Shotlighters.

The No. 4 mine includes the No. 4 and 6 seams, and is situated in the Coal Gully series of seams, the main entrance crosscutting the Nos. 4, 5, and 6 seams. Sections of Nos. 4 and 6 seams are as follows :—

No. 4 Seam.	*No. 4 Seam.*	*No. 6 Seam.*
5″ bony coal.	2″ bone.	51″ coal.
5″ coal.	2″ coal.	8″ bony coal.
1″ bone.	1″ bone.	9″ coal.
17″ bony coal.	21″ coal.	
32″ coal.	12″ bone.	
10″ bony coal.	4″ coal.	
21″ coal.	7″ bone.	
2″ bone.	12″ coal.	
9″ coal.	6″ bone.	
	60″ coal.	

In this mine also the pillar-and-stall method of work is used, pillars being left 30 x 60 feet and stalls 12 feet wide. The pitch of the seam is 25 degrees to the south. The coal is all mined by hand, blasting being accomplished by the use of Monobel, a permitted explosive, with electric fuses, under the supervision of certificated shotlighters. The haulage inside is by compressed-air hoists to the top of slope, and from there to the tipple by horses.

The method of work and inclination in No. 6 seam are the same as in the No. 4, but so far very little work has been done to the dip in No. 6. During the year an opening has been

made from No. 6 to the surface, east of and above the No. 7 mine, and in addition to forming an additional outlet, it is of great assistance in ventilating the upper workings and also for obtaining timber and other supplies.

The ventilation is produced by a Sheldon fan, 8½ feet in diameter, driven by an engine of the same make, using a continuous rope-drive. At my last inspection this fan was producing 84,500 cubic feet of air a minute for the use of forty men and six horses; speed of fan, 250 revolutions a minute; engine, 214 revolutions a minute; water-gauge, 2.7 inches.

Safety-lamps of the Wolf pattern are used exclusively in this mine, and I have always found the air conducted well up to the faces, doors and stoppings in good condition, and the roadways kept damp.

During the past year I have always found this mine free from explosive gas, the roads well timbered, and the "Systematic Timbering" order well carried out.

No. 4 East Mine.

Thos. Brace, Overman; James Fairfoul, Fireboss and Shotlighter.

This is a new opening on the No. 4 seam, a short distance to the east of the No. 4 mine. It is anticipated that the levels to the west of the slope will ultimately connect to the No. 4 mine, while to the east and south there is practically an untouched coalfield.

Already the slope has been sunk a distance of over 300 feet, the face showing about 16 feet of coal; one level to the west has been driven about 130 feet and communication established through an air-shaft to the surface.

At the air-shaft has been installed a fan, driven by a 10- x 12-inch Sheldon engine, and capable of producing 38,400 cubic feet of air a minute at a speed of 250 revolutions a minute.

This fan is 36 inches in diameter, 42 inches wide, and has been entirely built in the machine-shop, of steel, with a casing of the same material, and can be reversed if necessary with very little trouble. It has been built to stand a speed of about 800 revolutions a minute, and at that speed should easily double its present capacity.

At the present time there are nine men employed in this mine, and I have always found the conditions as to ventilation and timbering well attended to.

I have always found the mine free from gas, but safety-lamps are exclusively used as affording greater security.

The haulage at present is done with compressed-air hoist to the surface, and then the cars are taken by steam-locomotive to the tipple.

No. 7 Mine.

L. Warburton, Overman; L. Clarke, Jno. McDonald, Ar. Phalen, and Thos. Bullen, Firebosses; Jas. Blair, Shotlighter.

This mine, which is situated in the Coal Gully series, is about 300 feet higher up than the tipple and entrance to the No. 4 mine, and has been driven down on the coal for a distance of 1,500 feet. The coal-seam is about 15 feet thick and dips to the south at almost 25 degrees. Section of the coal-seam:—

Sandstone roof.
12″ bony coal.
1″ sandstone.
108″ inches coal.
1″ clay.
69″ coal.
2″ soft coal.

The method of work is pillar and stall, the pillars being 50 feet square, the stalls 14 feet wide. So far all the work has been narrow, the levels working almost the full thickness of the coal, the stalls only working about 8 feet of the top coal.

The haulage is by horse to the slope, then by air-hoist to the outside, from where they are lowered to the tipple by a gravity-incline about 300 feet long. The intention is to drive a crosscut tunnel from No. 4 mine to the No. 7, and thereby cut off the hoisting and lowering of the cars, and allow of them being hauled direct to the tipple.

Ventilation is by a small fan of the Guibal type, driven by a compressed-air engine. The size of the fan is 52 inches in diameter and 24 inches wide, which can be reversed when necessary. It is driven by a belt from a Gourlay-McCulloch engine, 8 x 10 inches, compressed air being used instead of steam.

I have generally found the mine well ventilated, and at my last inspection I found 43,200 cubic feet of air a minute for the use of twenty-four men and one horse, the fan running at 250 revolutions a minute, engine 142 revolutions a minute, water-gauge $\frac{7}{8}$ inch.

I have always found the ventilation well conducted around the faces, doors and stoppings in good shape, and the roads fairly damp. The roads and places I have always found well timbered, and generally the mine is kept in very good condition.

During the year safety-lamps have been introduced into this mine, with the exception of the rope-rider, who uses an open light. The coal is all mined by hand, and for blasting purposes Monobel is used, with electric detonator and battery, under the charge of certificated shotlighters. All the safety-lamps used are of the Wolf pattern, including those which are fitted with the Cadman-Cunninghame gas-detector, and are supplied to the officials for the purpose of detecting smaller percentages of gas than can be otherwise detected with the ordinary safety-lamp. The safety-lamps are provided by the company and are cleaned and tested in the lamp-room near the tipple, and are afterwards examined by the fireboss before being allowed into the mine.

All the coal comes to a common tipple, although there is a tipple at No. 2 mine which can be used in an emergency. The cars, which have a capacity of 1.5 tons, are brought from No. 2 by steam-locomotive, from No. 7 by gravity-incline, and from Nos. 4 and 4 East by horse.

The cars, which are built at the colliery, are of 2-inch plank with iron fittings, and have a door at one end. They are dumped by a Phillips crossover dump; a switchback and car-haul arrangement brings the empty cars back, so that they can be arranged into trips for whatever place required.

The coal passes to a shaking screen, which allows all coal under $2\frac{1}{2}$ inches to pass into a hopper, the lump coal passing over a picking-table 42 feet long, where the waste is picked out, the clean coal passing by a conveyor to the lump-coal bin.

The coal under $2\frac{1}{2}$ inches is fed to a washer of the Stewart type, erected by Roberts & Schaefer, of Chicago, capable of treating 100 tons of coal an hour. In the washer three grades of coal are made, each being taken by separate conveyors to the coal-bunkers. During the extreme cold months of winter this washer is not operated, a dry-cleaning method being used. For the purpose of facilitating the loading of box cars a Christy box-car loader is used.

Close to the tipple is situated the main power plant, consisting of four return-tubular boilers, each 150 horse-power, a Canadian Rand cross-compound air-compressor, with a capacity of 2,000 cubic feet of free air a minute, and a $27\frac{1}{2}$-kw. generator for lighting purposes. In addition to this plant, there is at the No. 2 mine an auxiliary steam plant consisting of one Goldie-McCulloch boiler of 150 horse-power and a 14 x 18 Rand compressor. In addition to the above is a well-equipped machine and car-repair shop.

A small though well-equipped mine-rescue training-station is also maintained, in which is kept two 2-hour type Draegers, 1911 type, recharging-pump, pulmotor, and a good supply of oxygen and potash cartridges. Here also is maintained, through the courtesy of the company, the Department of Mines rescue apparatus, consisting of two 2-hour and two ½-hour Draegers, all of the 1911 type.

All the officials and a great number of the workmen have already taken the Government certificate for rescue training, and during the year have maintained their standard of efficiency.

The apparatus is all in good condition and is examined every month by the officials who have already taken their training.

The following are the official returns of the Middlesboro Collieries, Limited, for the year 1914:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	52,699			
" export to United States				
" " other countries				
Total sales		52,699		
Used in making coke				
Used under colliery boilers, etc.	8,293			
Total for colliery use		8,293		
		60,992		
Stocks on hand first of year	555			
" last of year	268			
Difference taken from stock during year		287		
Output of colliery for year		60,705		

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	3.60	5	4.20	15	
Whites—Miners	70	3.30 - 5.00			70	
Miners' helpers	20	3.00			20	
Labourers	35	3.00 - 3.50	25	2.75 - 4.20	60	
Mechanics and skilled labour			15	3.30 - 4.25	15	
Boys			10	1.50 - 2.25	10	
Japanese						
Chinese						
Indians						
Totals	135		55		190	

Inland Coal & Coke Company, Ltd.

(FORMERLY THE COAL HILL SYNDICATE.)

Head Office—Merritt, B.C.

Capital, $1,500,000.

Officers.	*Address.*
Geo. I. Wilson, President,	Vancouver, B.C.
W. L. Nichol, Vice-President,	Vancouver, B.C.
Stanley Carr, Secretary-Treasurer,	Pacific Block, Vancouver, B.C.
Joseph Graham, Vice-Pres. and Gen. Man.,	Merritt, B.C.
Andrew Bryden, Mine Manager,	Merritt, B.C.

Value of plant, $90,000.

COAL HILL COLLIERY.

The property of this company is situated south-west of the Middlesboro Colliery, and at an elevation of 500 feet higher up.

No. 3 MINE.

Andrew McKendrick, Assistant Manager and Overman; Geo. Hudson, Jno. Brown, Jno. Wilcocks, Ab. Horrocks, R. S. Brown, and D. Crawford, Firebosses and Shotlighters.

The No. 3 mine, which is at present working, includes the Nos. 3 and 5 seams. The Main slope has been driven in the No. 3 seam, crosscut tunnels at No. 3 East and No. 6 West having been driven to reach the No. 5 seam. The No. 3 coal-seam is about 12 feet thick, the inclination being about 30 degrees, dipping to the south-east. The method of work is pillar and stall; pillars about 30 feet square, stalls 15 feet wide, stalls being driven up full pitch.

The coal is taken down the chutes, loaded into cars, then pushed to the slope, from where it is hoisted by a steam-hoist on surface.

Ventilation is produced by a fan of the Sheldon type, 6 feet in diameter, single-inlet type, and at the time of my last inspection was producing 45,000 cubic feet of air a minute for the use of 105 men and one horse. The fan runs at a speed of 310 revolutions a minute and gives a water-gauge of $\frac{5}{16}$ inch.

This ventilation is divided into three separate splits: No. 1 split consisting of Upper No. 5 seam and portion of East side of No. 3 seam, with 15,000 cubic feet of air a minute for thirty-five men; No. 2 split, consisting of Lower Nos. 3 and 5 seams, with 15,600 cubic feet a minute for the use of forty men; No. 3 split, consisting of No. 1 West and part of No. 3 West, with 13,300 cubic feet a minute for the use of twenty-eight men and one horse. This allows of a leakage of about 1,100 cubic feet a minute.

I have during the past year generally found the ventilation well conducted around the faces, and the doors and stoppings well attended to. The mine is fairly damp, the roads and places are fairly well timbered.

The No. 5 seam is 5½ feet thick, practically the same inclination as No. 3; the method of work is double-stall, with stalls 30 feet wide, leaving a pillar 30 feet square. The coal here is also taken from the chute and pushed to the slope of the No. 3 seam and hoisted to the surface.

All the blasting is done with either Monobel or Giant powder (coal), fuse and detonator being used, under the direction of competent persons.

Open lights are used in both seams, the inspections being made with safety-lamps of the Wolf type.

The cars in use are made at the mine, and have a capacity of 1 ton; the loaded cars are lowered from the mouth of the slope, a distance of 1,500 feet to the top of the gravity-plane, by a tail-rope engine which hauls the empty cars back.

The gravity-plane is a three-rail track with a passing in the centre, 2,000 feet long, operated by a Stine wheel, capable of handling 1,000 tons a day, using a 1-inch steel-wire rope, and running six cars to the trip.

The cars are dumped on an ordinary tip-dump, and the coal is picked before going into the bunkers, which have a capacity of 500 tons, and from which it is drawn as required to load the railroad cars. The tipple is connected to the Canadian Pacific Railway by a standard-gauge track one mile long.

The power plant at the mine consists of two 40-horse-power Leonard type boilers, which furnish steam for the hoists, fan, lighting, engine, and for heating the wash-house. An auxiliary plant at the tipple consisting of a 25-horse-power boiler furnishes steam for a small hoist used for hauling the cars on the tipple, also for the pumps used to deliver water to the plant at the mine.

The equipment at the mine consists of hoist-rooms, offices, machine and blacksmith shop, car repair shop, and fan-house.

As required by the Act, mine-rescue apparatus is maintained as already described; copies of the general and special rules, plan of the mine, and order *re* "Systematic Timbering" are kept posted at the mine.

The following are the official returns of the Inland Coal and Coke Company, Limited, for the year 1914:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	50,723			
" export to United States				
" " to other countries				
Total sales		50,723		
Used in making coke				
" under colliery boilers, etc.	2,070			
Total for colliery use		2,070		
Stocks on hand first of year				
" last of year	488			
Difference added to stock during year		488		
Output of colliery for year		53,281		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	6	4.50	3	5.00	9	4.75
Whites—Miners	80	3.50 - 6.00	.....	.....	80	4.50
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	20	3.00	30	3.00	50	3.00
Mechanics and skilled labour	20	3.25 - 3.50	16	3.25 - 3.50	36	3.40
Boys	.....	.....	.....	.....	.....	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	126	.....	49	.....	175	.....

Name of seams or pits—Nos. 1, 2, 3, 4, and 5.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 1 seam has a slope 350 feet deep on a 26-degree pitch; no work has been done on this seam for four years. This seam has 3 feet of good coal. No. 2 has a slope driven on a 32-degree pitch for 500 feet. This seam has 7½ feet of coal, but has not worked for four years. No. 3 seam, from which the major part of the year's output was obtained, is 12 feet thick, with sandstone roof and floor. The main slope and levels have been driven continuously during the year on this seam. No. 5 seam is 5½ feet thick and lies above the No. 3 seam, 200 feet, being operated by crosscut tunnels, driven from the No. 3 at the 300- and 600-foot levels. No work has been done on No. 4 seam.

Description and length of tramway, plant, etc.—Owing to the depression in the coal business in this section, caused principally by the importation of foreign fuel-oil duty free, there has been no addition to speak of to the plant at this colliery, but it has been well maintained and improved in certain respects. The main boiler plant consists of two 40-horse-power Leonard boilers. The fan is an Aelos type, capacity 50,000 cubic feet, belt-driven by a 60-horse-power engine. The winding-engine on the Main slope is a 60-horse-power Ottumwa hoist, and there is an 18-horse-power engine on the haul-back from the head of the tramway. The tramway is three-rail, 1,800 feet long, and handles six 1-ton cars to a trip by a Stine head-gear capable of handling 1,000 tons a day. There has never been any loss of life at this colliery, nor any serious accident during the past year.

Pacific Coast Colliery Co., of B.C.

Head Office—Minneapolis, Minn.

Capital, $500,000.

Officers.		*Address.*
Jas. C. Andrews, President,	514 Metropolitan Life Building,	Minneapolis, Minn.
G. B. Norris, Vice-President,	" "	Minneapolis, Minn.
G. H. Derry, Secretary,	" "	Minneapolis, Minn.
J. S. Sherril, Treasurer,	" "	Minneapolis, Minn.
John Howell, Superintendent,		Merritt, B.C.

The Pacific Coast Colliery Co.'s property is situated north-west of the Middlesboro Colliery, and comprises that area lying between Middlesboro and the Coldwater river. Very little active work has been done on this property during the year, except keeping the No. 1 slope free from water. The colliery consists of two shafts and a slope, but in neither of the shafts has any work been done during the year.

I have regularly inspected this mine and always found the same free from explosive gas. There was generally a small current of air circulating by natural ventilation, which varied from 2,000 to 3,000 cubic feet a minute, and as there were never more than two workmen employed, this was sufficient. The roads were maintained in good condition and well timbered, brattice kept well up to the faces, and all the roadways are naturally damp.

The power plant consists of two vertical boilers, each of 10 horse-power capacity, a 7- x 10-inch double-drum hoisting-engine, and two pumps, 4½ x 3 x 4 and 6 x 4 x 6 respectively. In addition to this, there is a small hoist-room, wash-house, repair-shop, and office buildings.

