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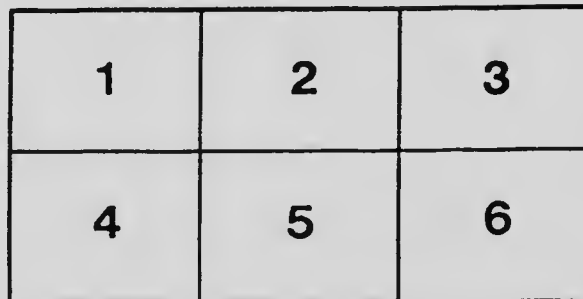
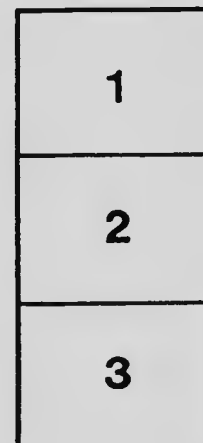
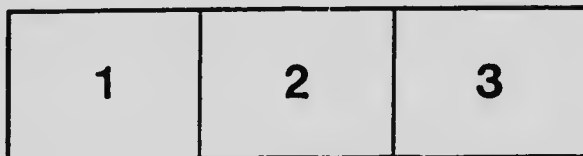
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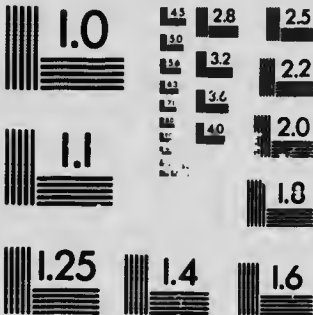
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BRITISH COLUMBIA BUREAU OF MINES

BULLETIN No. 4, 1915

**THE MINERAL RESOURCES OF A PORTION
OF THE
OMINECA MINING DIVISION**

BY

JOHN D. GALLOWAY, M.Sc., Assistant Mineralogist

SUBMITTED BY

WM. FLEET ROBERTSON, Provincial Mineralogist



THE EMBLEM OF
THE PROVINCE OF BRITISH COLUMBIA

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AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:

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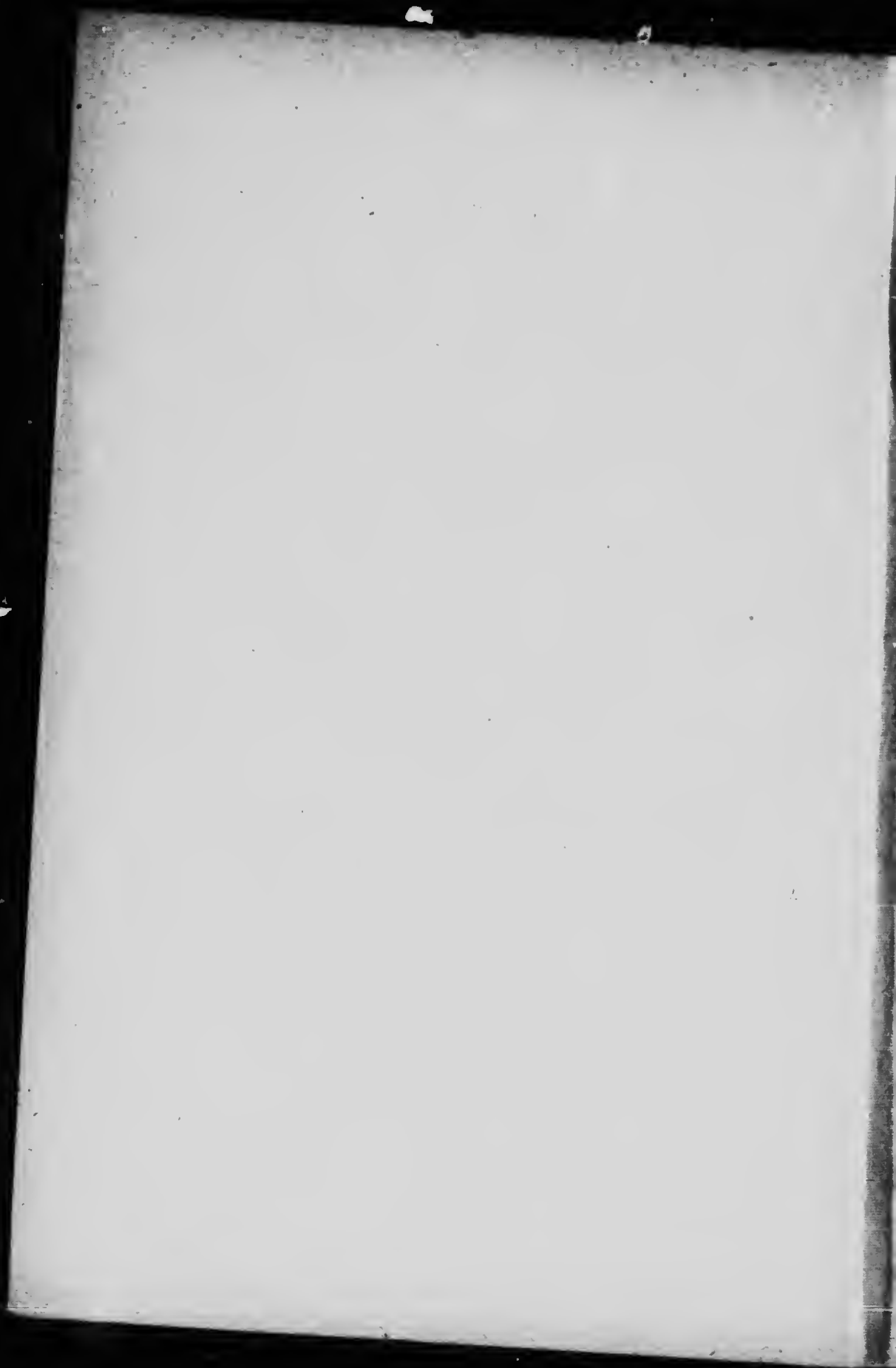
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Driftwood Creek Divide—Babine Range.

U.S. GEOLOGICAL SURVEY



*To the Honourable Sir Richard McBride, K.C.M.G.,
Minister of Mines.*

Sir,—I have the honour to submit herewith Report on the Mineral Resources of a portion of the Omineca Mining Division by John D. Galloway, Assistant Mineralogist, prepared this season under your instructions for the Bureau of Mines.