Copies of the general and special rules, plan of the mine, and order *re* "Systematic Timbering" are kept posted at the mine entrance.

The following are the official returns of the Pacific Coast Colliery Company for the year 1914:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	360			
" export to United States				
" " other countries				
Total sales		360		
Used in making coke				
" under colliery boilers, etc.	200			
Total for colliery use		200		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		560		

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	5.00			1	5.00
Whites—Miners	4	3.75			4	3.75
Miners' helpers	1	3.00			1	3.00
Labourers			1	3.00	1	3.00
Mechanics and skilled labour			1	3.50	1	3.50
Boys						
Japanese						
Chinese						
Indians						
Totals	6		2		8	

Name of seams or pits—No. 1 slope and No. 2 shaft.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 1 slope, 8 x 10, down 450 feet; direction, N. 51° E.; dip, N. 70° E. Three levels have been driven off the slope in a south-eastern direction; No. 1 level has been driven 175 feet, No. 2 level 112 feet, and No. 3 level 94 feet. Crosscuts have been driven from each level to connect up with the air-shaft, 6 x 6, depth 76 feet; thickness of seam is 5 feet. No. 2 shaft: During the past year there has been no work done in this mine.

Description and length of tramway, plant, etc.—Tramway from top of slope to tipple, 300 feet. Plant consists of two 10-horse-power vertical boilers, double cylinder, 7 x 10; double-drum hoisting engine; two pumps, one $4\frac{1}{2}$ x 3 x 4 Fairbanks duplex pump, and 6 x 4 x 6 Fairbanks duplex ram piston-pump.

Princeton Coal and Land Company, Ltd.

Head office—15 Great St. Helens, London, E.C.

Capital, $1,000,000.

Officers.	*Address.*
A. St. George Hamersley, Chairman,	London, Eng.
Sheffield Neave, Director,	London, Eng.
Alex. Crerar, Director,	London, Eng.
Arthur Hicklin, Advisory Director.	London, Eng.
Oswald J. Bambridge, Director.	London, Eng.
E. S. Neave, Secretary,	London, Eng.
Ernest Waterman, General Manager.	Princeton, B.C.
Francis Glover, Manager,	Princeton, B.C.

Value of plant, $77,000.

This company's property is situated near the town of Princeton, on the right-hand side of the Similkameen river, near its junction with the Tulameen, and is in the Similkameen Mining Division.

No. 1 MINE.

Robert Brown, Overman; A. Orr and R. Wilson, Firebosses.

The coal-seam, which was originally worked by a small adit level on the banks of the Similkameen river, is now operated by a slope, 12 x 9 feet, from the bench above; the slope is divided into two compartments, one for hoisting the other for a travelling-way.

This slope has been sunk for a distance of 1,100 feet to the No. 4 level, and from the No. 4 East level, starting at a point 200 feet inside, another slope, which will be ultimately connected to the Main slope, has been sunk 400 feet, being driven slightly across the pitch.

During the present year all the operations have so far been confined to the East side, and the principal development has consisted of driving this new slope and a parallel to it.

The coal, which is classed as a good lignite, lies at an angle of 12 degrees, dipping to the west, and has a thickness of 24 feet. Below is given a section:—

24″ top coal.
36″ coal.
6″ clay.
60″ coal.
9″ clay.
12″ coal.
12″ claystone.
40″ coal.
10″ clay and bone.
72″ coal.

The method of work is by pillar and stall; pillars 50 feet square and stalls 9 feet wide. The coal is mined by post coal-cutting machines either of the Rand or Hardy type, so that the minimum of explosives are used to bring the coal down, and a maximum of round or lump coal is produced.

For blasting purposes Monobel is used with either fuse or electric detonators, all the blasting being done under the supervision of certificated shotlighters.

The haulage is operated inside by horse to small air-hoists, which lower the loaded car and bring up the empty; then by horse to the Main slope, which is operated by a steam-driven hoist situated on the surface.

During my inspection of this mine I have generally found it free from explosive gas; only twice during the year have I detected a small percentage. I always found a good current of air circulating around the face and all the places well bratticed.

The fan which is of the Guibal type, 30 x 6 feet, driven by a 25-horse-power steam-engine, produces, according to the speed, from 20,000 to 35,000 cubic feet of air a minute, at a water-gauge of ¼ inch. This ventilation is divided into two separate splits, named East and West respectively.

In the East split I found at my last inspection 25,000 cubic feet a minute for the use of twenty men and one horse.

On the West side the air-current was slack, and the anemometer failed to record; there have been no men working on this side during the year. The speed of the fan was 145 revolutions a minute; water-gauge, ½ inch.

I have always found the places and roadways well timbered and in good condition, and the order *re* "Systematic Timbering" well complied with. Open lights have generally been used in this mine, the inspection being made with safety-lamps of the Wolf type, as required by section 91, Rule 4.

During the latter part of the year trouble has been experienced with an outbreak of fire in the old workings. Owing to the place being inaccessible and also to surface breaks, considerable difficulty has been experienced in sealing this area off, and lately efforts have been made to either flood it or flume in non-combustible material so as to effectively seal the district off.

In view of this experience, it would be a good practice to load out much, if not all, of the machine minings, and also to lay out the mine so that each district can be effectively sealed off as rapidly as possible after the coal has been extracted.

The surface plant consists of a screening plant erected by the Link Belt Engineering Company of Chicago, capable of treating 600 tons a day. The mine-cars, which have a capacity of 1.5 tons, are hauled up the Main slope in trips of six by a 50 horse-power Jenks hoist to the tipple, which is situated about 45 feet above the ground-level. Here the cars, after being weighed, are dumped by a rotary dump into a reciprocating feeder, which regulates the supply of coal to the shaking screens, where three different grades or sizes of coal are made—namely, all passing over the 4-inch screen called "lump," all over the 2-inch screen "egg," all over the ½-inch screen "nut," all under this goes at present either to the boilers or the dump, as there is no market for it. The various grades are taken to the bunkers by belt-conveyors and during transit the waste is picked out. Each grade is kept separate in the bunkers, which have a capacity of 240 tons. To facilitate the loading of box cars, a conveyor runs underneath the chute of each bunker, so that the coal can be drawn from either bunker or mixed as required and then taken to the box-car loader, which is of the Victor type. As the box-car stands on the weigh-scales while being loaded, the weight of coal can be accurately gauged, and so prevent trouble from either under or overloading.

The power plant consists of two Goldie-McCulloch boilers, each 275 horse-power, and a 50-horse-power Grey boiler. A Rand compressor with a capacity of 744 cubic feet of free air a minute supplies air for the underground pumps, hoists, and mining-machines. During the past year a new 60-kw. three-phase alternator, driven by a Gourlay-McCulloch steam-engine, has been installed to supply lights for the town of Princeton and the mines; 35- and 25-horse-power engines manufactured by the Link Belt Engineering Company are used to drive the picking-table.

The machine-shop is equipped with a McDougal lathe, a 350-lb. steam-hammer, drill-press, a 2-inch Acme bolt-cutter, pipe-machine, 20-inch shaper, hack-saw, and emery-grinder. For fire purposes a 12- x 7- x 12-inch pump is used, connected with a water-tank having a capacity of 30,000 gallons, giving a pressure of 200 lb. to the square inch.

Copies of the general and special rules, plan of mine, and order *re* "Systematic Timbering" are kept posted at the mine entrance.

The following are the official returns of the Princeton Coal and Land Company for the year 1914:—

SALES AND OUTPUT FOR YEAR	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	13,371			
" export to United States	2,505			
" " other countries	*Nil.*			
Total sales		15,876		
Used in making coke	*Nil.*			
" under colliery boilers, etc	3,145			
Waste	559			
Total for colliery use		3,704		
		19,580		
Stocks on hand first of year	45			
" last of year	*Nil.*			
Difference taken from stock during year		45		
Output of colliery for year		19,535		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	3	4.50	5	4.50	8	4.50
Whites—Miners	22	5.00			22	5.00
Miners' helpers	8	3.00 - 4.00			8	3.00 - 4.00
Labourers			7	3.00	7	3.00
Mechanics and skilled labour			7	3.50 - 4.00	7	3.50 - 4.00
Boys			1	1.00	1	1.00
Japanese						
Chinese						
Indians						
Totals	33		20		53	

Name of seams or pits—No. 1. slope.

Description of seams, tunnels, levels, shafts, etc., and number of same—The seam is 24 feet thick and dips at an inclination varying from 16 to 9 degrees. The top 9 feet is worked, and is a good-grade lignite and has a jet-black appearance. The slope is down a distance of 1,050 feet, driven on full pitch of the seam, with main and counter levels on strike of the seam, and 500 and 1,000 respectively both east and west. There is an air-shaft down to the seam and has a depth of 60 feet. Nos. 2 and 3 levels are in 1,200 feet; Nos. 4 and 4 East counter 1,000 feet; No. 1 West level 600 feet; No. 2 West level and counter are in 100 feet. The coal is mined by machines, of which six are used.

Description and length of tramway, plant, etc.—The plant consists of tipple having a length of 250 feet, with rotary dump, reciprocating feeder, shaking screen, picking-belts, and bunkers having a capacity of 240 tons; conveyor-belt and Victor box-car loader; two 75-horse-power and one 50-horse-power boilers; hack-saws; blacksmith and carpenter shops with steam-hammer and all necessary equipment.

United Empire Mining Co.

Capital, $500,000.

Officers.	*Address.*
W. C. McDougall, President,	Princeton, B.C.
M. H. Whitehouse, Vice-President,	Princeton, B.C.
E. G. Marston, Secretary-Treasurer,	Princeton, B.C.
W. G. Simpson, Mine Manager,	Princeton, B.C.

Value of plant, $1,000.

UNITED EMPIRE COLLIERY, PRINCETON, B.C.

The United Empire Mining Co.'s property is situated on Hunter creek, about a mile and a half from Princeton. The main tunnel is driven through the slide-rock to a point 900 feet inside, where it strikes the coal, and then continues on the coal for a distance of almost 500 feet.

This mine worked very intermittently in the early part of the year, then shut down in May, and up to the present there is no signs of reopening. During the time the mine operated W. G. Simpson was manager in charge of the work.

I found no trace of explosive gas during that time, and the places were all well bratticed and a good current of air kept circulating around the faces. The ventilation, which was produced by a small 8-foot fan of the Guibal type, driven by a 10-horse-power gas-engine, produced from 8,000 to 12,000 cubic feet of air a minute for the use of ten workmen. The places and roads were generally well timbered, and I always found the general conditions fairly good.

There are two distinct seams worked—namely, the Higher, about 8 feet 9 inches thick, and the Lower, about 4 feet thick. Operations were conducted on both on a small scale, the method of work being pillar and stall, pillars being left 45 feet square, stall 14 feet, driven up the full pitch, of about 45 degrees.

The only plant is the gas-engine for driving the fan. A small tipple allows the cars, which have a capacity of about 1,200 lb., to be dumped into the railroad-cars on a spur from the Great Northern Railway.

The most of the coal was used at the British Columbia Portland Cement Company's plant, the surplus being shipped to United States points.

Coalmont Collieries.

(FORMERLY COLUMBIA COAL AND COKE COMPANY, LTD.)

Officers.	*Address.*
Arthur McEvoy, President,	811 Rogers Bldg., Vancouver, B.C.
A. N. Canting, Vice-President and General Manager,	Coalmont, B.C.
A. H. Douglas, Secretary,	Dom. Trust Bldg., Vancouver, B.C.
A. Ford, Acting-Superintendent,	Coalmont, B.C.

(Not incorporated.)

This property was acquired late in 1913 by A. McEvoy, and is now operated by him under the name of the "A. McEvoy, Trustee Operators Coalmont Collieries," with the head office at Vancouver.

The operations of this company have been continued all the past year in the workings on the North fork of Granite creek. What was termed Nos. 2 and 4 tunnels were operated for some time and crosscutted to ascertain the qualities of the coal, and afterwards work for the present was discontinued on No. 4. Later a large tunnel, 12 x 7 feet, was started about 70 feet lower down than the No. 2, but so as to tap the No. 2 seam; this has been driven about 300 feet. The No. 2 tunnel, which has been used for prospecting purposes, has now been driven in almost 2,000 feet, and has a communication through to the surface about 200 feet from the mouth.

During the past year a considerable amount of coal has been taken out, and some has been transported almost five miles to the Great Northern Railway and shipped to various points.

During my inspections of the No. 2 tunnel I have always found it free from explosive gas, well ventilated, and generally the brattice well attended to.

Ventilation is produced by a 36-inch Comstock blower, driven by an 8-inch steam-engine, geared 1 to 3½, and produces 2,700 cubic feet a minute for the use of six men and one horse; water-gauge is 3½ inches; speed of blower, 600 revolutions a minute. The places and roads are well timbered and generally the mine is in good condition. In the No. 6 tunnel I have generally found the conditions very good; no trace of gas; tunnel well timbered and ventilated by a 24-inch Comstock blower, which is driven by a 12-inch steam-engine, the air being taken in to the face in pipes.

A 25-horse-power boiler supplies power to drive the fan, and in addition to this a small wash-house and offices have been built. A cook and bunk house has been erected, and a few small houses, with a residence for the foreman. A right-of-way for a tram has also been cleared.

Copies of the general rules and plan of the mine are kept posted at the mine entrance.

The following are the official returns of the Coalmont Colliery for the year 1914:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada (approx.)	4,300			
" export to United States	100			
" " other countries				
Total sales		4,400		
Used in making coke				
" under colliery boilers, etc	450			
Total for colliery use		450		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		4,850		

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	4.50			1	4.50
Whites—Miners	4	3.50			4	3.50
Miners' helpers	3	3.00			3	3.00
Labourers						
Mechanics & skilled labour			2	4.00	2	4.00
Boys						
Japanese						
Chinese						
Indians						
Totals	8		2		10	

* Taken from pay-roll, December 1st, 1914. Fifty men were employed during spring and summer.

Names of seams or pits—No. 2 seam, Nos. 2 and 6 tunnels.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 2 seam is 12 feet thick, with a fireclay foot-wall and a sandstone roof, an additional cover of thin seams of hard coal and sandstone, and a final cover of hard shales. What is known as No. 2 tunnel is a prospect-tunnel, with crosscuts driven on the horizontal from foot-wall to hanging-wall, a distance of some 170 feet; the portion of coal intended to be mined—viz., the 12-foot seam—is about 60 feet from the hard shales. No. 6 tunnel is the permanent tunnel which is driven 11 feet 6 inches by 6 feet 6 inches in the clear. This tunnel is a vertical distance of 70 feet below the prospect-tunnel. The inclination or pitch of the seam is about 26 inches.

Description and length of tramway, plant, etc.—Tramway in No. 2 tunnel, 1,860 feet, 18-inch gauge, 15-lb. steel rails being used; tramway in No. 6 tunnel, 350 feet, 18-inch gauge, 30-lb. steel rails being used. No. 2 tunnel plant consists of 25-horse-power vertical boiler, an 8 x 10-inch Climax vertical engine, and a 4-foot Buffalo force-fan. No. 6 tunnel plant consists of 10 x 10 Comstock horizontal engine and a 2-foot 6-inch Buffalo blow-fan. In addition to the above, there is the steam-heated wash-house, blacksmith-shop, warehouse, offices, etc. The coal for the present time is being shipped to the railroad by teams, which will be replaced by a tramway in the near future.

Boundary Mining and Exploration Company, Limited.

Capital, $1,000,000.

Officers.	*Address.*
A. E. Watts, President,	Wattsburg, B.C.
A. Carney, Vice-President,	Kaslo, B.C.
S. J. Miller, Vice-President,	Grand Forks, B.C.
E. R. J. Forster, Secretary-Treasurer,	Grand Forks, B.C.

MIDWAY COLLIERY.

Ed. Bridge, Manager.

This company's property is situated in the Greenwood Mining Division on the banks of the Kettle river, two miles and a half west of Midway. There are two adit levels and a shaft; the work during the present year has been confined to the No. 2 level. The inside work was discontinued about February, and further efforts were confined to proving the field with a diamond-drill.

The No. 2 level has been driven in a distance of 572 feet, and has a slope down about 90 feet and a raise up 30 feet.

During the time the mine was in operation I generally found the condition fairly good; places and roads well timbered.

Ventilation was effected by two small blowers which produced 400 cubic feet a minute for the use of four workmen. A steam-boiler with 60-horse-power capacity has been installed to operate the hoist and the air-blowers.

EAST KOOTENAY DISTRICT.

Until within the year 1909 there was only one company actually producing coal in the East Kootenay District—that is, the Crow's Nest Pass Coal Company, although this company operated three separate collieries; but during that year two new companies began to produce—namely, the Hosmer Mines, Limited, at Hosmer, and the Corbin Coal and Coke Company, at Corbin. These new companies began to ship coal towards the latter part of 1908, and, as they have extensive and fully equipped collieries, have now become important factors in the production of the district.

The Hosmer Mines continued operations until about the middle of the year 1914, when all operations were suspended.

The district is divided into two separate Inspection Districts. The Southern East Kootenay District, which was during the year 1914 under the late Inspector Evan Evans, with headquarters at Fernie, includes the Coal Creek Collieries and the Carbonado Collieries of the Crow's Nest Pass Coal Company, although this latter colliery has not been worked this past year. Mr. Evan Evans was unfortunately killed in a Coal Creek mine on January 2nd, 1915. Subsequently George O'Brien was appointed Inspector of the district.

The Northern East Kootenay District, under Inspector T. H. Williams, with headquarters also at Fernie, includes the Hosmer Colliery of the Hosmer Mines, Limited, the Michel Collieries of the Crow's Nest Pass Coal Company, and the Corbin Colliery of the Corbin Coal and Coke Company.

The headquarters of both inspectorates is in the Government rescue-station at Fernie.

SOUTHERN EAST KOOTENAY INSPECTION DISTRICT.

REPORT OF T. H. WILLIAMS, INSPECTOR.

I have the honour to submit the annual report of the inspection of the mines in the Southern East Kootenay District for the year 1914.

The inspections were made by the late Evan Evans, Inspector of Mines of this district, who died at Coal Creek on January 2nd, 1915, and this report is based upon the records which were on file in his office. These records show that each mine was regularly inspected as required by section 77, subsection (4), of the "Coal-mines Regulation Act."

Crow's Nest Pass Coal Company, Ltd.

Capital, $3,500,000.

Officers.	*Address.*
Elias Rogers, President,	Toronto, Ont.
E. C. Whitney, Vice-President,	Ottawa, Ont.
R. M. Young, Secretary,	Fernie, B.C.
Elias Rogers, Treasurer,	Toronto, Ont.
W. R. Wilson, General Manager,	Fernie, B.C.
Bernard Caufield, Colliery Manager, Coal Creek Collieries,	Fernie, B.C.
Thomas Russell, Colliery Manager, Michel Collieries,	Michel, B.C.

The above company is now operating the following extensive collieries on the western slope of the Rocky mountains in the East Kootenay District, namely:—

COAL CREEK COLLIERY, situated on Coal creek, about five miles from the town of Fernie, on a branch railway to the mines, connected at Fernie with the tracks of the Canadian Pacific Railway and also those of the Great Northern Railway.

CARBONADO COLLIERY, situated on Morrissey creek and connected by a branch railway with the Canadian Pacific Railway and the Great Northern Railway at Morrissey. The colliery is about fourteen miles from Fernie by rail, in a south-easterly direction. This colliery has been shut down for more than three years.

MICHEL COLLIERY, situated on both sides of Michel creek, on the line of the Canadian Pacific Railway, being twenty-three miles in a north-easterly direction from Fernie. This last colliery is in the Northern Inspection District.

The total gross combined output of all the company's collieries for the past year was 778,403 tons. Of this, 296,136 tons was used in the manufacture of coke, yielding 199,866 tons, and as 2,703 tons of coke was added to stock, the amount of the coke sold was 197,163 tons, of which 142,850 tons was sold for consumption in Canada, and 54,313 tons was exported to the United States. The coal exported to the United States amounted to 335,671 tons, while 89,535 tons was sold for consumption in Canada.

The amount and disposition of this combined output of the company's collieries is more fully shown in the following table:—

RETURNS FROM CROW'S NEST PASS COAL CO.'S MINES FOR YEAR 1914.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	89,535		142,850	
" export to United States	335,671		54,313	
" " other countries				
Total sales		425,206		197,163
Used in making coke	296,136			
" under colliery boilers, etc.	53,561			
Total for colliery use		349,697		
Stocks on hand first of year	94		62	
" last of year	3,594		2,765	
Difference added to stock during year		3,500		2,703
Output of colliery for year		778,403		199,866

NUMBER OF HANDS EMPLOYED, INCLUDING THOSE AT COKE-OVENS, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	45		14		59	
Whites—Miners	750				750	
Miners' helpers						
Labourers	88		239		327	
Mechanics and skilled labour	328		142		470	
Boys	23		27		50	
Japanese						
Chinese						
Indians						
Totals	1,234		422		1,656	

COAL CREEK COLLIERY.

Bernard Caufield, Manager.

This colliery is on Coal creek, five miles from Fernie, transportation being afforded by a branch line which makes connection with both the Canadian Pacific and the Great Northern Railways at Fernie.

The mines in operation during the year were as follows: No. 1 North, No. 5, No. 9, and B North, on the north side of the valley of Coal creek; No. 1 South, No. 1 East, No. 2, and No. 3 on the south side. The coal from all of these mines is conveyed to a central tipple, of steel construction, 840 feet in length.

There were three fatal and ten non-fatal accidents reported, being a decrease of six and seven respectively as compared with the previous year.

No. 1 NORTH MINE.

R. Anderson, Overman; T. Tully, R. Brown, and E Rutledge, Firebosses.

This mine is situated on the north side of the valley at an elevation of 300 feet above the tipple. At the time of the last inspection, which was made on December 3rd, explosive gas was found in one place. The ventilation and timbering was good and the roadways fair. The quantity of air measured was 15,000 cubic feet a minute for the use of fifteen men and one horse.

No. 5 MINE.

W. Commons, Overman; J. White, H. Dunlap, and J. Lane, Firebosses.

This mine was divided into two sections—namely, the rise and the dip workings. The rise workings have been discontinued, so that all the coal at present being worked is in the dip section, and is brought to the surface up the new Diagonal slope mentioned in the last report.

The report of the last examination, which was made on December 9th, showed that it was clear of explosive gas, well timbered, and generally in a good condition. The quantity of air measured was 36,000 cubic feet a minute, which was divided into two splits, as follows: Right of slope, 18,000 cubic feet a minute for sixteen men and two horses; left of slope, 18,000 cubic feet a minute for twenty-seven men and four horses.

No. 9 MINE.

W. McFegan, Overman; J. McPherson, Fireboss.

The work done in this mine during the year has been confined to prospecting and repairing the main haulage-road, no coal being produced. When the last inspection was made the timbering and roadways were good and no explosive gas was found.

B NORTH MINE.

W. McFegan, Overman; Alex. McFegan, D. Shanks, and J. Moore, Firebosses.

This mine, which was placed on the shipping-list during the year 1913, has steadily developed and is producing about 400 tons a day. It is 1,800 feet north-east of the tipple, and is opened by two tunnels, 10 x 8 feet in size, which struck the coal at a distance of 150 feet from the surface. The ventilation is produced by a Brazil fan, 10 feet in diameter and 4 feet wide.

At the last inspection it was reported clear of explosive gas and well timbered. The quantity of air measured was 38,000 cubic feet a minute for the use of sixty-three men and ten horses.

No. 1 South Mine.

Adam Watson, Overman; T. Ratcliffe, W. Stockwell, and W. Joyce, Firebosses.

This mine is 2,500 feet south-west of the tipple, and is opened by a tunnel driven on the strike of the seam. At a point 460 feet from the tunnel-mouth a drift 130 feet long has been driven to cut No. 2 seam, which is now being developed.

Upon the last inspection, which was made on December 18th, it was clear of explosive gas, well timbered and ventilated, the quantity of air measured being 26,000 cubic feet a minute in No. 1 seam for the use of fifty-eight men and seven horses, and 14,000 cubic feet a minute in No. 2 seam for eight men and one horse. Speed of fan, 120 revolutions a minute; water-gauge, 1.8 inches.

No. 1 East Mine.

D. Martin, Overman; T. Wilson, J. Caufield, J. Bell, J. Mawson, J. Steele, and J. McLaughlin, Firebosses.

This mine is at an elevation of 90 feet above the tipple and 800 feet east of it, and is opened by a rock tunnel 215 feet in length. While it is a comparatively new mine, it has developed into the largest producing mine at this colliery.

At the time of the last inspection, in December, small quantities of explosive gas were found in three places. The timbering, ventilation, and general conditions were good through out. The amount of air measured in the different splits was as follows: Diagonal district, 14,200 cubic feet a minute for the use of twenty-eight men and three horses; Right side of slope, 21,000 cubic feet a minute for thirty men and three horses; East side of tunnel, 9,000 cubic feet a minute for twenty-four men and three horses; West side of slope, 20,400 cubic feet a minute for thirty men and four horses. Speed of fan, 110 revolutions a minute; water-gauge, 2 inches.

No. 2 Mine.

W. Lancaster, Overman; F. Landers, J. Bushell, and C. O'Brien, Firebosses.

This mine is being reopened beyond the old workings. At the time of the last inspection a little explosive gas was found in two places. The ventilation was good, the roadways and timbering being fair. The quantity of air measured was 13,000 cubic feet a minute for the use of thirty men and three horses. Speed of fan, 130 revolutions a minute; water-gauge, $2\frac{1}{2}$ inches.

No. 3 Mine.

John Biggs, Overman; W. Puckey, J. Worthington, and A. Kinsman, Firebosses.

This mine is working the same seam as No. 2 mine, and is entered by a slope 2,250 feet long, driven on the full pitch. The method of working has been changed from long-wall to pillar and stall. The last inspection was made on December 12th, when it was found clear of explosive gas, well timbered, and in good condition. The quantity of air measured was 8,100 cubic feet a minute in the Slope district for twelve men and one horse, and 8,000 cubic feet a minute in the Main level district for twenty men and four horses. Speed of fan, 100 revolutions a minute; water-gauge $1\frac{1}{2}$ inches.

Wolf safety-lamps are used throughout at this colliery. Very little blasting is done in the coal. Wherever this is necessary, Monobel powder, fired with electric detonators is used. Two new 2-hour sets of the 1914 type of Draeger apparatus and four mouth-breathing devices have been added to the mine-rescue equipment.

The following are the official returns for the Coal Creek Colliery for the year 1914:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL. Tons.	Tons.	COKE. Tons.	Tons.
Sold for consumption in Canada	53,949		*111,596	
" export to United States	271,635		30,266	
" " other countries				
Total sales		325,584		141,862
Used in making coke	212,313			
Used under colliery boilers, etc.	37,073			
Total for colliery use		249,386		
Stocks on hand first of year	94		*Nil.*	
" last of year	2,423		1,598	
Difference added to stock during year		2,329		1,598
Output of colliery for year		577,299		143,460

* Includes 722 tons coked at and shipped from Hosmer ovens.

NUMBER OF HANDS EMPLOYED, INCLUDING THOSE AT FERNIE COKE-OVENS, ETC.

CHARACTER OF LABOUR.	UNDERGROUND. No. employed.	Average Daily Wage.	ABOVE GROUND. No. employed.	Average Daily Wage.	TOTALS. No. employed.	Average Daily Wage.
Supervision and clerical assistance	31		9		40	
Whites—Miners	547				547	
Miners' helpers						
Labourers	67		166		233	
Mechanics and skilled labour	242		97		339	
Boys	20		21		41	
Japanese						
Chinese						
Indians						
Totals	907		293		1,200	

Owing to depression in trade, the mines did not work steadily during 1914. The following shows the number of days each month that Coal Creek Colliery was operated:—

	Days.		Days.
January	20½	August	14½
February	17	September	11½
March	18	October	6
April	15½	November	10
May	14	December	13
June	16		
July	16½	Total	172½

Name of seams or pits—No. 1 North, No. 1 South, and No. 1 East, same seam; No. B, No. 2, No. 3, No. 9, and No. 5, same seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—

No. 1 North Fan.—When the mountain movement took place at No. 1 North mine in March, 1914, there was danger of losing the fan, so it was withdrawn. The fan was reinstalled after the new tunnel was opened.

No. 1 East Fan.—A new 125-horse-power fan-drive engine was installed to work in duplicate with the first engine installed. This engine was placed on the opposite side of the fan and a new engine-house built for same. The engine-house is a wooden frame building 34 x 18 feet and covered with galvanized corrugated iron.

No. 1 East Main Tunnel, 7 x 14 Feet in the Clear.—This work, which was referred to in 1913 report, was completed in 1914 by the driving of 712 feet. The endless-rope-haulage system is not yet installed. Double track was laid and graded, and refuge-holes, 6 x 4 x 4 feet, were made every 60 feet throughout the length of the tunnel. In the meantime two 75-horse-power Lidgerwood hoists have been installed. In addition to this, a new haulage-road was made in the No. 10 East cross-dip entries to hoist the coal from the workings on the lower side of the main entry up to the new haulage-road. This new road is 1,200 feet long, and is laid throughout with heavy track-steel. A 75-horse-power Lidgerwood hoist was installed on this road to do the hoisting.

No. 1 East Drainage Tunnel, 7 x 9 Feet in the Clear.—This tunnel has been completed during the year, or driven 272 feet.

No. 1 North New Tunnel, 8 x 12 Feet in the Clear.—In March, 1914, a mountain movement closed the main entrance to No. 1 North mine. A new tunnel was started 100 feet west of old tunnel-mouth, and was driven to a point where it intersected the main entry beyond where the subsidence of mountain occurred. This tunnel is 540 feet long, of which 150 feet is through the gravel. It has a double track from the head of the old jig for a distance of 400 feet in the new tunnel.

No. 2 Mine.—We had to enlarge the return airway through very bad and broken ground for a distance of 600 feet.

Rock Tunnel, No. 1 North Mine, 7 x 10 Feet in the Clear.—The face of the main level being in faulty ground, a rock tunnel 320 feet long was driven to a point beyond the fault-line, regaining the coal seam.

No. 5 Mine.—A prospect-tunnel 120 feet long, 7 x 9 feet in the clear, was driven in faulty ground on the Main slope. The coal was not located and tunnel is stopped at present.

No. 9 Mine.—The rock tunnel and parallel being driven in 1913 were extended a further 100 feet in 1914, mainly in coal. It was found there was a 20-foot upthrow fault toward the west; this was crossed and ventilation connection made with the old back entry by a shaft 35 feet deep, 4 x 5 feet. Development of coal beyond the fault is awaiting a more encouraging business outlook and general remodelling repairs to main haulage-roads.

New Steam Plant.—A new boiler-site was made on the south side of the tipple. The mountain-side was excavated for a distance of 60 feet by 40 feet wide. Crib-work was put in to hold the sides. This was built 11 feet on two adjacent sides for a distance of 96 feet, and was carried eastwards a further distance of 132 feet to form foundations for the coal-tracks leading to the boiler-bunkers. A small Samson steam-hoist was installed to handle the coal for the boilers. A new return-tubular boiler was installed on this new

site, and the two locomotive boilers were moved up from the old site near the mouth of No. 2 mine to the new site. A new duplex boiler-feed pump was put in to feed boilers, taking its water from a new water-tank, whose capacity is 5,000 gallons, which was erected behind the boilers. The water in this tank is heated by steam radiators, the exhaust steam from No. 3 mine fan-engine being utilized to supply the radiators. There was also a new return-tubular boiler installed on the main battery of boilers.

Miscellaneous.—The box-car loader on the south side of the tipple was rebuilt. The cribbing on the mountain-side north of the tipple which was erected as a safeguard against danger from snowslides was extended 42 feet eastward, made 17 feet wide, built to an average height of 20 feet, and filled in with rocks and gravel.

NORTHERN EAST KOOTENAY INSPECTION DISTRICT.

REPORT OF T. H. WILLIAMS, INSPECTOR.

I have the honour to submit the annual report as Inspector of Coal-mines for the Northern East Kootenay Inspection District for the year 1914.

The mines at present in operation in this district are those of the Michel Colliery, operated by the Crow's Nest Pass Coal Company, and those of the Corbin Colliery, operated by the Corbin Coal and Coke Company. The mines of the Hosmer Colliery in this district formerly were in operation, but they were permanently closed in July, 1914, the material all being taken out and the openings sealed with plank stoppings.