I have the honour to be,

Sir,

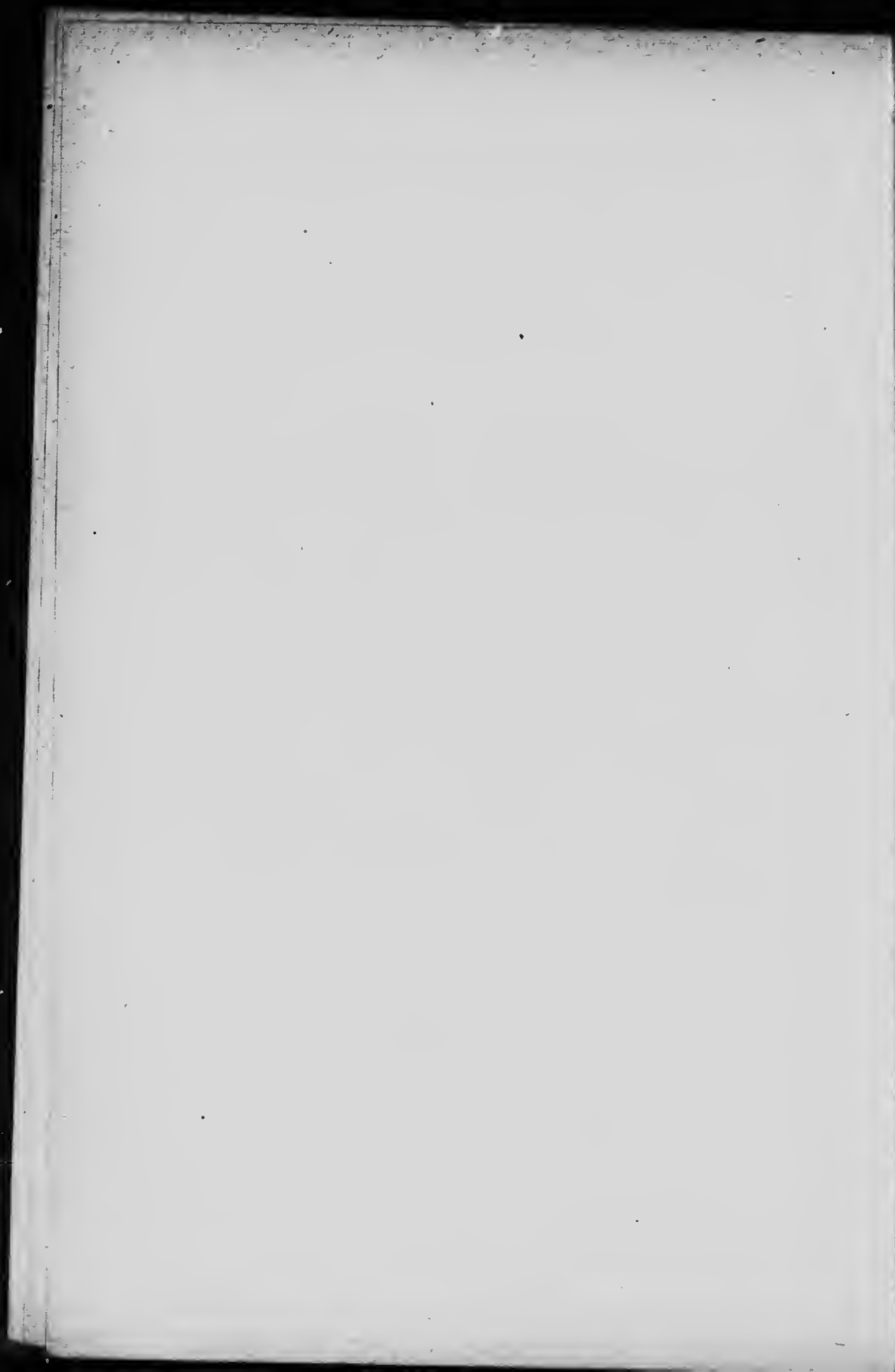
Your obedient servant,

WILLIAM FLEET ROBERTSON,

Provincial Mineralogist.

Bureau of Mines, Victoria, B.C.,

March, 1915.



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.

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

* Mr. Brewer's notes on this portion of the Omineca Mining Division will be found included in the report on the Skeena Mining Division.

divide to the Nechako river; thence down the Nechako to the Fraser river at Fort George; thence up the Fraser to Tete Janne 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 the 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-steamers were used, and, although most of the river is easily navigable, there are a number of canyons, notably Kitsulas 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 Klispox 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 centred 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	1894.....	No returns.
1875.....	32,040	1895.....	"
1876.....	No returns.	1896.....	"
1877.....	"	1897.....	"
1878.....	"	1898.....	\$15,000
1879.....	36,000	1899.....	5,000
1880.....	45,800	1900.....	12,527
1881.....	39,300	1901.....	19,100
1882.....	25,330	1902.....	40,000
1883.....	21,000	1903.....	28,000
1884.....	12,000	1904.....	11,600
1885.....	16,500	1905.....	10,000
1886.....	17,600	1906.....	10,000
1887.....	13,000	1907.....	20,000
1888.....	No returns.	1908.....	20,000
1889.....	"	1909.....	15,000
1890.....	"	1910.....	15,000
1891.....	"	1911.....	10,000
1892.....	"	1912.....	8,000
1893.....	"	1913.....	6,000

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 Déboulié 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 past years been reported on by several writers. The first mention of it is by Dr. Geo. 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

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 Klitsunigallum 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 D'Éboulé 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 D'Éboulé and Hudson Bay mountains and the Bahine 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 Bahine range is Bahine 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 penetration 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 D'Éboulé mountains to the undulating rolling country around François 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.
Kitsulas 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 Kitsulas 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 eruptives.

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 overlies the Hazelton group in many places, but as a rule the area of 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."

Kitsulas 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 M. Lane 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 this 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 DEBOULE 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 Kitsequekia 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.

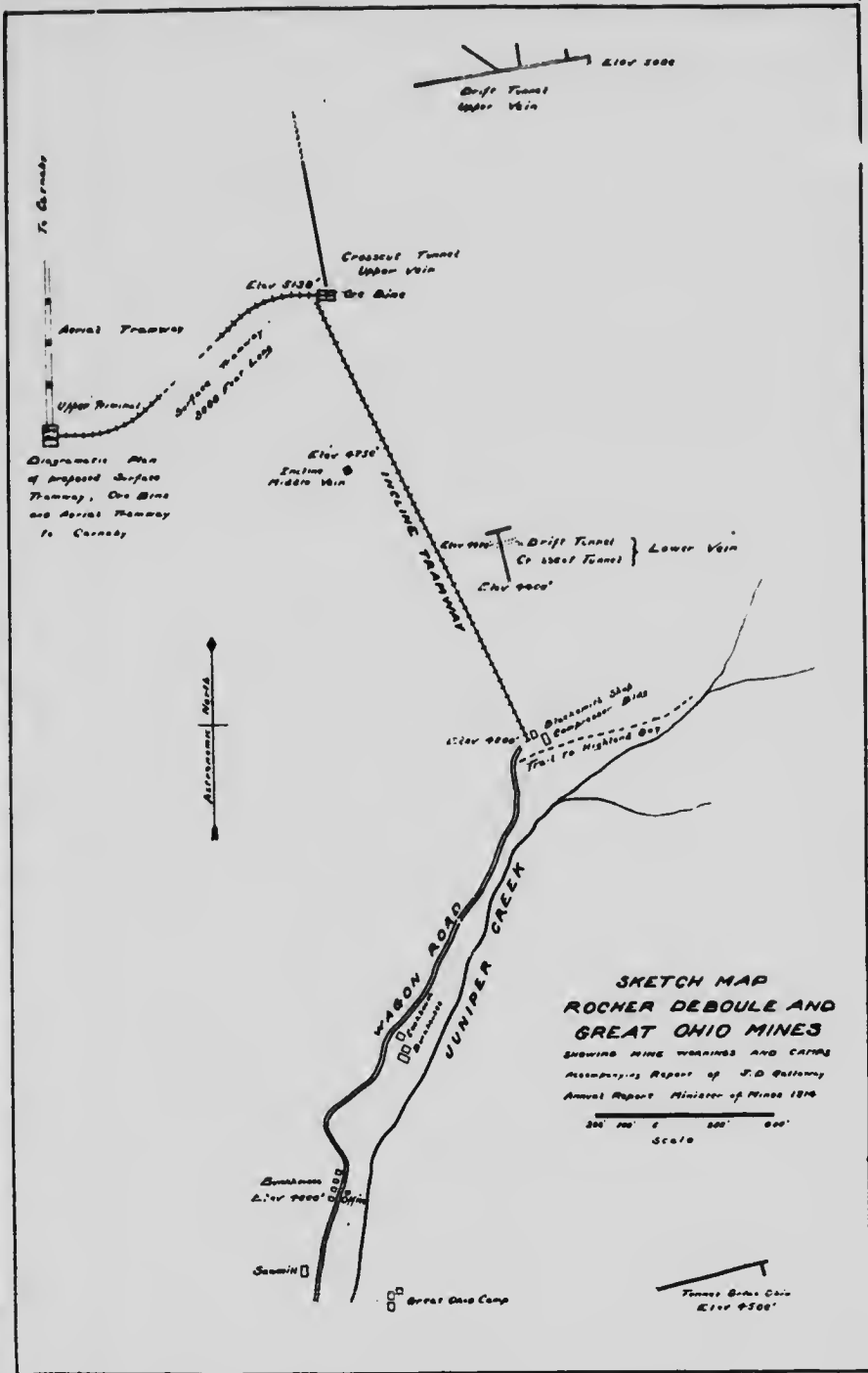
From the end of the wagon-road Petersen and Ek have constructed a good trail up Balsam creek to the Red Rose basin, a distance of a mile and a half. Six miles up the wagon-road from Skeena Crossing a trail leads off to the Brian Boru basin, a distance of about six miles farther.