There were four fatal and seven non-fatal accidents reported during the year. This is a decrease of eight in the non-fatal class as compared with last year, but I regret not being able to report any decrease in the fatal class, the number remaining the same.

Two of the fatalities were caused by men being suffocated while lying buried underneath coal-heaps, the other two being due to haulage, one above and one below ground. Of the seven non-fatal accidents, two were due to falls of coal at the face, two to miscellaneous causes, and three to haulage.

FERNIE RESCUE-STATION.

During the year there were twenty-nine men trained in the use of mine-rescue apparatus at the Fernie station, each being awarded a certificate of proficiency. These men were all employed by the Crow's Nest Pass Coal Company at the Coal Creek mines. To effect this training, 3,000 cubic feet of oxygen and 286 No. 1 and six No. 2 potash cartridges were used.

Crow's Nest Pass Coal Company.*

MICHEL COLLIERY.

Thomas Russell, Colliery Manager.

This colliery, operated by the Crow's Nest Pass Coal Company, Limited, is situated on both sides of Michel creek, and comprises Nos. 3, 4, 5, and 3 East, on the south side, and Nos. 7, 8, and 8 North mines on the north side.

* *See also* page 483.

Work progressed steadily during the first half of the year, but, owing to the depression in the coal and coke trade brought about by the war, considerable time was lost during the second half. The total number of days worked was 205, 135½ of which were worked in the first half and 69½ in the second half of the year. September, October, and November were the slowest months, the number of days worked being 5½, 4, and 7½ respectively.

No. 3 MINE.

J. Touhey, Overman; R. Spruston, A. Frew, and J. Henney, Firebosses; W. Almond, and F. Hutchinson, Shotlighters.

At this place a main rock tunnel cuts Nos. 5, 4, and 3 seams successively. No. 3, which is 970 feet in from the tunnel-mouth, is the only one that produced any coal during the year. The method of working is room and pillar, the entries being driven 12 feet wide and the rooms from 16 to 20 feet wide, with pillars of about 50 feet. In the West level district the size of every fourth pillar is increased to 120 feet.

Upon my last inspection I found this mine clear of explosive gas and well timbered.

The ventilation is produced by a 6- x 12-foot Sullivan fan, which is giving 90,000 cubic feet of air a minute, with a speed of 175 revolutions and a 2-inch water-gauge. This quantity is divided into two splits, as follows: East side split, 40,000 cubic feet a minute for forty men and three horses; West side split, 21,120 cubic feet for thirty-eight men and six horses.

The work of enlarging the main return airway on the West side, which has been in progress for some considerable time, has been completed, thus making it of a much greater area than it was before.

The coal on the East side is all mined without the use of explosives, but explosives are used on the West side, the shots being charged with Monobel powder, and fired with electric detonators.

No. 3 EAST OR NEW No. 3 MINE.

T. Cunliffe, Overman; E. Hayes, J. Mason, and T. Phillips, Firebosses; B. Ball, Shotlighter.

This mine is situated about 3,000 feet south-east of the tipple and is worked on the room-and-pillar system. The entries are driven 12 feet wide and the rooms 16 feet wide, with 60-foot pillars between.

At the time of my last inspection I found a small quantity of explosive gas in one place. The mine was well timbered and ventilated and the general conditions were good.

The rock tunnel mentioned in my last report, which was being driven to connect the Main slope of No. 4 mine with the No. 2 West level of No. 3 East mine, was completed in January. This enabled the Wilson fan which formerly ventilated No. 4 mine to be used at No. 3 East mine; this fan is 8 x 16 feet in diameter and is giving 80,000 cubic of air a minute for the use of sixty men and eight horses. This air is divided into four splits, as follows: No. 6 East split, 16,000 cubic feet for fourteen men and three horses; main East split, 20,250 cubic feet for sixteen men and two horses; East of slope, 19,400 cubic feet for sixteen men and two horses; West of slope, 22,000 cubic feet for fourteen men and one horse. Speed of fan, 105 revolutions a minute; water-gauge, 2 inches.

In addition to finishing the rock tunnel, a great amount of work has been done towards improving the main return airways. The coal in a few places is blasted with Monobel powder, fired with electric detonators.

NEW NO. 8 MINE.

W. Whitehouse, Overman; M. Littler, T. Baybutt, and M. D. McLean, Firebosses.

This mine is situated on the north side of Coal creek at an elevation of 535 feet above the tipple. It is worked on the room-and-pillar system, entries being driven 10 feet wide and the rooms 14 feet wide, with 50-foot pillars. About 12 feet of the seam is being worked, and according to present indications it will rank with one of the best mines of this company.

Upon my last inspection I found the mine clear of gas and well timbered.

The ventilation is produced by a 4-foot fan which is giving 11,500 cubic feet of air a minute for the use of thirty-two men and three horses. A new air-shaft, 9 x 10 feet, has been sunk from the surface to a depth of 62 feet, where it is connected by a short drift to the main return airway of the present fan, and a Champion reversible fan, 8 feet by 4 feet four inches wide, is being installed to take the place of the one now in use.

NO. 8 NORTH.

The main tunnel of this mine was developed for a distance of 750 feet, and the raise workings for about 250 feet. Operations have been suspended on account of shortage of orders.

The Draeger rescue equipment, which consists of four 2-hour and six ½-hour sets, one pulmotor, oxygen-tanks, recharging-pump, etc., is in good condition.

A disused building owned by the company was remodelled and converted into a training-station in mine-rescue work. Twelve of the officials underwent the regular course of training adopted at the Fernie training-station, each of them receiving a certificate of proficiency. G. O'Brien, Instructor at the Fernie rescue-station, supervised this training and gave the usual lectures which go along with it.

Wolf safety-lamps are used throughout at this colliery.

The following are the official returns from the Michel Colliery for the year 1914:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	35,586		31,254	
" export to United States	64,036		24,047	
" " to other countries				
Total sales		99,622		55,301
Used in making coke	83,823			
" under colliery boilers, etc.	16,488			
Total for colliery use		100,311		
Stocks on hand first of year	*Nil.*		62	
" last of year	1,171		1,167	
Difference added to stock during year		1,171		1,105
Output of colliery for year		201,104		56,406

NUMBER OF HANDS EMPLOYED, INCLUDING THOSE AT COKE-OVENS, 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	14		5		19	
Whites—Miners	203				203	
Miners' helpers						
Labourers	21		73		94	
Mechanics and skilled labour	86		45		131	
Boys	3		6		9	
Japanese						
Chinese						
Indians						
Totals	327		129		456	

Owing to depression in trade, the mines did not work steadily during 1914. The following shows the number of days each month that Michel Colliery was operated:—

	Days.		Days.
January	26	August	10½
February	24	September	5½
March	25	October	4
April	24	November	7½
May	17½	December	16
June	19		
July	26	Total	205

Name of seams or pits—New No. 3 (top section of No. 3 seam); Old No. 3 (lower section of No. 3 seam); New No. 8 (Old No. 8 seam continued). No. 8 North: Main tunnel has been developed for a distance of 750 feet in a southerly direction. Raise development in a westerly direction has been driven 250 feet. Operations suspended during last two months on account of shortage of orders.

Description of seams, tunnels, levels, shafts, etc., and number of same—

Old No. 3 Mine.

Rock Tunnels.—This tunnel was completed, 240 feet being driven in 1914 through fault at bottom of No. 3 slope, and connected same with crosscut driven in coal to shaft at the end of tunnel already driven from counter-slope, using same as return airway for workings developed at base of syncline basin between the Elk and Michel valleys.

Enlarging and making Airways.—Trebled the area of the main West return from the head of slope eastwards for a distance of 600 feet.

New Haulage-roads.—Fixed track in main tunnel and changed timbers to permit the use of air-locomotive to haul cars from Nos. 2 and 3 slopes. New parting partly made for coal from No. 3 slope.

Fan-installation.—Drift, 120 feet long, driven from outside in line with main return, and vent-doors provided to avoid damage to fan in case of accident.

New Steam Plant.—Samson hoist placed in No. 2 slope to haul the coal from six rooms to the rise of No. 13 East level, and also to drive the dips some 400 feet and rooms off same. New Ottuma hoist, 12½ x 14 inches, placed at the head of No. 3 slope.

New No. 3 Mine.

Rock Tunnel.—Drove tunnel in Main slope about 50 feet below No. 6 West level for a distance of 50 yards to connect with seam through fault to dip already reached by tunnel driven in counter-slope from No. 6 West level, and also in shaft sunk in back airway and now used as return airway for this district. There are eleven working-places in this district at the end of the year, with a promising outlook.

Enlarging Airways.—Did considerable work in fan-drift, and also centre-posted a good portion of both East and West main returns.

New Haulage-roads.—Made new siding in No. 6 East level, using 30-lb. steel, continuing to grade this level for a main haulage-road for a large area to the east of the present workings.

No. 8 Mine.

Shaft-sinking.—Sunk a new air-shaft, 9 x 10 feet, to a depth of 62 feet and connected same with short drift to main airway to present fan.

Fan-installation—We are at present installing a Champion reversible fan at this shaft of the following dimensions: Diameter, 8 feet by 4 feet 4 inches wide; 305 revolutions a minute will give 85,000 cubic feet of air a minute at a 2-inch water-gauge. This is to replace the present fan with a capacity of 15,000 cubic feet a minute.

New Power Plant.—Put in a new 6-inch air-line from tipple to opposite entrance to New No. 8 mine a distance of 2,000 feet, and made new 3-inch branch line to hoists in mine, 2-inch branch line to No. 8 North, and also a line to small hoist at head of outside incline, used for hauling material sent up to track leading to mine. Installed Ingersoll hoist in West incline, 10 x 12 inches; also Samson hoist, 6 x 8 inches, in main East incline.

Outside Work.

Mine-rescue Work.—The company fitted up a rescue-station convenient to the mines for the purpose of instructing the officials and other employees of the company in mine-rescue work.

Hosmer Mines, Ltd.

C.P.R. Department of Natural Resources.

Head Office—Montreal.

Capital, $1,500,000.

Officers.	*Address.*
Sir Thos. G. Shaughnessy, President,	Montreal, P.Q.
D. McNicoll, Vice-President,	Montreal, P.Q.
W. R. Baker, Secretary,	Montreal, P.Q.
H. E. Suckling, Treasurer,	Montreal, P.Q.
G. L. Naismith, Manager,	Calgary, Alta.
Lewis Stockett, General Superintendent, Coal-mines Branch,	Calgary, Alta.
Wm. Shaw, Mine Manager,	Hosmer, B.C.

Value of plant, $1,000,000.

HOSMER COLLIERY.

William Shaw, Manager.

This colliery, which operated steadily for the first half of the year, had mines producing coal from two different levels, known as A and B.

A LEVEL.

T. Shaw, Overman; J. Maltman, W. Rankin, R. Fowler, E. Jones, J. Wardrop, and J. Bain, Firebosses.

The coal on this level is reached by an adit tunnel driven through the measures for a distance of 4,931 feet, crosscutting ten seams, but only two of these, Nos. 2 and 9, were being worked when the mine was closed. At the time of my last inspection I found explosive gas in two places in No. 9 seam.

B LEVEL.

A. Allan, Overman; S. Richards, J. Mackie, G. Loxton, J. Loxton, J. Donnachie, and W. Clarkston, Firebosses.

This level, which is at an elevation of 500 feet above A level, had two producing mines, No. 2 North and No. 2 South. Upon my last inspection I found both of these clear of gas, well timbered, and in good condition.

The following are the official returns of the Hosmer Colliery for the year ending 31st December, 1914:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	32,317		35,003	
" export to United States				
" " to other countries				
Total sales		32,317		35,003
Used in making coke	59,325			
Used under colliery boilers, etc	11,121		3	
Total for colliery use	70,446	70,446		3
		102,763		35,006
Stocks on hand first of year	295		295	
" last of year	*Nil.*		*Nil.*	
Difference taken from stock during year		295		295
Output of colliery for year		102,468		34,711

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	6.00 - 2 50	14	9.00 - 2.50	29	
Whites—Miners	113	7.00 - 3.30			113	
Miners' helpers	113	2.75			113	
Labourers	144	3.03 - 2.75	92	2.90 - 2.47	236	
Mechanics and skilled labour	67	3.75 - 3.00	60	4.25 - 2 90	127	
Boys			19	2.00 - 1.37	19	
Japanese						
Chinese						
Indians						
Totals	452		185		637	

Name of seams or pits—No. 2, No. 9.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 2 A North, No. 9 A South, No. 2 B North, No. 2 B South.

Description and length of tramway, plant, etc.—No additions to plant in 1914. New slope partially completed in No. 9 A South.

Corbin Coal & Coke Company, Limited.

Head Office—Spokane, Wash.

Capital, $10,000,000.

Officers.	*Address.*
D. C. Corbin, President,	Spokane, Wash.
E. J. Roberts, Vice-President,	New York, N.Y.
A. M. Allen, Secretary-Treasurer,	Spokane, Wash.
R. S. Ord, General Manager,	Spokane, Wash.
Chas. Graham, Mine Manager,	Corbin, B.C.

Value of plant, $330,000.

CORBIN COLLIERY.

Charles Graham, Manager.

This colliery, which comprises Nos. 1, 3, and 4 mines, is situated on the East branch of the South fork of Michel creek, about fourteen miles from McGillivray Junction, on the Crowsnest branch of the Canadian Pacific Railway, and is connected to it by the Eastern British Columbia Railway.

The whole of the coal produced during the year was from No. 3 and No. 4 mines, No. 1 mine still being sealed on account of the fire mentioned in my last report.

No. 3 Mine.

D. Brown, Overman; T. Owen, Fireboss.

The coal at this mine, which is also known as the "Big Showing," is worked both on the surface and underground. The surface operations are carried on by the open-cut or quarrying system, the loading being done by hand into small bottom-dump cars which have a capacity of about 1 ton. These are pushed back a short distance and dumped into the railway-cars. The underground work is carried on by the room-and-pillar system. At the time of my last inspection I found it clear of gas and well timbered.

No. 4 Mine.

J. Quinn, Overman; W. Walker and G. Treherne, Firebosses.

This mine is situated between No. 1 mine and the tipple, and is working a part of the Prime seam. The coal stands nearly vertical, and is worked on the room-and-pillar system, the levels being connected by raises. Upon each of my inspections I have found it clear of gas and well timbered. The ventilation is produced by a 4- x 12-foot fan which is giving 12,000 cubic feet of air a minute for twenty-one men and one horse. Wolf safety-lamps are used throughout at both mines. Monobel powder is used for blasting the coal, fired with electric detonators.

Three new tunnels have been opened on the surface at a higher elevation than the workings of No. 4 mine, and a surface incline tram has been built to convey the coal from these places to the tramway below which connects with the tipple. A new Marcus screen has been installed, and I understand that its operation and results are quite satisfactory.

No accidents were reported from this colliery during the year.

The operations at No. 3 mine were temporarily suspended at the beginning of December, but I understand that it is the intention of the management to resume work again in the spring.

The following are the official returns from the Corbin Colliery for the year 1914:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	18,242			
" export to United States	53,712			
" " other countries				
Total sales		71,954		
Used in making coke				
Used under colliery boilers, etc.	2,358			
Total for colliery use		2,358		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		74,312		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	3		7		10	
Whites—Miners	38				38	
Miners' helpers						
Labourers, including surface Miners	20		19		39	
Mechanics and skilled labour	2		15		17	
Boys						
Japanese						
Chinese						
Indians						
Total	63		41		104	

SUMMARY—TABLE SHOWING ACCIDENTS OCCURRING IN B.C. COLLIERIES IN TEN YEARS—1905 TO 1914.

For the year	1905.				1906.				1907.				1908.				1909.				1910.				1911.				1912.				1913.				1914.				Total for 10 years.			
Output of coal—tons.	1,825,832				1,899,076				2,219,608				2,109,387				2,400,600				3,139,235				2,193,062				3,025,709				2,570,760				1,810,967				23,194,236			
No. persons employ'd	4,407				4,805				6,059				6,095				6,418				7,758				6,873				7,130				6,671				5,732				61,948			
Nature of Injury.																																											
Cause of Accident.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.
Explosion (cause unknown).	..	..	..	..	..	.	..	..	..	..	..	..	..	..	..	..	..	..	.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.	..	..	..	..	..
Gas explosions	.	..	9	9	..	..	1	1	1	1	18	20	1	..	8	9	32	..	7	39	..	..	6	6	..	..	10	10	7	2	3	12	..	..	13	13	..	1	2	3	41	4	77	122
Falls of coal.....	2	8	3	13	5	6	3	14	8	15	7	30	3	6	10	19	7	7	4	18	5	16	5	26	3	5	6	14	4	7	9	20	6	4	2	12	2	6	..	8	45	80	49	174
" rock	4	6	1	11	7	8	7	22	2	7	8	17	5	10	7	22	6	13	9	28	8	15	12	35	...	5	24	29	5	9	10	24	11	9	3	23	2	14	..	16	50	96	81	227
Mine cars and horses	3	9	8	20	2	13	13	28	8	22	15	45	1	19	15	35	6	17	24	47	11	49	23	83	5	7	18	30	5	10	10	25	4	28	9	41	5	18	2	25	50	192	137	379
" timber	1	2	..	3	..	1	1	2	..	4	1	5	1	3	..	4	..	2	3	5	1	4	2	7	...	..	5	5	1	2	2	5	3	6	1	10	..	2	2	4	7	26	17	50
Hoisting, ropes, &c .	..	..	1	1	..	2	1	3	..	..	3	3	1	4	..	5	..	.	3	3	..	2	4	6	...	1	1	2	3	7	6	16	1	2	..	3	2	1	1	4	7	19	20	46
Powder, &c., explo'n	1	1	3	5	..	1	1	2	1	2	4	7	..	2	4	6	1	1	3	5	1	1	3	5	...	1	2	3	2	1	..	3	..	2	..	2	2	3	..	5	8	15	20	43
Underground — Miscellaneous.	..	2	1	3	..	2	3	5	1	1	4	6	4	2	5	11	2	2	2	6	1	4	4	9	4	..	5	9	...	4	4	8	..	..	6	6	3	..	..	3	15	17	34	66
On surface — Miscellaneous.	1	2	..	3	1	3	2	6	10	9	2	21	2	4	3	9	3	5	4	12	1	4	7	12	4	4	11	19	1	2	3	6	2	6	1	9	1	8	1	10	26	47	34	107
	12	30	26	68	15	36	32	83	31	61	62	154	18	50	52	120	57	47	59	163	28	95	66	189	16	23	82	121	28	44	47	119	27	57	35	119	17	53	8	78	249	496	469	1214

ACCIDENTS IN BRITISH COLUMBIA COLLIERIES DURING 1914.

Causes of Accident and Nature of Injury.	Name of Colliery.																																		Total for 1914.			
	W.F.Co. Nanaimo.			C.C. Extension.			C.C. Comox.			P.C.C. Co. S. Wellington			V.N.C. Co. E. Wellington.			I. C. & C. Co. Coal Hill.			M.C. Co. Middlesboro.			P.C. & L. Co. Princeton.			C.N.P. Co. Crowsnest.			C.P.R. Hosmer			C.C. & C. Co. Corbin.			Other Collieries.					
	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Total.
Gas—Explosion of																																						3
Fatal																																						
Serious								1																											1			
Slight														1						1																2		
Falls of Coal																																						8
Fatal							1																					1							2			
Serious								2									1									2			1							6			
Slight																																						
Falls of Rock or Roof																																						16
Fatal	1						1																												2			
Serious		4						6						1						1						2										14			
Slight																																						
Mine Cars and Horses																																						25
Fatal							2																		3										5			
Serious		2			4			2			2															8										18			
Slight									1			1																									2		
Shots or Powder																																						5
Fatal	2																																		2			
Serious								3																												3			
Slight																																						
Ropes, Hoisting or Haulage																																						4
Fatal	1																								1										2			
Serious																	1																			1			
Slight																		1																			1		
Post or Timber																																						4
Fatal																																						
Serious					1																					1										2			
Slight						1								1																						2			
Miscellaneous—Underground																																						3
Fatal							2																					1							3			
Serious																																						
Slight																																						
Miscellaneous—Surface																																						10
Fatal																												1							1			
Serious								1						1						3						2		1							8			
Slight																					1																1		
Total	4	6			5	1	6	15	1		2	1		2	2		2	1		4	2				4	15		3	2						17	53	8	78
Number of men employed	805			518			1,047			281			248			175			190			53			1,656			637			104			18			5,732		

ANALYSIS OF ACCIDENTS DURING YEAR 1914.

	No. of Accidents per 1,000 Men employed.				Tons of Coal mined per Accident.			
	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.
East Kootenay District	2.90	7.1	....	10.0	136,455	56,187	....	39,799
Coast District	3.00	10.8	2.4	16.2	121,124	33,646	151,406	22,431
Total Province	2.97	9.25	1.40	13.62	127,437	40,876	270,803	27,775

PER CAPITA PRODUCTION OF COLLIERIES.

	Gross Tons of Coal mined in 1914.	Total Number of Men employed by Producing Collieries.	Tons of Coal mined per Man employed at Collieries.	Number of Men employed Underground in Producing Collieries.	Tons of Coal mined per Man employed Underground.
East Kootenay District	955,183	2,397	399	1,749	547
Coast District	1,211,245	3,335	363	2,518	481
Total for Province	2,166,428	5,732	379	4,267	508

DETAILED STATEMENT OF ACCIDENTS IN B.C. COLLIERIES DURING 1914.

COAST COLLIERIES.

REPORTED BY HENRY DEVLIN AND JOHN NEWTON, INSPECTORS.

No.	Colliery.	Date.	Name.	Occupation.	Details.
1	East Wellington. (V.N.C. Co.)	Jan. 12	Sing.....	Labourer	He tripped and fell on a circular saw and had his left forearm almost severed.
2	East Wellington. (V.N.C. Co.)	" 27	W. Staltzenberg...	Miner	Ignition of gas from a drill-hole burnt his right arm.
3	Extension No. 1. (C.C.)	" 30	Thomas Salvak	Mule-driver...	Squeezed about the hips by being dragged between cars.
4	Nanaimo..... (W.F. Co.)	" 30	John Harrison.....	Labourer	Right leg was broken below knee by piece of roof falling.
5	Nanaimo..... (W.F. Co.)	Feb. 3	John Sojka.....	Brusher	Roof caved in, due to not putting in stringer as ordered by the foreman. Broken back and veinous hæmorrhage.
6	Comox ..... (C.C.)	" 7	Ching Sit	Miner's helper.	While clearing up a place where rock had caved a piece fell from the roof, striking Ching Sit on the head and killing him.
7	Comox No. 7... (C.C.)	" 9	Thomas Harvey ...	Driver-boss....	He was struck by a runaway car and received a contusion on the right thigh.
8	Nanaimo..... (W.F.)	" 10	John Hadnan.....	Brusher.....	Chest and back injured by a piece of rock falling from the roof.
9	Comox..... (C.C.)	" 19	T. Fukumoto	Miner's helper.	A piece of coal hit him on the back, causing an injury to the spine and complete paralysis of his legs.
10	Comox..... (C.C.)	" 28	Ma Su Yup	Miner's loader.	While he was loading a car a piece of a pillar fell on him, causing injuries that resulted in death.
11	East Wellington. (V.N.C. Co.)	" 28	J. Dack.....	Miner	Left leg fractured near ankle by a piece of rock falling on it.
12	Nanaimo..... (W.F. Co.)	Mar. 3	Steve Morris.....	Loader.....	Killed by a fall of rock.
13	Comox No. 8.... (C.C.)	" 20	Alfred Fosford	Ashman.... ..	Received wound by falling on a pinch-bar.
14	Wellington Ex.. (C.C.)	Apr. 6	George Owens.....	Mule-driver...	Slipped in front of empty car and sustained a fractured rib.
15	Nanaimo..... (W.F.)	" 11	Edward Waters ...	Driver.....	He jumped off loaded cars in motion and sustained a compound fracture of the right leg.
16	Wellington Ex.. (C.C.)	" 14	Zack Palmer	Miner	He was putting up a stringer and lost his balance and was thrown back against a post, getting two ribs cracked.

ACCIDENTS IN COAST COLLIERIES.—*Continued.*

No.	Colliery.	Date.	Name.	Occupation.	Details.
17	Comox.. ..... (C.C.)	Apr. 15	Austin Harper	Mule-driver...	The mules knocked out a prop which allowed a stringer to fall on Harper, causing injury to spinal cord which resulted in death on November 2nd.
18	Comox No. 4.... (C.C.)	" 20	Fuk Yet.....	Miner's loader.	A piece of rock fell from the roof and bruised his head and cut his face.
19	Comox..... (C.C.)	" 24	Jap Hosaka.....	Rock-miner ...	He was trying to get the cap out of a missed hole when cap went off; lost one eye and impaired the sight of the other, lacerated hand and lost left little finger.
20	Comox No. 8.... (C.C.)	" 28	S. Morris.....	Miner	A piece of rock fell on him, causing bruise and sprain of left knee, back, and scalp-wound.
21	Comox No. 8.... (C.C.)	" 28	T. Tsumoda.....	"	A piece of rock fell from the roof and lacerated his hand and back.
22	Comox No. 8.... (C.C.)	" 28	William Styles....	Pumpman	Accidentally fell down shaft and was killed.
23	South Wellington (P. C.C.M.)	May 14	Pari Gov.....	Rope-rider....	He was riding on a trip and had his arm resting on top of a large piece of coal. On coming to a low place his arm was crushed between a stringer and the coal in the car; left forearm fractured.
24	Nanaimo..... (W.F. Co.)	June 12	John Hacker	Cager.....	Was coupling cars when some other cars bumped in, causing his shoulders to be squeezed and resulting in a broken collar-bone.
25	Comox ..... (C.C.)	" 15	Joseph Stanich....	Miner	Picked into missed hole and received superficial wounds of face, eyes, neck, chest, hands, and wrists.
26	Wellington Ex.. (C.C.)	" 29	Choy Lung.....	Pusher..... .	While lowering a loaded car by a rope around a post his foot got caught between the rope and the post and was cut off.
27	Wellington Ex.. (C.C.)	July 6	Alexander Ross....	Mule-driver...	He was jammed between an empty car and a post, squeezing his pelvis.
28	Comox..... (C.C.)	" 13	William Carvill....	Driver.....	Fell in front of loaded car, which ran over him, causing fractured spine and subsequent death on July 20th.
29	South Wellington No. 2. (P.C.C.Co.)	" 23	Paul Bell	Rope-rider....	Slightly squeezed between cars and side of road.
30	Comox..... (C.C.)	" 31	Wong Yun.....	Miner	While timbering, a piece slid away from the cap-piece and fell on his leg, causing dislocation of right ankle and fracture right leg.
31	Comox..... (C.C.)	Aug. 4	Wong Yung.....	Driver.....	A piece of coal fell on him and broke both bones of his leg.
32	Nanaimo..... (W.F. Co.)	" 12	James Berry	Fireboss	Deceased was riding on edge of bucket when he lost his balance, fell to the bottom of the shaft, and was killed.

ACCIDENTS IN COAST COLLIERIES.—*Concluded.*

No.	Colliery.	Date.	Name.	Occupation.	Details.
33	Nanaimo..... (W.F. Co.)	Aug. 27	James McIntosh...	Miner	Deceased was killed by a powder-blast, but the cause thereof is unknown.
34	Nanaimo..... (W.T. Co.)	" 27	Richard Munroe...	"	Same accident; killed.
35	Comox..... (C.C.)	" 27	Jung Nong.....	Miner's loader.	He stayed too close to a blast and a piece of coal hit him, breaking his right leg.
36	South Wellington (P.C.C. Co.)	Sep. 2	William Jones.....	Shotfirer.....	A runaway car smashed his leg below the knee, necessitating amputation.
37	Comox..... (C.C.)	" 26	Dong Hing.....	Miner's loader.	Deceased was walking up slope instead of manway; slipped and grasped electrical wires and was electrocuted.
38	Comox..... (C.C.)	Oct. 7	John Poy.....	Loader.....	Right arm was fractured by being caught between two cars.
39	Comox..... (C.C.)	" 19	William Hutchison.	Miner	Superficial burns of face, ears, and hands when a gas-feeder was ignited. A mule also kicked him on the face and hands.
40	East Wellington. (V.N.C. Co.)	Nov. 11	Alex. McLellan....	Timberman....	While timbering, a piece of rock from the roof fell and bruised his back.
41	Comox..... (C.C.)	" 26	Chin Jung.....	Miner's loader.	Leg broken by a piece of rock falling from the roof.
42	Comox..... (C.C.)	" 28	Moy Fung	Pusher.....	Leg broken by a loaded car passing him; did not give the car sufficient clearance.
43	Comox..... (C.C.)	" 30	Wataru Sarayama .	Miner's loader.	Leg broken by fall of piece of rock from the gob—at this place 7 feet high.
44	Nanaimo..... (W.T. Co.)	Dec. 11	Henry Fletcher....	Machineman .	Was working on machine at face when a piece of rock fell and broke his right leg below the knee.
45	Wellington Ex.. (C.C.)	" 21	Sidney Henley....	Miner	He was hammering in a post when a piece of bark flew off, striking him in the eye and injuring it.

NICOLA COLLIERIES.

REPORTED BY ROBERT STRACHAN, INSPECTOR.

46	Inland C. & C. Co	Jan. 13	Thos. Conway.....	Miner	Collar-bone broken by a fall of top coal.
47	Middlesboro .... (N.V.C. & C. Co.)	" 29	Richard Jackson...	Timber-framer.	Arm broken and hip bruised by a falling stringer while unloading a car of timber on surface.
48	Middlesboro .... (N.V.C. & C. Co.)	Apr. 4	Jas. Black	Miner	Scorched on face and neck by the ignition of a gas-feeder.

ACCIDENTS IN NICOLA COLLIERIES.—*Concluded.*

No.	Colliery.	Date.	Name.	Occupation.	Details.
49	Middlesboro .... (N.V.C. & C. Co.)	June 2	Walter Nelson.....	Tipple-boy	A ring on his finger caught on a rivet in a belt and caused laceration of second finger of right hand, and later amputation was necessary.
50	Middlesboro .... (N.V.C. & C. Co.)	" 24	Thomas Clark	Machine-shop [boy	Fell between cars and received a cut on his left thigh.
51	Middlesboro .... (N.V.C. & C. Co.)	July 4	John Sharp White .	Brakesman	Right ankle dislocated and both bones broken by getting his foot jammed between rope and bed-plate of hoist.
52	Middlesboro .... (N.V.C. & C. Co.)	" 4	Lenord Warburton.	Overman.....	A piece of rock fell on his finger, bruising it and later necessitating amputation.
53	Inland C. & C. Co	Dec. 9	Tom Smith.....	Rope-rider	Slipped down a slope and was severely shaken up.
54	Inland C. & C. Co	" 9	Joseph Fairley	"	Slipped down a slope, receiving scalp-wounds and a broken nose.

NORTH-EAST KOOTENAY COLLIERIES.

REPORTED BY T. H. WILLIAMS, INSPECTOR.

55	Hosmer..... (C.P.R.)	Jan. 2	Fred. Steponov....	Coke-oven [larryman	While riding into the slack-bin on empty larry deceased raised his head and was caught between the larry and the door-lintel; neck broken.
56	Hosmer..... (C.P.R.)	Feb. 10	Mike Knisacky....	Miner	A plank battery gave way, causing coal to fall on deceased, thereby causing death by suffocation.
57	Hosmer..... (C.P.R.)	" 24	Nick Bakry	Labourer.....	He got tangled up with a rope on a drum in the tipple and sustained a fracture of arm above the elbow.
58	Hosmer..... (C.P.R.)	" 24	A. Sussko.....	"	A run of coal from the face of a chute buried him, causing death by suffocation.
59	Michel ..... (C.N.P. Co.)	Mar. 12	Humphrey Evans..	Miner	A runaway truck knocked out props and caused a cave-in; deceased was caught in the cave-in and died as result of injuries.
60	Michel ..... (C.N.P. Co.)	" 23	L. Fanna.....	Carpenter's [helper	The sleeve of his coat got caught in the cogs of a motor and he sustained a crushed right arm, which had to be amputated.
61	Michel ..... (C.N.P. Co.)	" 28	Emil Tapay.....	Pusher	He sustained a compound fracture of left leg when hit by a runaway car.
62	Hosmer..... (C.P.R.)	Apr. 14	Jo. Kulla	Miner	Right forearm fractured by a piece of coal falling from the face.
63	Michel ..... (C.N.P. Co.)	May 20	V. Chaldeny	Driver...	Fell in front of loaded car, receiving fracture of right leg and injury to back.