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

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all above timber-line 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.

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 **Jnniper Creek**. The camp and power 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 chalcopryrite, 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.

The following samples were taken, which give an idea of the values:—

No.	Place taken.	Width sampled.	Gold.		Silver.		Copper.
			Oz.	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-foot from face.	4 feet.	0.06	1.30	11.5		
3	Waste level, foot of 17-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	1.00	10.0		

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 6-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 150 to 200 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 two miles and a half up the hill, was farthest advanced, the towers being all erected and the cable on the ground ready for stringing. Mr. 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 now done, has a very encouraging showing, and that further development is warranted.

Lower Vein.—The lower vein on this property outcrops at an elevation of 4,400 feet a short distance east of the railway. 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 each other 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 crosses 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, 11.0 per cent; lead, 1.5 per cent.; zinc, 10.0 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 would be found.

The Great Ohio, which is situated on the south side of Juniper creek, nearly opposite the *Rocher Déboulé*, was staked in 1910 by Sargent and Munroe, the locators of the *Rocher Déboulé* group. The property is now under lease and bond to Jemhugs 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 5,360 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.; 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 lencers 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 vein and drift for some distance on it in both directions.

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 *Hutte-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 8. 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 chalcocryrite. 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. Its 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 of gold, silver, and copper.

This property is well worth more development than has as yet been done.

RED ROSL 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 head-waters 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 mountain.

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 *State* and *Slater*, lying south-east from this basin on Slate creek near the divide between this basin and the Brian Born 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.

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

**Brunswick
Group.**

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 Débonlé mountains which are really cirques, gouged out by former glaciers. This basin lies at the head of Glacier creek and about north-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 the north-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 Débonlé 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*.



Highland Boy Mountain—Juniper Basin.



Brian Horn Mountain.

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 hogback running out from the main mountain. Claims are staked running over this hogback 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.

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 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 hogback. 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 townsit schemes were started, many of which have never advanced beyond the initial stage. One townsit 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 Carbahy, 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 advantages 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 Awlligate 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. McDonnell, 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.

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.

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-porphry 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.

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Main Shaft—Silver Standard.



Shaft—Black Prince.

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 cross-cuts 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 as 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 mill-lug-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, cre-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 down-

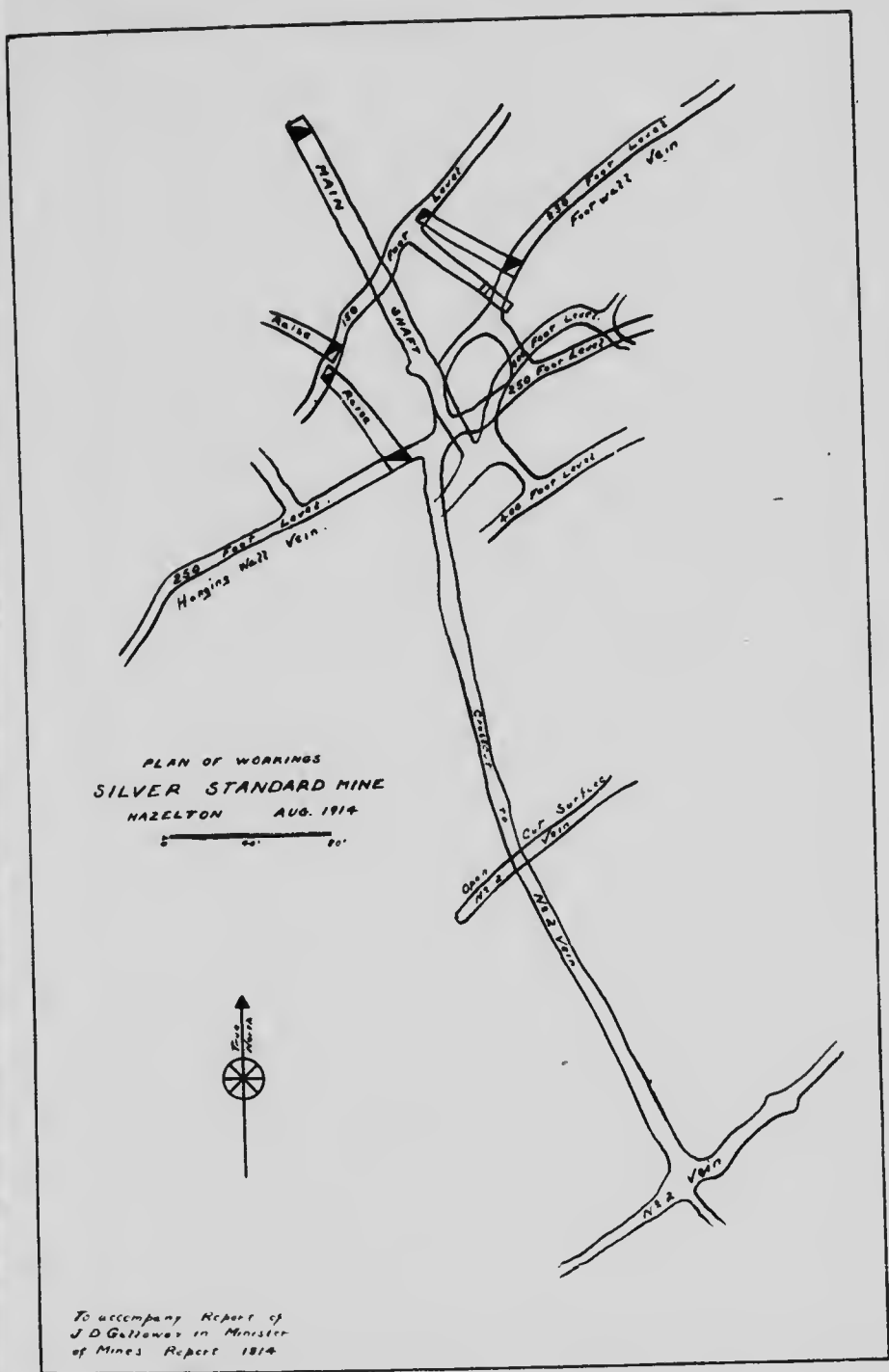
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PLAN OF WORKINGS
SILVER STANDARD MINE
HAZELTON AUG. 1914

To accompany Report of
J.D. Galloway in Minister
of Mines Report 1914

wards 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.