ACCIDENTS IN NORTH-EAST KOOTENAY COLLIERIES.—*Concluded.*

No.	Colliery.	Date.	Name.	Occupation.	Details.
64	Michel ..... (C.N.P. Co.)	July 18	A. Mitchell	Driver.....	He got his foot caught in an open latch and car came down on him, fracturing his leg.
65	Michel ..... (C.N.P. Co.)	Sep. 10	U. Gatto	Miner	A piece of coal fell away from a slip, knocked Gatto off his bench and broke his right leg.

SOUTH-EAST KOOTENAY COLLIERIES.

REPORTED BY EVAN EVANS, INSPECTOR.

66	Coal Creek... .. (C.N.P. Co.)	Feb. 24	William Smith	Motorman	While assisting to put a tram of timber back on a trestle, Smith was knocked off the trestle and sustained a crushed chest and internal hæmorrhage of lungs.
67	Coal Creek .... (C.N.P. Co.)	Apr. 14	Tony Rato.....	Miner's helper.	A piece of coal fell from the face and knocked him off the bench, causing a compound fracture of right leg.
68	Coal Creek ..... (C.N.P. Co.)	May 14	John Flood..	Miner	Femur fractured and two ribs broken by a fall of coal and slate while brushing airway.
69	Coal Creek..... (C.N.P. Co.)	July 12	Thomas J. Barnes..	"	Scaffolding gave way and he was thrown to the ground; sustained a fractured fibula and a crushed ankle.
70	Coal Creek. .... (C.N.P. Co.)	Aug. 13	Matt Janko.....	Driver.....	Some props rolling off a car jammed the injured man against a bridge-stick, causing a fractured clavicle and ribs.
71	Coal Creek..... (C.N.P. Co.)	Sep. 8	Frank Nee.....	"	A piece of rock fell on him, causing dislocation and fracture of his right femur, also face, scalp, and right wrist cut.
72	Coal Creek..... (C.N.P. Co.)	" 15	Thomas Bratti....	Miner	A car jumped the track and jammed his hand between the car and a post; crushed and lacerated hand and loss of third and fourth fingers of right hand.
73	Coal Creek..... (C.N.P. Co.)	Dec. 4	Thomas Meyers....	Rope-rider's [helper	While riding on end of trip was caught by cave-in which killed him.
74	Coal Creek..... (C.N.P. Co.)	" 4	Peter Catenaro....	Rope-rider....	Same accident; killed.
75	Coal Creek..... (C.N.P. Co.)	" 12	Harry France	Motorman ...	Foot severely crushed by being jammed between a car-bumper and motor-frame.
76	Coal Creek ..... (C.N.P. Co.)	" 12	Mike Janos	Miner	Injured man was helping to lift a car on to the track when the horse jerked, and one of the posts in the car struck him, and fractured his shoulder-blade.

ACCIDENTS IN SOUTH-EAST KOOTENAY COLLIERIES.—*Concluded.*

No.	Colliery.	Date.	Name.	Occupation.	Details.
77	Coal Creek. .... (C.N.P. Co.)	Dec. 21	William Corrigan..	Gripper-bell [boy	While riding on an empty, was run down by other cars from behind; bruised hip, left foot lacerated, fourth and fifth toes amputated.
78	Coal Creek..... (C.N.P. Co.)	" 21	Ray Van Mechalen.	Miner	Suffocated by cave of roof; cause unknown.

PROSECUTIONS UNDER "COAL-MINES REGULATION ACT."

As is incumbent upon the Inspector, he has been obliged to lay information before the local Magistrates in a large number of cases for infractions, by the workmen in the mines, of the general and special rules, which are provided solely for their own protection. These regulations are for the general safety of all the underground employees, and the carelessness of one man endangers all his fellow workmen, whose lives are practically in the hands of such foolishly careless or criminal person.

The following prosecutions have been brought during the year for the offences noted; the judgments given by the Magistrate being shown:—

Date.	Name.	Occupation.	Mine.	Offence charged.	Judgment.
Feb. 7	H. N. Freeman	Manager....	Van.-Nan. C. [Co.	Failed to report a slight explosion of gas as required by sec. 63	Fined $20 and costs.
" 27	Mike Farby...	Miner	S. Wellington	Having matches in his possession in mine contrary to sec. 91, Rule 9	Fined $10 and costs.
" 27	Tony Elinsky..	"	"	Same offence	Fined $10 and costs.
" 27	Louie Jukes...	"	"	Same offence	Fined $10 and costs.
Mar. 17	William Wilson	Overman....	Coal Creek..	Gross negligence in permitting the use of a §-inch wire rope on an incline, two strands of the rope being missing for a distance of 60 feet. The rope broke and a man was killed	Certificate of competency as an overman was suspended for a period of four months.
May 26	J. Roberts	Miner	" .	Violating Special Rule 114 (neglected to sprag coal)	Fined $10 and costs.
" 26	Hugh Barr....	"	" ..	Same offence	Fined $10 and costs.
June 2	W. Dinnie	Helper	" ..	Damaging a safety-lamp.....	Fined $10 and costs.
" 16	John Millar...	Labourer....	" ..	Violating Rule 9 (matches in possession in mine)	Fined $10 and costs.
" 17	Percy Warr...	Master me- [chanic	Michel.....	Violation of Special Rule 81..	Fined $10 and costs.
July 16	B. Sloane	Miner	Coal Creek..	Violating Rule 9 (matches in possession in mine)	Fined costs of Court.
" 29	A. Conouik ...	Helper.....	" ..	Damaging safety-lamp	Fined $10 and costs.
Sep. 3	John Tomok ..	"	Weste'n Fuel	Failed to use a drag as required by General Rule 15	Fined $10 and costs.
" 3	N. Warakara..	"	Comox.....	Violating General Rule 9 (matches in possession in mine)	Fined $5 and costs.
" 15	W. Booth.....	"	"	Same offence	Fined $5 and costs.

PROSECUTIONS.—*Concluded.*

Date.	Name.	Occupation.	Mine.	Offences charged.	Judgment.
Sep. 15	H. Armishaw..	Miner	Comox.....	Violating General Rule 9 (matches in possession in mine)	Fined $5 and costs.
" 27	M. Vlacouvich.	"	Extension...	Charging a shot-hole in the absence of the shotlighter, contrary to sec. 91, Rule 12	Fined $10 and costs.
Oct. 7	Adam Stewart.	"	Van.-Nan. C. [Co.	Having matches in his possession, contrary to sec. 91, Rule 9	Fined $10 and costs.
" 7	Fred Crew....	"	"	Same offence	Fined $10 and costs.
" 7	Jesse Meredith	Driver.....	"	Same offence	Fined $10 and costs.
" 7	Beecher Smith.	Miner	S. Wellington	Same offence	Fined $10 and costs.
" 7	Hugh Clarkson	Driver.....	"	Same offence	Fined $10 and costs.
" 7	John Alusan ..	"	"	Same offence	Fined $10 and costs.
" 14	William Baird.	Miner	Weste'n Fuel	Violating Special Rule 126 (neglecting to sprag coal)	Fined $10 and costs.
" 14	Joe Capanach..	"	"	Same offence	Fined $10 and costs.
" 14	Geo. Black....	"	S. Wellington	Used small coal for tamping instead of clay, contrary to Rule 11	Fined $10 and costs.
" 14	Wm. Rickerby	"	"	Same offence	Fined $10 and costs.
" 14	Nick Bulick...	"	"	Same offence	Fined $10 and costs.
" 27	Wm. Jenkins..	"	Van.-Nan. C. [Co.	Violating Rule 9 (matches in possession in mine)	Fined $10 and costs.
" 27	James Bryant .	"	"	Same offence	Fined $10 and costs.
Nov. 9	Ticki.....	"	Comox.....	Violating sec. 91, General Rule 11	Fined $10 and costs.
" 28	Robert Hastie.	Driver.....	Weste'n Fuel	Violating Special Rule 82 (riding on motor-trips)	Fined $10 and costs.
" 28	Hugh Patterson	"	"	Same offence	Fined $10 and costs.
" 28	G. Banford....	"	"	Same offence	Fined $10 and costs.
Dec. 2	Frank Rhodes.	Miner	S. Wellington	Violating General Rule 11 (using coal-dust for tamping)	Fined $10 and costs.
" 2	Nick Spenich..	"	"	Same offence	Fined $10 and costs.
" 12	George Jardine	Fireboss	Weste'n Fuel	Failed to protect all approaches to where a shot was to be fired, contrary to General Rule 12	Fined $15 and costs.

METALLIFEROUS MINES SHIPPING IN 1914.

CASSIAR.

ATLIN MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Engineer	Windy Arm	J. Alexander	Carcross	Gold.

SKEENA.

SKEENA MINING DIVISION.

Granby Group	Anyox	Granby Cons. M. S. & P. Co.	Anyox	Copper, gold.

QUEEN CHARLOTTE MINING DIVISION.

Early Bird	Moresby island	J. McLellan	Queen Charlotte	Gold.
Tasu Mine	Tasu harbour	Tasu Mining Co	"	Gold, copper.

OMINECA MINING DIVISION.

American Boy	9-Mile mountain	Harris Mines, Ltd.	Hazelton	Gold, silver, lead.
Colorado	Hunter basin	Chester Thoman	Telkwa	Silver, copper.
Silver Cup	9-Mile mountain	Silver Cup Mines, Ltd.	Hazelton	Silver, lead.
Empire Group	Hudson Bay mountain	Simpson Bros.	Smithers	" "
Silver Standard	Glen mountain	Silver Standard Mining Co.	New Hazelton	Gold, silver, lead.

EAST KOOTENAY.

FORT STEELE MINING DIVISION.

St. Eugene	Moyie	Consolidated M. & S. Co.	Marysville	Silver, lead.
Sullivan	Kimberley	" "	"	"

WEST KOOTENAY.

AINSWORTH MINING DIVISION.

Bluebell	Riondel, Kootenay lake	New Canadian Metal Co.	Riondel	Silver, lead.
Caledonia				"
Charleston	Whitewater			"
Cork-Province	South Fork, Kaslo creek	W. E. Zwicky	Kaslo	"
Early Bird	Ainsworth			"
Highland	"	Consolidated M. & S. Co.	Ainsworth	"
Maestro-Banker	"	" "	"	"
No. 1	"	" "	"	"
Panama	Bear lake	H. Giegerich	Kaslo	Silver.
Revenue	Kaslo creek	Lachlan MacLean	"	Silver, lead.
Silver Hoard	Ainsworth	Silver Hoard Mines, Ltd.	Ainsworth	"
U.S	Jackson basin	W. B. Smith	"	Zinc.
Utica	Paddy mountain	Utica Mines, Ltd.	Kaslo	Silver, lead, zinc.
Whitewater	Whitewater	J. L. Retallack & Co.	"	Gold, silver, lead, zinc.

WEST KOOTENAY.—*Concluded.*

SLOCAN MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Antoine				Silver, lead.
Buck Frac				"
Cinderella	Three Forks	G. B. Dean	Three Forks	"
Colonial	Sandon	A. D. Coplen	Spokane	"
Evening & Jennie	"	G. T Gormley	Sandon	"
Hartney	New Denver	A. H. Blumenauer	New Denver	Silver, lead, zinc.
Hewitt	Silverton	Silverton Mines, Ltd	Silverton	"
Ivanhoe	Sandon	Minnesota Silver Co.	Sandon	Silver, lead.
Lone Bachelor	Three Forks	Angus Cameron	Three Forks	"
Lucky Thought	Silverton	Con. Mining & Smelting Co.	Trail	"
Noonday	Cody creek	Bruce White	Sandon	"
Rambler-Cariboo	McGuigan	Rambler-Cariboo Mines, Ltd.	Three Forks	Silver, lead, zinc.
Richmond-Eureka	Sandon	Con. Mining & Smelt'g Co. of Can.	New Denver	Silver, lead.
Ruth	"	The Ruth Mines, Ltd.	Kaslo	"
Slocan Star	"	Slocan Star Mines, Ltd	Sandon	"
Standard	Silverton	Standard Silver Lead Mining Co.	Silverton	Silver, lead, zinc.
Surprise	Sandon	J. P. MacFadden	Sandon	Silver, lead.
Van-Roi	Silverton	Van Roi Mining Co., Ltd.	Rossland	Silver, lead, zinc.
Wonderful	Sandon	Wonderful Group Mining Co.	Sandon	Silver, lead.

SLOCAN CITY MINING DIVISION.

Black Prince	Lemon creek			Silver, lead.
Eastmont	Ten-mile creek	Ellis Silver Mining Co.	Slocan	Gold, silver, lead.
Enterprise	"	S. S. Fowler	Riondel	"
Ottawa	New Denver	Consolidated M. & S. Co.	Trail	Silver.

NELSON MINING DIVISION.

Burnett				Gold, silver.
California	Toad mountain	W. Moore	Nelson	"
Emerald	Salmo	Iron Mountain, Ltd.	Salmo	Silver, lead.
H.B.	Deer creek	H. B. Mining Co.	"	Silver, lead, zinc.
Hope	South Fork, Salmon river	Wm. A. Talbot	"	Silver, lead.
Molly Gibson	Kokanee creek	Consolidated M. & S. Co.	Nelson	"
Molybdenite Group	Lost creek	Bell Bros. & Bennet	Salmo	Molybdenum.
Motherlode	Sheep creek	Motherlode Sheep Creek Min. Co.	Sheep Creek	Gold, silver.
Perrier	Cottonwood creek	C. Crossley	Nelson	"
Porto Rico	Barrett creek	W. B. DeWitt	"	Gold.
Queen	Sheep creek	Queen Mines, Incorporated	Sheep Creek	Gold, silver.
Queen Victoria	Beasley	B.C. Copper Co.	Greenwood	Gold, silver, copper.
Revell				Silver, lead.
Second Relief	Erie	A. D. Westby	Nelson	Gold, silver.
Silver King	Toad mountain	Consolidated M. & S. Co.	"	Gold, silver, copper.
Summit Group	Sheep creek	W. B. DeWitt	Sheep Creek	Gold.
Taft				"
Venus	Morning mountain	A. H. Gracey	Nelson	"
Yankee Girl	Ymir	Hobson Silver Lead Co.	Ymir	Gold, silver.
Zincton	Deer creek	P. F. Horton	Salmo	Silver, lead, zinc.

TRAIL CREEK MINING DIVISION.

Blue Bird	Rossland	Rosalia Mining Co.	Rossland	Gold, silver, lead.
Centre Star Group	"	Consolidated M. & S. Co.	"	Gold, silver, copper.
Le Roi	"	Consolidated M. & S. Co.	"	" "
Josie Group	"	Le Roi No. 2, Ltd.	"	" "
Phœnix	"	Phœnix Gold Mining Co.	"	" "

TROUT LAKE MINING DIVISION.

Ajax	Ferguson	Ferguson Mines, Ltd.	Ferguson	Gold, silver, lead.
Silver Cup	"	"	"	" "

REVELSTOKE MINING DIVISION.

Lanark	Illecillewaet	Fred C. Elliott	Victoria	Gold, silver, lead.

BOUNDARY.

GRAND FORKS MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Rawhide	Phœnix	New Dominion Copper Co.	Greenwood	Gold, silver, copper.
Union	Franklin camp	Louis Johnson	Grand Forks	Gold, silver.

GREENWOOD MINING DIVISION.

Carmi	Carmi	W. H. Burke	Carmi	Gold, silver.
Dynamo				Gold, silver, lead.
Granby	Phœnix	Granby M., S. & P. Co.	Grand Forks	Gold, silver, copper.
Imperial	Rock creek	E. L. Steeves	Rock Creek	" "
Jewel-Denoro	Greenwood	Jewel Denero Mines, Ltd.	Greenwood	Gold, silver.
Motherlode	"	B.C. Copper Co., Ltd.	"	Gold, silver, copper.
Sally	Wallace mountain	Alex. Robinson	"	Gold, silver, lead.
Standard	"	W. H. Rambo	Beaverdell	Silver, lead.

OSOYOOS MINING DIVISION.