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.

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.

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-porphry dykes in close relationship to the veins. These dykes are no

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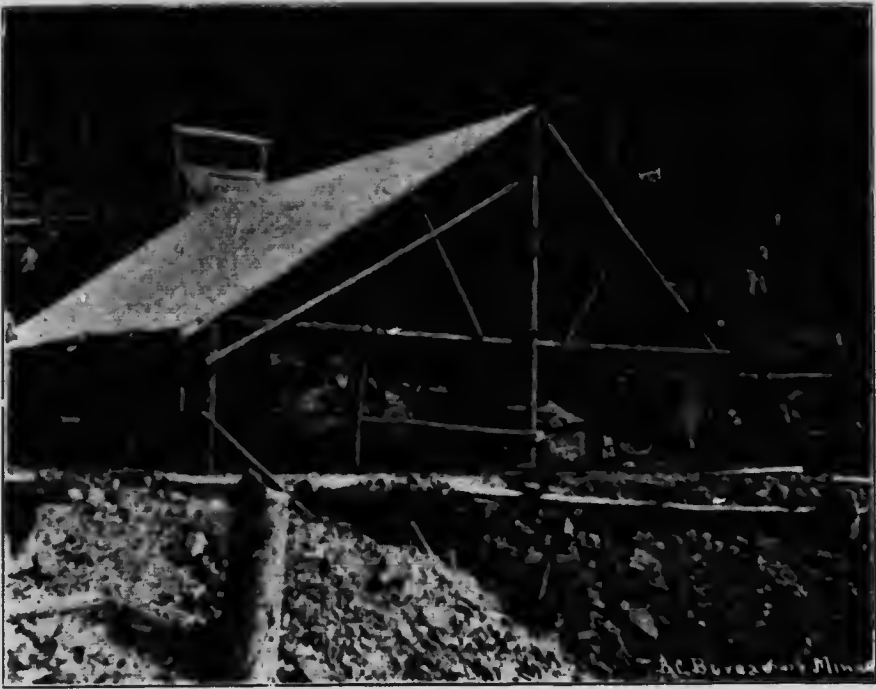
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Ore-sorting Shed—American Boy.



Shaft on No. 1 Vein—American Boy.

dent 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, further 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 further 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, sand-stones, and shales, but along the foot-wall a quartz-porphry 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	5.0	
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, 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 cut 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 slight water-concentration on this material, which would bring it up to a product running from \$50 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 DEBOULE 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 Comenn, 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.

The claims are known as the *Bellon* and *Cap*, and are staked

Cap Group. 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. Comenn 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 Déboilé* 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 0.7 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, knollized 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.

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 siliceous 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.

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-porphry 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.

The *Silver Cup* group consists of the four Crown-granted **Silver Cup** claims—the *Silver Cup*, *Silver Dollar*, *Duke*, and *Duchess*—all staked in 1900, 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 D'Éboulé 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.

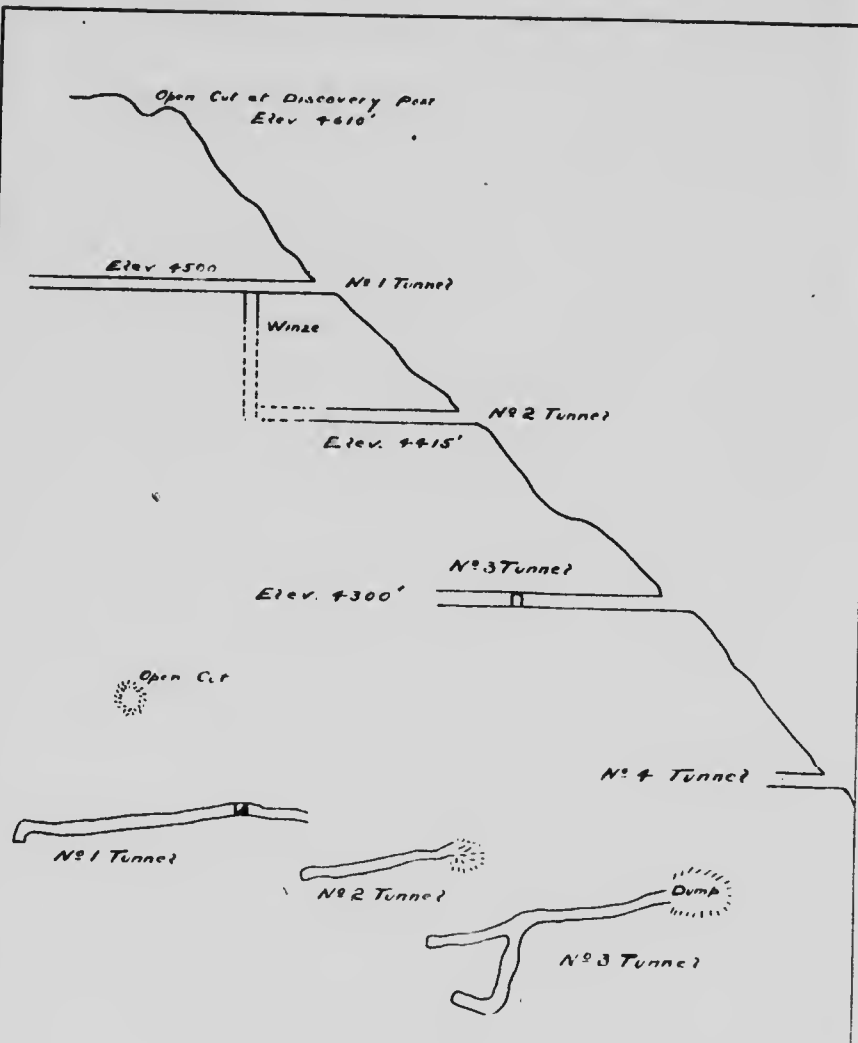
The main vein is developed by six drift-tunnels, which, starting with No. 1 near the top of the mountain, are numbered downwards to No. 5, the lowest one being called the *Duchess* tunnel. The vein cuts the mountain in a direction of N. 30° E., with an easterly dip of about 78 degrees, cutting the sediments 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 700 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 slope has been started upwards on the vein, which was up 25 feet, plainly showing the step-line 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 slope 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



Plan and Elevation of
SILVER CUP TUNNELS

NINE-MILE MOUNTAIN

Accompanying Report of J.D. Galloway
in Annual Report Minister of Mines 1914.