Dividend	Kruger mountain	Dividend-Lake View C. G. M. Co.	Spokane	Gold, silver, copper.
Nickel Plate	Hedley	Hedley Gold Mining Co.	Hedley	Gold.

VERNON MINING DIVISION.

St. Paul	Monashee mountain	Paul Rembler	Kelowna	Gold.

KAMLOOPS MINING DIVISION.

Iron Mask	Kamloops	E. G. Wallinder	Kamloops	Gold, silver, copper.

LILLOOET MINING DIVISION.

Coronation	Cadwallader creek	Coronation Gold Mines, Ltd.	Victoria	Gold.

COAST.

VANCOUVER MINING DIVISION.

Britannia	Howe sound	Britannia Mining & Smelting Co.	Britannia Beach	Silver, copper.

NANAIMO MINING DIVISION.

Copper Queen	Texada island	Jas. Raper	Vananda	Gold, silver, copper.
Cornell	"	I. Little	"	" "
Gem	"	A. A. Logan	Vancouver	Gold.
Marble Bay	"	Tacoma Steel Co.	Tacoma	Gold, silver, copper.

CLAYOQUOT MINING DIVISION.

Kallapa	Meares island	Kallapa Mining Co., Ltd.	Vancouver	Gold, silver, copper.
Leora	Elk river	W. W. Gibson	Victoria	Gold.

LIST OF CROWN-GRANTED MINERAL CLAIMS.

CROWN GRANTS ISSUED IN 1914.

CASSIAR.

Claim.	Division.	Grantee.	Lot No.	Acres.	Date.
Daisy	Atlin	James Alexander	970	33.29	Mar. 3
Even Star	"	Saml. Johnston	208	48.52	July 10
Gibb Frt.	"	David Gibb	210	19.53	Nov. 9
Gnat Frt.	"	"	378	27.28	Aug. 21
Jersey Lily	"	W. C. S. Hathorn and Thos. Kirkland	21	51.65	May 29
Mickey	"	Jas. Alexander and John Dunham	967	47.20	Mar. 3
New Brunswick	"	Jerry P. Quinlan	805	17.67	Jan. 14
Northern Partnership No. 4 Frt.	"	Jas. Alexander and John Dunham	209	14.58	Mar. 3
Northern Partnership No. 5	"	Jas. Alexander	972	31.86	Mar. 3
Speculation	"	John Roxborough	969	51.65	Jan. 12
Blue Grouse	Stikine	Bruno Greif, C. M. Coulter, Peter C. McCormack, Alex. Vreatt, Geo. H. Whitney, E. S. Busby, John Maloney, and F. E. Bronson	2869	51.64	Nov. 9
Brown Bear	"	Bruno Greif, Cassius M. Coulter, Peter Constantine McCormack, Alex. Vreatt, Geo. H. Whitney, E. S. Busby, John Maloney, and F. E. Bronson	2865	51.15	Nov. 6
Copper Queen	"	Bruno Greif, C. M. Coulter, Peter Constantine McCormack, Alex. Vreatt, Geo. H. Whitney, E. S. Busby, John Maloney, and F. E. Bronson	2870	51.64	Nov. 9
El Oro	"	Bruno Greif, C. M. Coulter, Peter C. McCormack, Alex. Vreatt, G. H. Whitney, E. S. Busby, John Maloney, and F. E. Bronson	2862	51.65	Nov. 6
Golden Pheasant	"	Bruno Greif, C. M. Coulter, P. C. McCormack, Alex. Vreatt, G. H. Whitney, E. S. Busby, Jno. Maloney, and F. E. Bronson	2864	46.70	Nov. 6
Iskoot	"	Bruno Greif, C. M. Coulter, P. C. McCormack, Alex. Vreatt, G. H. Whitney, E. S. Busby, John Maloney, and F. E. Bronson	2866	51.15	Nov. 7
Margurette	"	Bruno Greif, C. M. Coulter, P. C. McCormack, Alex. Vreatt, G. H. Whitney, E. S. Busby, John Maloney, and F. E. Bronson	2868	48.8	Nov. 9
Silver Dollar	"	Bruno Greif, C. M. Coulter, P. C. McCormack, Alex. Vreatt, G. H. Whitney, E. S. Busby, John Maloney, and F. E. Bronson	2867	48.30	Nov. 7
Big Dick	Portland Canal	Indian Mines, Ltd. (N.P.L.)	1981	40.19	Nov. 18
Billy	" "	Portland Canal Tunnels, Ltd. (N.P.L.)	2954	37.81	May 1
Chicago	" "	Bear River Mng. Co.	98	51.65	Jan. 21
Chicago Kid Frt.	" "	" "	99	31.80	Jan. 21
Fritz	" "	Indian Mines, Ltd. (N.P.L.)	1982	25.90	Nov. 18
Go-Between Frt.	" "	Portland Canal Tunnels, Ltd. (N.P.L.)	2959	2.31	May 1
Helen	" "	" "	2956	45.85	May 1
Jane	" "	" "	2955	50.33	May 1
Jennie	" "	" "	2958	28.88	May 1
Kootenay	" "	" "	1385	46.70	May 1
Lipton No. 1	" "	Wm. Spurck	1977	51.65	Feb. 27
" No. 2	" "	"	1978	42.67	Feb. 27
Little Joe	" "	Portland Canal Tunnels, Ltd. (N.P.L.)	873	51.65	Jan. 14
Little Pearl Frt.	" "	" "	1384	49.15	May 1
London	" "	Bear River Mng. Co.	1480	51.65	Jan. 21
Lucky Seven	" "	Portland Canal Tunnels, Ltd.	874	42.43	Jan. 14
Mabel	" "	" "	2957	44.22	May 1
Melba	" "	" "	437	40.71	May 2
New York	" "	Bear River Mng. Co.	1485	49.82	Jan. 21
O.K. Frt.	" "	Joseph Perrault	2960	39.28	Sept. 16
Olga	" "	Portland Canal Tunnels, Ltd.	436	45.48	May 2
Portland No. 1	" "	Indian Mines, Ltd.	1980	33.96	Nov. 18
" No. 2	" "	"	1979	29.29	Nov. 18
Wolverine Frt.	" "	Joseph Perrault	2961	13.24	Sept. 16
Buffalo	Skeena	J. H. McMillan, official administrator, administrator of the estate of John James Lee, deceased, intestate	2230	13.61	Dec. 2
Cayuse	"	J. H. McMillan, official administrator, administrator of the estate of John James Lee, deceased, intestate	2229	50.43	Dec. 2
Eagle	"	Wm. T. Kergin, Geo. Rudge, and Preston Charles Coates	2347	51.61	July 4
Gold Cup	"	Richard James Grant	2214 R. 4	35.03	April 14

CASSIAR.—*Concluded.*

Claim.	Division.	Grantee.	Lot No.	Acres.	Date.
Gold Sovereign	Skeena	Richard James Grant	2215 R. 4	51.65	April 14
Groundhog	"	W. T. Kergin, Geo. Rudge, and Preston C. Coates	2345	51.65	July 4
Mountain Goat	"	" "	2346	48.25	July 4
Ptarmigan	"	Wm. R. Lord and P. C. Coates	2342	51.65	July 4
Rupert	"	Fred. J. Colman	2227	28.60	Dec. 2
Copper Queen	Omineca	Leeman Wood and Peter Schafer	5751 R. 5	44.39	Mar. 6
Hill Crest	"	Thos. Scott Gilmour	5818 R. 5	27.00	Nov. 3
Iron Horse	"	Mancell Clark	5813 R. 5	34.20	June 6
Iron Mask	"	"	5814 R. 5	31.48	June 6
Iron Monk	"	Leeman Wood and Peter Schafer	5750 R. 5	51.65	Mar. 12
Iron Mountain	"	Mancell Clark	5816 R. 5	46.80	June 6
Iron Vault	"	Leeman Wood and Peter Schafer	5754 R. 5	43.95	Mar. 12
Ivanhoe	"	Hy. T. Ceperley	2266 R. 5	29.43	Jan. 6
Limonite	"	Mancell Clark	5812 R. 5	30.90	June 6
Old Ironsides	"	"	5815 R. 5	41.46	June 6
Silver Crown	"	Thos. S. Gilmour	5819 R. 5	30.10	Nov. 3
Texada	"	Leeman Wood and Peter Schafer	5752 R. 5	51.65	Mar. 12
Van Anda	"	" "	5756 R. 5	50.66	Mar. 12
Waverly	"	Geo. R. Naden	2267 R. 5	51.65	Jan. 6
Cash Box	Queen Charlotte	Moresby Island Mines, Ltd. (N.P.L.)	2012	20.95	Oct. 20
Cypress Queen	" "	John S. McMillin	2607	29.64	May 5
Della	" "	"	2597	20.58	May 21
Diana	" "	"	2599	42.63	May 5
Dorothy M.	" "	"	2603	39.13	May 5
Grandview	" "	Wm. Harry Burley	2349	46.27	May 5
Ida	" "	John S. McMillin and Pioneer Queen Charlotte Dev. Co.	2601	51.65	May 5
Eagle Tree	" "	John S. McMillin	2600	29.97	May 5
Lizzie B.	" "	"	2604	40.72	May 5
Maggie C.	" "	John S. McMillin and Pioneer Queen Charlotte Dev. Co.	2602	51.24	May 5
Marion Frt.	" "	Jas. Emery Corlett	623	19.75	Sept. 25
Mattie H. Frt.	" "	John S. McMillin	2608	39.67	May 5
Meal Ticket	" "	Moresby Island Mines, Ltd.	2011 G. 1	82.97	Oct. 20
Paul	" "	John S. McMillin	2598	35.69	June 15
Sadie	" "	Ike Thompson	2610	30.37	June 10
Spade Flush	" "	Ike Thompson and Ben Metcalfe	2612	6.34	June 10
Surprise	" "	Wm. Hy. Burley	2350	34.04	May 5
Thunder	" "	Ike Thompson and John S. McMillin	2611	44.44	June 10

EAST KOOTENAY.

Alice Fr.	Fort Steele	Frank Guindon, Jos. Gosselin, David Fortin, Alp. Demers, Jos. Montpellier, and Adelia Montpellier	9807 G. 1	3.26	July 14
Annie	"	Consol M. & S. Co. of Canada, Ltd.	12005 G. 1	46.52	Oct. 15
B. & M.	"	Jas. A. Arnold, official administrator, administrator of the estate of John P. Larsen, deceased, intestate	11813 G. 1	44.25	Oct. 7
Ben Fr.	"	Consol. Mng. & S. Co. of Canada, Ltd.	11997 G. 1	48.3	Oct. 14
Cobalt Frt.	"	Jas. T. Laidlaw	9086 G. 1	49.98	Oct. 1
Dore	"	Margaret L. Freter	11782 G. 1	51.65	Jan. 6
Eric	"	Consol. Mng. & S. Co. of Canada	11999 G. 1	48.64	Oct. 14
Fereole	"	Frank Guindon, Jos. Gosselin, David Fortin, Alphonse Demers, Jos. Montpellier, and Adelia Montpellier	9806 G. 1	37.00	July 14
Guindon	"	Frank Guindon, Jos. Gosselin, D. Fortin, Alp. Demers, Jos. Montpellier, and Adelia Montpellier	6127 G. 1	48.41	July 14
Iron Mask	"	Jas. A. Arnold, official administrator, administrator of the estate of John P. Larson, deceased, intestate	11816 G. 1	51.65	Oct. 8
Karl	"	Consol. M. & S. Co. of Canada	12002 G. 1	46.56	Oct. 14
Ken	"	" "	12006 G. 1	48.16	Oct. 15
Liny Frt.	"	" "	11995 G. 1	48.89	Oct. 14
Montana	"	J. A. Arnold, official admlnistrator, administrator of estate of John P. Larsen, deceased, intestate	11820 G. 1	40.60	Oct. 8
Mountain View	"	J. A. Arnold, official administrator, administrator of estate of John P. Larsen, deceased, intestate	11814 G. 1	42.24	Oct. 7
Moyie Frt.	"	Consol. M. & S. Co. of Canada	11996 G. 1	26.81	Oct. 14
Pine	"	" "	12003 G. 1	41.64	Oct. 14
Poorman	"	J. A. Arnold, official administrator, administrator of estate of John P. Larsen, deceased, intestate	11818 G. 1	46.17	Oct. 8
Silver Crown	"	J. A. Arnold, official administrator, administrator of estate of John P. Larsen, deceased, intestate	11819 G. 1	51.62	Oct. 8
Strathcona	"	Saml. B. Steele	11812 G. 1	51.65	Oct. 15
Tiger	"	Jas. A. Arnold, official administrator, administrator of estate of John P. Larsen, deceased, intestate	11815 G. 1	39.01	Oct. 7
Trail Frt.	"	Consol. M. & S. Co. of Canada, Ltd.	11998 G. 1	18.04	Oct. 14
Uncle Sam	"	Jas. A. Arnold, official administrator, administrator of estate of John P. Larsen, deceased, intestate	11817	50.94	Oct. 8
Winnie Frt.	"	Consol. M. & S. of Canada, Ltd.	11992 G. 1	14.21	Oct. 14
Pretty Girl	Windermere	Jas. L. McKay	2570 G. 1	32.20	Sept. 29

WEST KOOTENAY.

Claim.	Division.	Grantee.	Lot No.	Acres.	Date.
Corinthian	Nelson	Robt D. Munro and Luzetta Field	2090 G. 1	45.08	June 29
Gold Crown	"	James B. O'Brian	10014 G. 1	51.52	Jan. 13
Gold Crown Frt.	"	"	10047 G. 1	38.74	Jan. 13
Helena	"	Maggie L. Fennell	9344	19.45	Sept. 10
Independence	"	Jas. B. O'Brian	10012 G. 1	46.96	Jan. 13
Independence Frt.	"	"	10048 G. 1	4.89	Jan. 13
R. & L.	"	Robt D. Munro and Luzetta Field	2089 G. 1	45.66	June 29
Sumit	"	Jas. B. O'Brian	10010 G. 1	51.65	Jan. 13
Big Bertha	Ainsworth	Henry Geigerich and Wm. R. Will	10056 G. 1	40.13	June 29
Black Warrior	"	Pleasant M. Starnes, DeForest Bowman, and Jas. M. Miller	11335 G. 1	35.38	Mar. 20
Consolidated	"	P. M. Stearns, DeForrest Bowman, and Jas. M. Miller	11334 G. 1	32.07	Mar. 20
Burr	Slocan	Van-Roi Mng. Co., Ltd	10051 G. 1	43.43	Jan. 26
El Camino	"	"	10052 G. 1	35.72	Mar. 21
Goodwin	"	Alex. Longwell and Wm. Thomlinson	11736 G. 1	20.71	June 9
Minora	"	" "	11735 G. 1	43.14	June 9
Ridgeway	"	McAllister Mng. & Mill. Co., Ltd.	11898 G. 1	49.42	July 25
Rowse Frt.	"	" "	11901 G. 1	11.64	July 25
Silver King	"	" "	11900 G. 1	49.89	July 25
Silver Queen	"	" "	11899 G. 1	51.55	July 25
Tramway No. 2 Frt.	"	Van-Roi Mng. Co., Ltd.	10053 G. 1	27.36	Jan. 26
Democrat	Trail Creek	Coast & Cariboo Co., Ltd.	2084	20.20	June 12
Ironclad	"	"	2724 G. 1	51.65	Mar. 6
Republic	"	"	2083	42.63	June 12

BOUNDARY.