Scale - Feet

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.

Dickens 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 workings, 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 swagging to the east.

This vein is similar to the main vein, but so far has not shown nearly as much mineralization. Sparling 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 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, 0.63 oz.; silver, 163.6 oz.

This claim, which is owned by Geo. T. Stewart, of Hazelton, **Silver Bell**, 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.

* 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.



Nine-mile Mountain.



Skeena and Klappan Valleys from Nine-mile Mountain.

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.

The *Sunrise* group of four claims lies over the ridge of the **Sunrise Group**. 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 granodiorite 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.

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 run in which, apparently, cuts the stringer at a point 15 feet in, and then continues for about 50 feet. A drift has been run on the stringer for 30 feet from where it enters the tunnel. All the rock on both walls is granodiorite, and no ore of any importance can be seen.

At a 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.

This group consists of the *Silver Pick*, *Silver Leaf*, and **Silver Pick Group**. *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 D'Éboulé 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 Spence, 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 southwest flank of Hudson Bay mountain. It flows westerly for about twenty miles, then

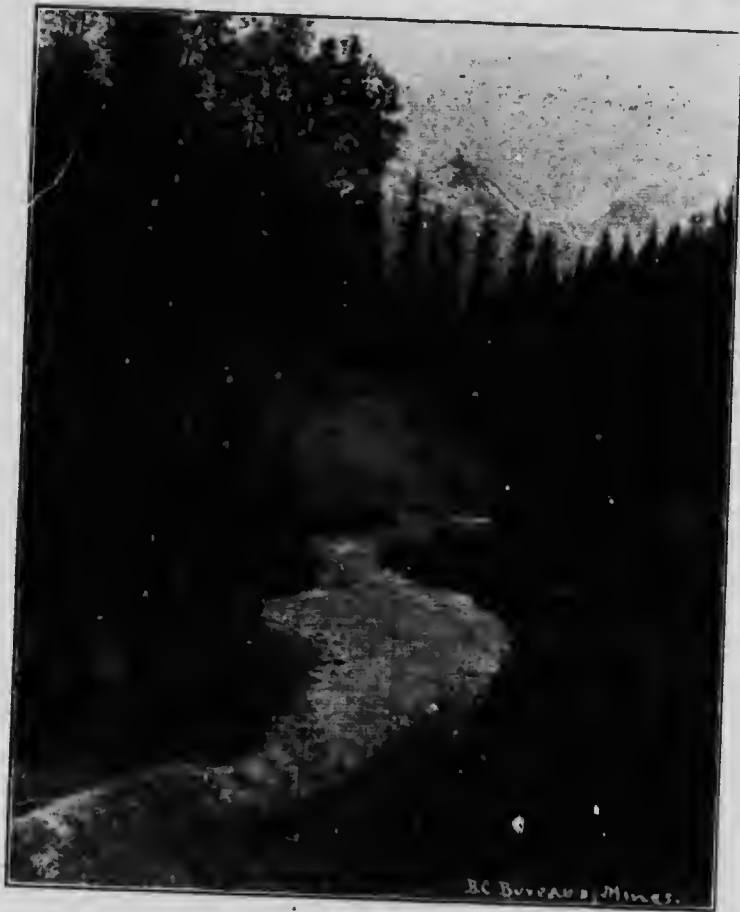


Mine Camp—Coal Creek.

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 number of mineral claims along this river, including a deposit of hematite 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



Looking up Coal Creek.

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 taking-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-



Crosscut Tunnel, No. 1 Seam—Coal Creek.



Tunnel, No. 2 Seam—Coal 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.
Molsture	3.3	3.9
Volatile combustible matter	34.5	31.2
Fixed carbon	56.1	55.1
Ash	6.1	9.8
	<hr/> 100.0	<hr/> 100.0
Coking	Fair.	Fair.

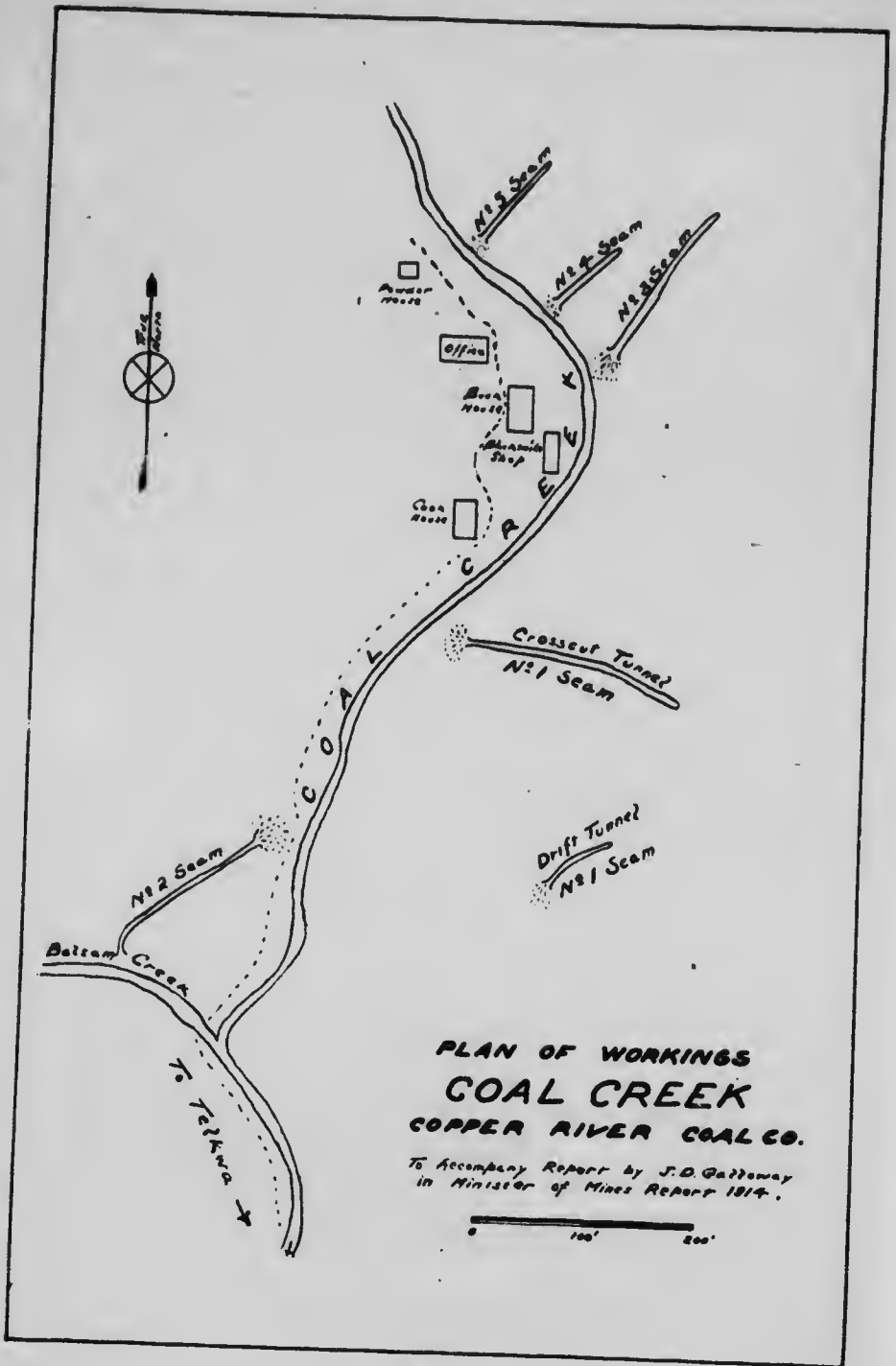
This seam has also been prospected by a crosscut tunnel running easterly from the creek-level which strikes the coal at about 158 feet; no further work having been done beyond this point. The seam where cut is 75 feet below the upper tunnel and is almost identical in appearance; the bottom and top coal and various clay-seams being all in evidence in the same 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 :—

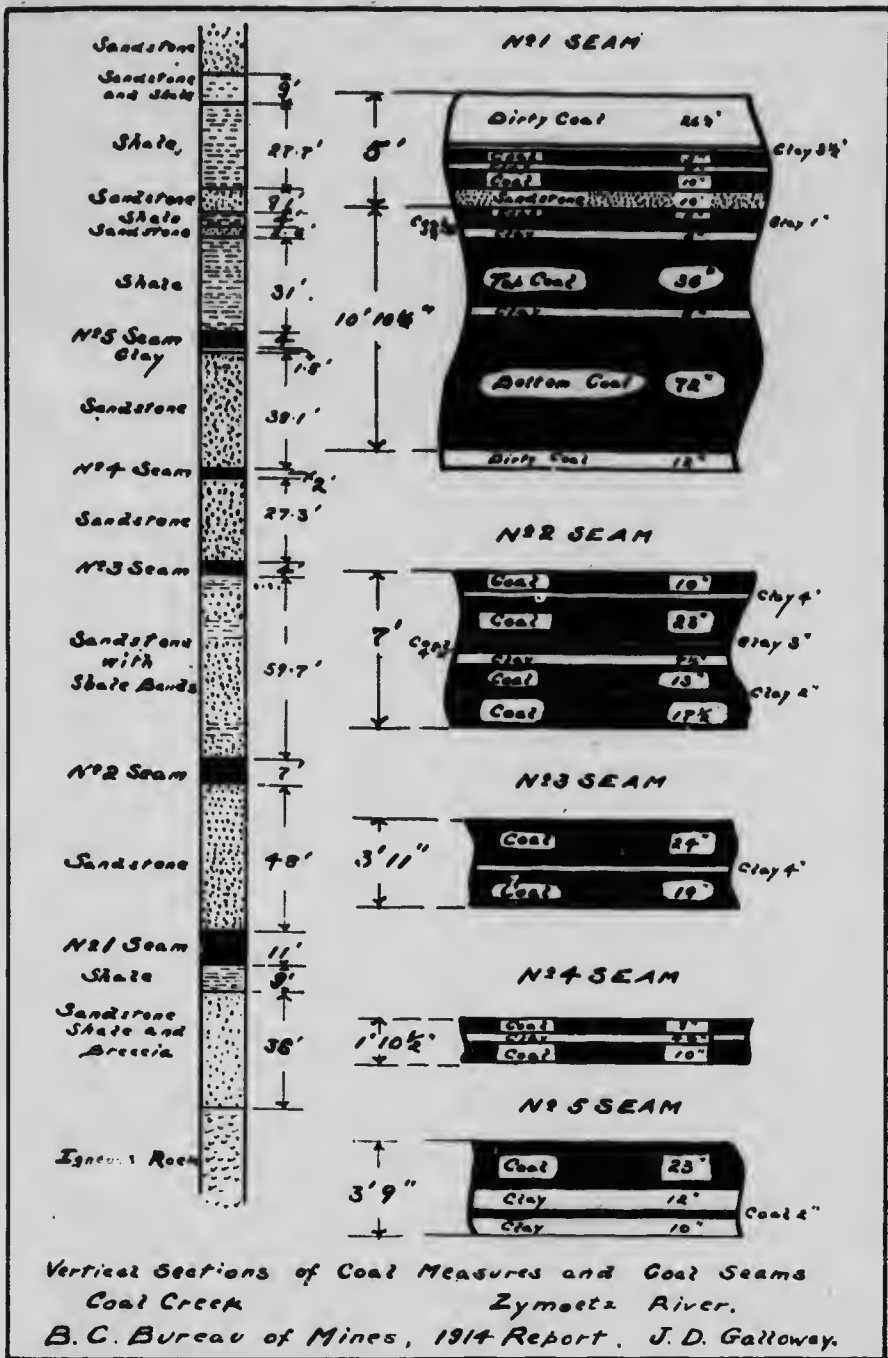
	(A.) Per Cent.	(B.) Per Cent.
Molsture	2.4	3.3
Volatile combustible matter	36.7	31.9
Fixed carbon	56.2	52.8
Ash	4.7	12.0
	<hr/> 100.0	<hr/> 100.0
Coking	Fair.	Fair.

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 $14\frac{1}{2}$ 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 20 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 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, 32.0 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 this 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 coalmine 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.

The *Coronado* group of claims lies up the hill a short distance *Coronado Group*. above the 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. McDonell, 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 rather 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 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, but this is of no importance.

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.

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.

This claim lies to the east of the *White Swan*, and is owned Henderson Frac. 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.

This property lies up the hill above the last-mentioned claim, Humming Bird, 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.

These claims are located on the east bank of Sloan creek Newcastle and near its head, and are owned by C. Hastings. The vein on this Dominion. 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.

This claim is situated some distance up the mountain at an Myrtle. 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 are 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.

This claim lies up the hill from the Myrtle, and is also owned Iron King. 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, 13.8 per cent.

This property lies to the west of the *Coronado* group and consists of the *Victory*, *Standard*, and *Triumph* claims. It is owned Victory Group. 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 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 the 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 material. 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 Kathiyo lake. One property was bonded in 1913 by a London company, and developed for a time under the superintendency of A. H. Brown. 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. Timberline 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.

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, as yet, 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.

The *Mohock*, adjoining the *Idaho* to the west and extending farther up the hill, is another of Wm. Hunter's claims. The ore in 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.

The *Rainbow* adjoins the *Mohock* on the west, and has had 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 lylug 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 strippling 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.

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 stragglers 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, 20.9 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, 0.06 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.

The vein on the *Colorado* is a silica-filled fissure varying from **Colorado.** 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 as he, 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 Teikwa and then shipped to either Tacoma or Traji.

This property is situated to the north-east of the *Colorado*, **Tribune.** 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.

This claim adjoins the *Tribune* to the north, and is owned by Hunter. 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 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.

These claims lie to the north-west of the Colorado and up Western Group. on top of the mountain at an elevation of about 8,000 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 the 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.

This group, consisting of the *H. & O.* and *W.J.* claims, was Hannah Group. 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 shattered 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.

These claims adjoin the *Hansen* property, and are owned by *Gypsy Queen* Paddy Quinn and partner. The outcropping on the surface of *and Blue Grouse*. 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 evidence 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.