Union	Gd. Forks	J. C. Henderson, Lewis Johnson, Patrick Maginnis, and Donald McCallum, official administrator	1022 S.	51.65	Mar. 28
Elkhorn Frt.	Greenwood	Robt. Daniel McKenzie	297 S.	6.35	Mar. 20
International	"	Jas. P. Blaine	1877 S.	46.62	Jan. 6
Scarboro	"	Duncan Buchanan and Evan O. Lewis	1416 S.	50.78	April 26
77 Fractional	"	Consol. Mng. and S. Co. of Canada	1419 S.	48.65	June 8
Z Car	"	Jas. P. Blaine	1876 S.	51.65	Jan. 6
Crown Point	Osoyoos	John McLean and Chas. Harvey	501 S.	51.65	Jan. 26
Dayton	"	" "	500 S.	43.77	Jan. 26
Independence	"	Chas. Henry Cornell	256 S.	51.65	Dec. 21
Sparr Dyke	"	"	258 S.	51.65	Dec. 21
Success	Lillooet	LeRoy Ledgerwood and Albert Williams	3093 G. 1	50.15	April 29
Barnes	Ashcroft	Thos. J. S. Skinner	3374 G. 1	47.40	June 29
Grosvenor	"	"	3378 G. 1	51.65	July 18
Lundy	"	"	3373 G. 1	51.65	July 18
Savona	"	"	3376 G. 1	51.65	July 18
Sherwood	"	"	3377 G. 1	50.58	June 29
Taylor	"	"	3379 G. 1	51.65	July 18
Fortuna No. 4 Frt.	Kamloops	Geo. W. Richmond	2331 G. 1	24.61	Jan. 12
Humbolt	Similkameen	Wm. A. Cooper and Alf. J. Cooper	121A	51.65	Aug. 7
Vancouver	"	Clive Pringle, W. G. McMynn, W. E. Decks, and P. C. McArthur	123A	51.07	Feb. 16
W. G. Frt.	"	Francis W. Groves	943 S.	6.30	June 25

VANCOUVER ISLAND AND COAST.

Columbia	Nanaimo	Magnus P. Olsen	3012 G. 1	51.20	Oct. 6
Dolphin	"	Colin F. Jackson	1040 R. 2	51.65	Nov. 30
Gillis	"	"	917 R. 2	51.65	Nov. 30
Iron Pirate	"	"	1038 R. 2	51.65	Nov. 30
Red Cloud	"	Rich. K. Walkem	113	51.00	Dec. 21
Virginia	"	Catherine Mary Burns	112	51.36	Dec. 21
Waterloo	"	"	114	51.65	Dec. 21
Hillside	Quatsino	Teta River Mng. Co. (N.P.L.)	678	26.79	June 17
Paramount	"	"	677	36.95	June 17
Quatsino King	"	"	676	51.65	June 17
Anacortes	Vancouver	Britannia M. & S. Co., Ltd	2205 G. 1	51.65	Nov. 17
Arctic Fir	"	Job Greasley and James A. Tomlinson	3728 G. 1	51.65	Nov. 25
B Fractional	"	Britannia Mng. & S. Co., Ltd.	3711 G. 1	49.23	June 30
Bruce	"	Angus A. Crowston	1710 G. 1	21.40	July 16
C	"	Britannia Mng. & S. Co.	3709	51.65	May 30
Canadian Consolidated	"	Dom. Trust Co.	3592 G. 1	27.93	Jan. 26
Can. Consol., No. 1	"	"	3591 G. 1	24.57	Jan. 26
" No. 2	"	"	3590 G. 1	10.28	Feb. 26
" No. 3	"	"	2870 G. 1	43.68	Feb. 26
" No. 4	"	"	2869 G. 1	42.64	Feb. 26
Christiania	"	Britannia M. & S. Co.	2203 G. 1	51.65	Nov. 17
Conifer Frt.	"	"	2198 G. 1	46.67	Nov. 17
Cycad Frt.	"	"	2197 G. 1	38.86	Nov. 17
Cyrtina	"	"	2199 G. 1	51.65	Nov. 17
Delta	"	"	3714 G. 1	48.80	June 4
Detroit	"	Annie L. Crowston	1700 G. 1	9.24	July 16
Dorothy Vernon	"	Job Greasley and Jas. A. Tomlinson	4030 G. 1	49.65	Nov. 25
E	"	Britannia Mng. & S. Co.	3708 G. 1	51.65	May 30
Epsilon Frt.	"	"	3706 G. 1	44.71	June 30
Equator	"	Angus A. Crowston	1708 G. 1	5.77	July 14

VANCOUVER ISLAND AND COAST.—*Concluded.*

Claim.	Division.	Grantee.	Lot No.	Acres.	Date.
Ford	Vancouver	Angus A. Crowston	1713 G. 1	21.30	July 16
G Frt	"	Britannia M. & S. Co	3710 G. 1	48.90	June 30
Gem	"	"	2206 G. 1	50.45	Nov. 18
Golden Pheasant	"	Job Greasley and James A. Tomlinson	3733 G. 1	49.24	Nov. 25
Golden Wren	"	" "	3730 G. 1	29.26	Nov. 25
Guinea Fowl	"	" "	3731 G. 1	44.79	Nov. 25
Gwendolyn	"	Angus A. Crowston	1697 G. 1	26.20	July 14
H.	"	Britannia M. & S. Co., Ltd	3712 G. 1	51.65	June 5
Horley	"	Angus A. Crowston	1707 G. 1	9.92	July 16
John	"	"	1714 G. 1	15.12	July 16
Joker	"	"	1702 G. 1	11.70	July 16
Kappa	"	Britannia M. & S. Co	3707 G. 1	47.70	June 5
Kelvin	"	Angus A. Crowston	1698 G. 1	41.39	July 16
King George	"	Dom. Trust Co	4019 G. 1	12.47	Feb. 26
L	"	Britannia M. & S. Co	3705 G. 1	47.70	May 30
Langside	"	Annie L. Crowston	1699 G. 1	27.90	July 16
Little Jap, No. 4	"	Britannia M. & S. Co	3575 G. 1	48.05	June 6
" No. 5	"	"	3576 G. 1	49.05	May 30
" No. 6	"	"	3577 G. 1	51.60	May 30
Lucknow	"	Angus A. Crowston	1704 G. 1	43.22	July 14
Old Ireland	"	Dom. Trust Co	2871 G. 1	35.72	Feb. 26
Peacock	"	Job Greasley and J. A. Tomlinson	3729 G. 1	45.12	Nov. 25
Pendrill	"	Angus A. Crowston	1709 G. 1	42.56	July 16
Phi	"	Britannia M. & S. Co	3703 G. 1	48.66	May 30
Phœnix	"	Henry C. Stewart	3724 G. 1	34.30	Dec. 21
Reggie	"	Job Greasley and J. A. Tomlinson	3732 G. 1	45.69	Nov. 25
Roosvelt	"	Dom. Trust Co	3593 G. 1	15.28	Feb. 26
Rossland	"	Robt. B. Kirk	3725	40.98	Dec. 21
S	"	Britannia M. & S. Co., Ltd	3704 G. 1	51.15	May 30
Sechelt	"	Angus A. Crowston	1708 G. 1	38.62	July 16
Star of Hope	"	Dom. Trust Co	3698 G. 1	51.65	Feb. 26
Success Frt	"	Angus A. Crowston	1696 G. 1	16.90	July 16
Sun	"	"	1705 G. 1	9.47	July 14
Thorne	"	Annie L. Crowston	1706 G. 1	47.92	July 16
Titania	"	Britannia M. & S. Co., Ltd	2204	51.65	Nov. 17
Totem Frt	"	"	3715 G. 1	48.10	June 30
Townsite	"	Angus A. Crowston	1712 G. 1	17.83	July 14
Vega Frt	"	Dom. Trust Co	4020 G. 1	3.50	July 9
Venus	"	Britannia M. & S. Co., Ltd	2207 G. 1	51.65	Nov. 17
Wedge Frt	"	"	3716 G. 1	0.18	June 29
Windsor	"	Annie L. Crowston	1701 G. 1	5.26	July 14
Y	"	Britannia M. & S. Co., Ltd	3713 G. 1	51.65	June 30

DEPARTMENT OF MINES.

VICTORIA, B.C.

HON. SIR RICHARD MCBRIDE,	*Minister of Mines.*
R. F. TOLMIE,	*Deputy Minister of Mines.*
WM. FLEET ROBERTSON,	*Provincial Mineralogist and Assayer.*
D. E. WHITTAKER,	*Provincial Analyst and Assistant Assayer.*
JOHN D. GALLOWAY,	*Assistant Provincial Mineralogist.*
THOMAS GRAHAM,	*Chief Inspector of Mines, Victoria.*
HENRY DEVLIN,	*District* ,, *Nanaimo.*
JOHN NEWTON,	,, ,, ,,
GEO. O'BRIEN,	,, ,, *Fernie.*
THOMAS H. WILLIAMS	,, ,, ,,
ROBERT STRACHAN,	,, ,, *Merritt.*
JAMES MCGREGOR,	,, ,, *Nelson.*

GOLD COMMISSIONERS AND MINING RECORDERS.

Mining Divisions.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Atlin Mining Division	Atlin	J. A. Fraser	W. G. Paxton	
Sub-office	Discovery			R. Webster.
"	Telegraph Creek			H. W. Dodd.
"	Summit Station			Geoffrey Butler.
"	Wynnton			W. H. Simpson.
"	Haines (U.S.)		(Com. for taking Affidavits)	Risdon M. Odell.
"	Nahlin			J. F. Pilling.
Stikine Mining Division	Telegraph Creek	H. W. Dodd	H. W. Dodd	
Sub-office	Boundary	"	"	William Strong.
Liard Mining Division	Telegraph Creek	"	"	
Sub-office	Porter			Chas. H. Smith.
"	McDame Creek			Amos Everson.
Skeena Mining Division	Prince Rupert	J. H. McMullin	J. H. McMullin	
Sub-office	Alice Arm			H. H. Carney.
"	Kitimat			Geo. L. Anderson.
"	Port Simpson			J. R. C. Deane.
"	Essington			A. Forsythe.
"	Stewart (Portland Canal)			John Conway.
"	Unuk River			Burt E. Daily.
"	Anyox			F. A. McKinnon.
Portland Canal M.D.	Stewart	J. H. McMullin (at Prince Rupert)	John Conway	
Bella Coola Mining Div.	Prince Rupert	J. H. McMullin	J. H. McMullin	
Sub-office	Bella Coola			Frank Broughton.
Queen Charlotte Min'g D.	Queen Charlotte	E. M. Sandilands	E. M. Sandilands	Petrie S. Jack.
Sub-office	Jedway			W. Prescott.
"	Masset			C. Harrison.
"	Lockeport			William Morgan.
Omineca Mining Division	Hazelton	Stephen H. Hoskins	Jas. E. Kirby	
Sub-office	Fort Grahame			John Ross.
"	Fort St. James			Alex. C. Murray.
"	Manson Creek			W. B. Steele.
"	Copper City			P. R. Skinner.
"	Telkwa			R. Gale.
"	Terrace			C. E. Doolittle.
"	Fort St. John			F. W. Beatton.
"	Babine Portage			R. J. Cameron.
"	Fort Fraser			J. E. Hooson.
"	Junction Finlay & Parsnip Rivers			Wm. Fox.
"	Pacific			T. H. McCubbin.
"	Smithers			Walter Noel.

GOLD COMMISSIONERS AND MINING RECORDERS.—*Continued.*

Mining Divisions.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Peace River Mining Div..	Fort St. John	.....	F. W. Beatton	
Sub-office	Hudson's Hope...	.....	.....	Thomas A. Mansell.
"	Pouce Coupe	.....	.....	G. J. Duncan.
Cariboo Mining Division..	Barkerville	C. W. Grain	.....	
Sub-office	Quesnel.....	.....	.....	A. P. Halley.
"	Fort George.....	.....	.....	T. W. Herne.
"	Tete Jaune.....	.....	.....	Henry Taylor.
Quesnel Mining Division..	150-Mile House...	C. W. Grain	Arthur Sampson...	
Sub-office	Quesnel.....	(at Barkerville)	.....	George Milburn.
Clinton Mining Division..	Clinton	E. C. Lunn.....	.....	
Lillooet "	Lillooet.....	Caspar Phair....	Caspar Phair.....	
Kamloops Mining Division	Kamloops.....	E. T. W. Pearse	E. Fisher	
Ashcroft "	Ashcroft.....	" (at Kamloops)	H. P. Christie.....	
Nicola "	Nicola.....	" "	W. N. Rolfe	
Yale "	Yale	" "	L. A. Dodd	
Sub-Office.....	Hope.....	" "	.....	George Blue.
Similkameen "	Princeton	Hugh Hunter	Hugh Hunter	
Sub-office	Hedley	.....	.....	F. M. Gillespie.
Vernon Mining Division..	Vernon	L. Norris	H. F. Wilmot	
Greenwood Mining Div...	Greenwood.....	W. R. Dewdney...	.....	
Sub-office	Vernon	.....	.....	H. F. Wilmot.
"	Rock Creek.....	.....	.....	H. Nicholson
"	Beaverdell	.....	.....	E. F. Ketchum.
Grand Forks Min. Div....	Grand Forks	S. R. Almond	S. R. Almond	
Osoyoos Mining Division..	Fairview.....	J. R. Brown	R. D. Tweedie.....	
Sub-office	Olalla.....	.....	.....	R. W. Northey.
"	Hedley	.....	.....	F. M. Gillespie.
Golden Mining Division..	Golden	H. C. Rayson	F. H. Bacon	
Windermere " ..	Wilmer.....	.....	Ronald Hewat	
Fort Steele Mining Div...	Cranbrook	N. S. A. Wallinger.	H. S. Clark	
Sub-office	Steele.....	.....	.....	Joseph Walsh.
"	Fernie.....	.....	.....	Geo. F. Stalker.
"	Moyie	.....	.....	John P. Farrell.
"	Marysville	.....	.....	Alfred Dryden.
Ainsworth Mining Div ...	Kaslo	R. J. Stenson	A. McQueen	Wm. J. Green.
Sub-office	Howser.....	.....	.....	W. Simpson.
"	Trout Lake	.....	.....	A. N. Vars.
Slocan Mining Division...	New Denver	R. J. Stenson (at	Angus McInnes ...	
Sub-office	Sandon	" Kaslo)	.....	W. J. Parham.
Slocan City Mining Div...	Slocan.....	.....	Howard Parker....	
Trout Lake Mining Div..	Trout Lake	R. J. Stenson	A. N. Vars.....	
Nelson Mining Division ..	Nelson	John Cartmel.....	S. S. Jarvis.....	
Sub-office	Creston.....	.....	.....	Guy Loewenberg.
"	Ymir.....	.....	.....	Geo. S. Coleman.
"	Sheep Creek	.....	.....	James Thompson.
"	Salmo	.....	.....	G. A. Kennington.
Arrow Lake Min. Division	Nakusp.....	John Cartmel.....	Walter Scott.....	
Sub-office	Vernon.....	(at Nelson)	.....	H. F. Wilmot.
Revelstoke Mining Div...	Revelstoke.....	Robt. Gordon	R. S. Squarebriggs.	Newton R. Brown
Lardeau Mining Division.	Beaton	" (at Revelstoke)	William A. Strutt.	Mrs. A. H. Strutt.

GOLD COMMISSIONERS AND MINING RECORDERS.—*Concluded.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Trail Creek Mining Div...	Rossland	H. R. Townsend...	H. R. Townsend...	
Nanaimo Mining Division	Nanaimo	George Thomson...	George Thomson...	
Sub-office	Ladysmith	.....	.....	John Stewart.
"	Alert Bay	.....	.....	H. F. Helmsing.
"	Vananda	.....	.....	David Jones.
"	Rock Bay.....	.....	.....	W. H. Lines.
Alberni Mining Division..	Alberni.....	J. Kirkup	.....	
Clayoquot " ..	Clayoquot	" (at Alberni)	W. T. Dawley	
Quatsino " ..	Quatsino	" "	O. A. Sherberg....	
Victoria Mining Division..	Victoria	Herbert Stanton...	Herbert Stanton...	
New Westminster Min. D.	New Westminster.	F. C. Campbell....	I. Wintemute.....	
Sub-office	Harrison Lake....	.....	.....	L. A. Agassiz.
"	Chilliwack	.....	.....	J. Pelly.
Vancouver Mining Div...	Vancouver	John Mahony	A. P. Grant.....	

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LIST OF ILLUSTRATIONS.

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Victoria, Government Printing Office, 1915.

Author.

Robertson, William Fleet. *(Provincial Mineralogist.)*

Annual Report of the Minister of Mines of British Columbia for the year ending 31st December, 1914, being an account of mining operations for gold, coal, etc., in the Province. (British Columbia, Bureau of Mines.) 544 pp., plates, maps, 1914.
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MINING DIVISIONS & RECORDING OFFICES
YUKON
LIARD
STIKINE
OMINECA
CARIBOO
ALBERTA
UNITED STATES
PACIFIC OCEAN
DIXON ENTRANCE
BELLA COOLA
CLINTON
NANAIMO
VANCOUVER
NEW WESTMINSTER
VICTORIA
DEPARTMENT OF MINES
BRITISH COLUMBIA
MINING DIVISIONS
LEGEND