Many locations have been made in this vicinity in years past, *Highgrade*. 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 well 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-porphyr 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 $\frac{1}{2}$ 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.

This group consists of four claims—the *Stirling*, *Big Blue*, *Loring Group*, *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, 0.0 oz.; copper, 1.8 per cent.

There are six claims in this group—the *Camosun*, *Lion*, and *Forest Group*. *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-porphry 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 Kathryn 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-porphry 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 from 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 headwaters 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 tuffaceous 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.

This group, consisting of the *Venus*, *Centre Star*, *Uranus*, and *Lone Pine* group, is located up the hill a short distance from Barrett's *Group*, and is distant about eighteen miles from Telkwa. It is owned by Joseph Bussinger and Chas. Barrett. At an elevation of 2,500 feet a quartz vein is exposed which strikes north and south and dips to the east at 15 degrees. The vein is quartz, with a little galena, iron pyrites, and chalcopyrite scattered throughout. The rock formation here consists mainly of a white 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.

This group, consisting of the *Grafter*, *Iron King*, and *Iron Grafter Group*. *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.

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.

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, Paul 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-porphry 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 $\frac{1}{2}$ 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 *Lakerien* 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.

"Work has been done on three of the claims, the most *Helen Group*, 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 23 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 paystreak; 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 elevation of these claims is 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.

"This property lies about a mile to the south-west of the **Big Four and Helen** group, and is owned by P. Powers, J. Beamau, R. Hamilt-Hidden Treasure, ton, 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 graudiorite, 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-porphry 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 no 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 Tutchi river in the Babine range, and has been prospecting and developing them more or less continuously since that time. This property, which is owned by the Babine-



Camp—Cronin's Mine.



Main Tunnel—Cronin's Mine.

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, having 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 south-east. 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.

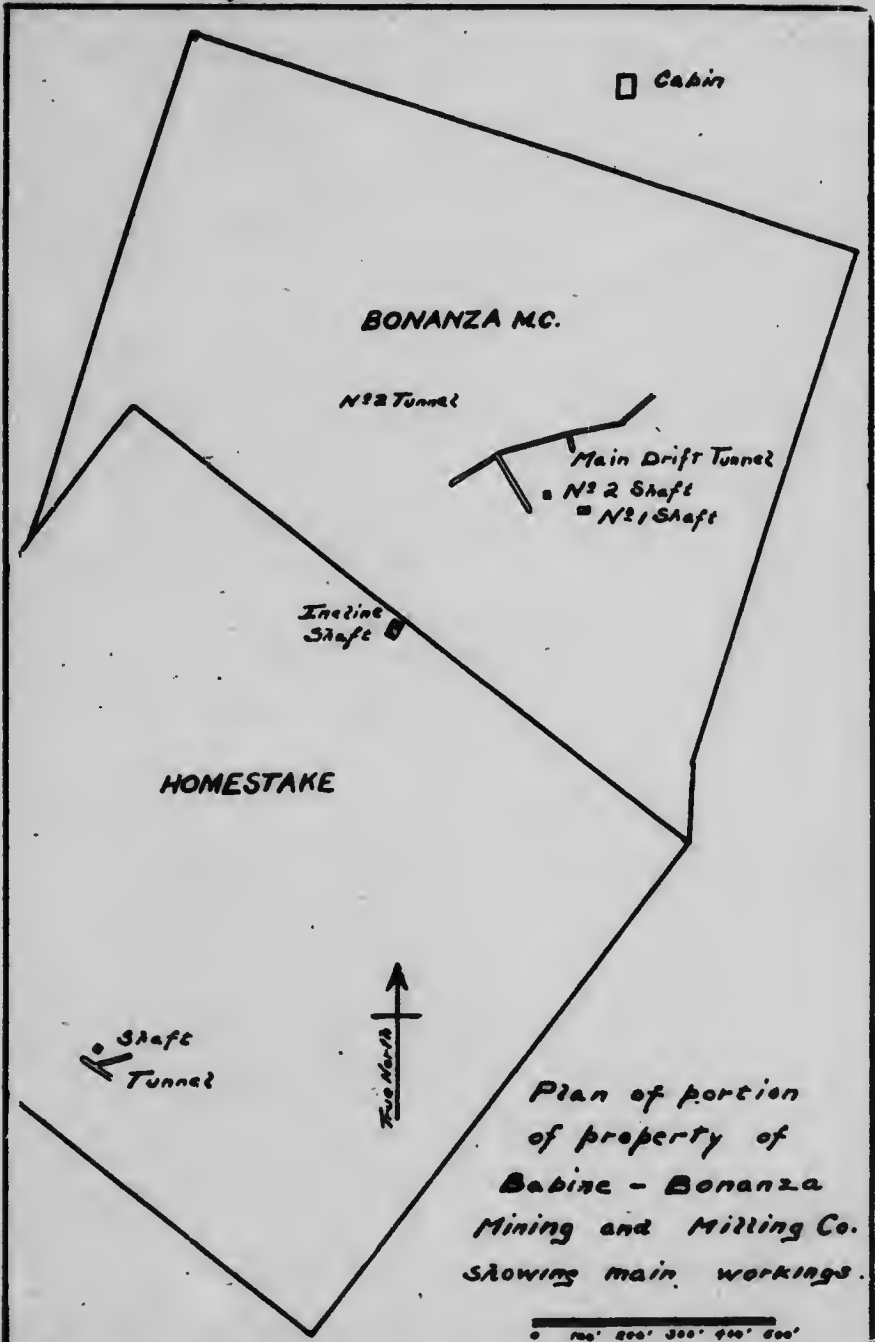
The best showings on the property are in two shafts which would seem to have been worked on during the past summer. These are 100 feet apart and are sunk on the same or nearly parallel veins, which have a strike of N. 60° W; and a northerly dip of about 55 degrees. No. 1 shaft, the most easterly one, 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, 50.6 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.

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, 22.4 per cent.

* Summary Report, Geological Survey of Canada, 1910.



B.C. Bureau of Mines. To accompany Report by J.D. Galloway

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 atoping 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-porphry, 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 30 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 overlooking the deep draw in which the water from the divide drains towards Bahue 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	..	23.1	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 per-

centage 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 insufficient 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 Smilthers. 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.

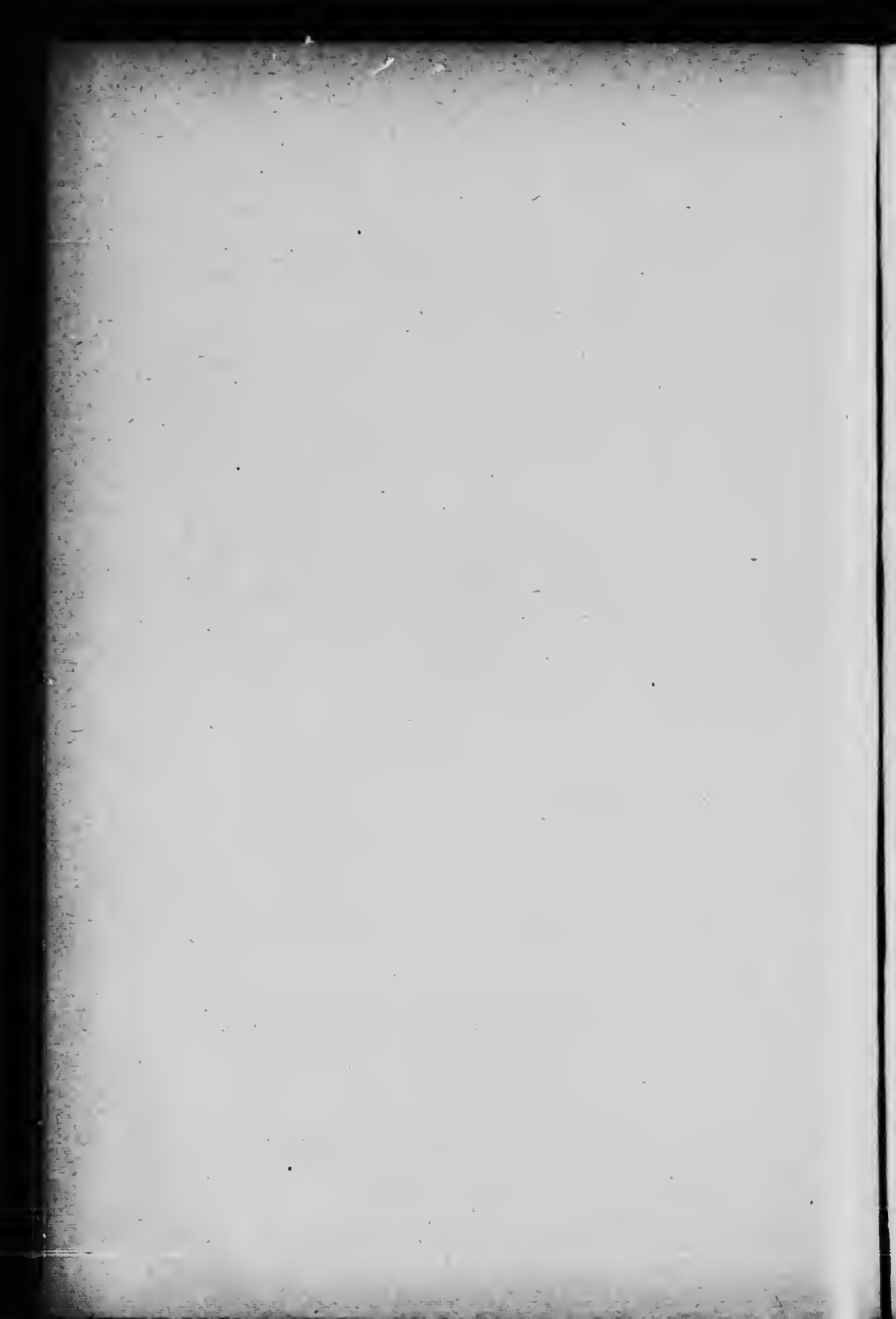
A large porphyry dyke carrying low values in gold is reported from the vicinity of Bob creek, but as far as is known no development-work has been done on it as yet, although claims have been staked there.

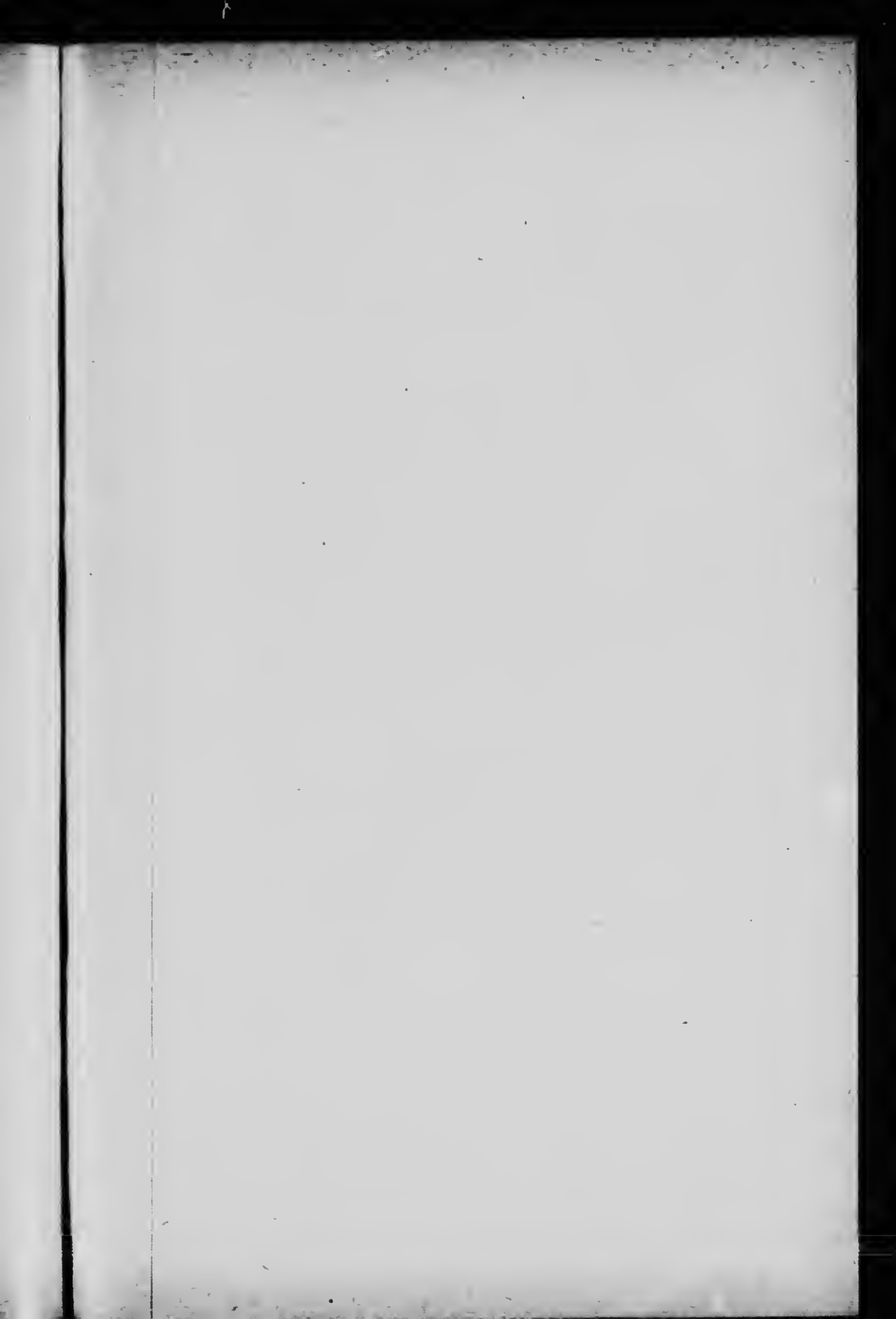
In the Omineca Mining Division, easterly from Telkwa along the line of the railway, no important mineral discoveries have been reported, so after finishing with the camps in this vicinity the writer proceeded by trail to Fort George, thus passing on into the Cariboo Mining Division.

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.

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Sketch Map showing MINERAL CLAIMS in the vicinity of HAZELTON BRITISH COLUMBIA

D. Galloway, for Minister of Mines Report, 1914
 Geo T. Stewart, Hazelton



