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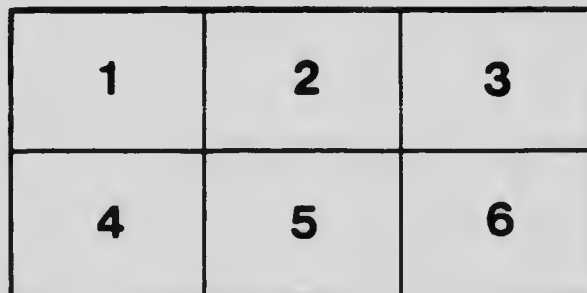
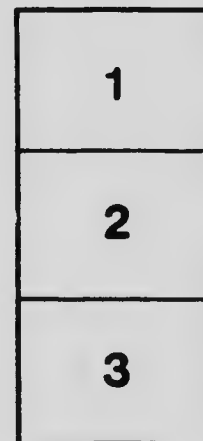
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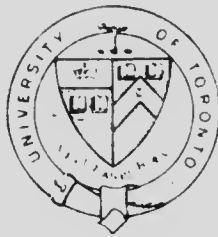
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BULLETIN No. 2 1914

THE MINERAL RESOURCES OF THE
LARDEAU AND TROUT LAKE
MINING DIVISIONS

BY

NEWTON W. EMMENS, M.E.

EDITED BY

WM. FLEET ROBERTSON, Provincial Mineralogist

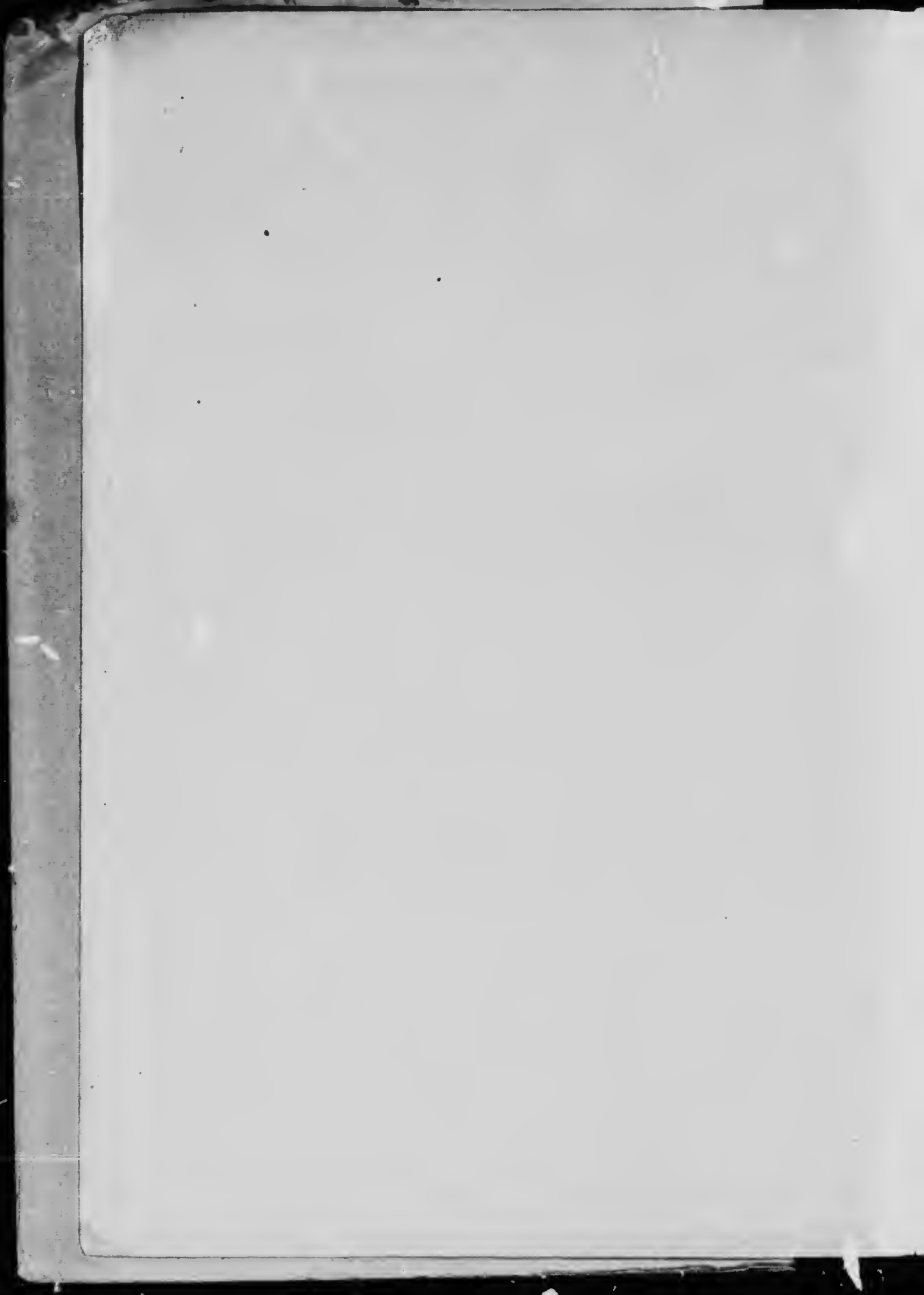


THE GOVERNMENT OF
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PRINTED BY
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VICTORIA, B.C.:

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1914.



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Plate 2. Lardau—Valley of Incomapicax River—looking North from Era Miac.

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

SIR,—I have the honour to submit herewith Reports on the Mineral Resources of the Ladang and Front Lake Mining Divisions by Newton W. Emmens, M.E., A.I.M.E., 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.,

November 21st, 1914.

MINERAL RESOURCES OF THE LARDEAU MINING DIVISION.

REPORT BY NEWTON W. EMMENS, M.E.

THE area covered by the Lardeau Mining Division embraces the territory bounded on the north by a line following the summit of the ridge dividing the watersheds of the Illecillewaet and the Incomappleux rivers; on the south by a line following the summits of the ridges forming the divide between the watersheds of Pingston and Bannock creeks and the Upper Arrow and Trout lakes; on the east by a line following the summits of the ridges dividing the watersheds of the Incomappleux river from that of Lardeau creek and the upper portion of the Dunnean river and Beaver creek; while on the west it follows along the summits of the ridges forming the divide between the watersheds of the Shuswap and the Columbia rivers.

That portion of the area bordering the Upper Arrow lake north of Albert point, the North-east arm and the valley of the Columbia river as far north as Mile-post 23, on the Arrowhead branch of the Canadian Pacific Railway, has already been dealt with in the geological report on the Arrowhead section, and will not therefore be repeated here.

All bearings mentioned in this report are astronomic and all elevations are above sea-level.

ACCESSIBILITY.

The greater portion of the Lardeau Mining Division is comparatively easy of access, being, as it is, practically bisected by the wide, flat valley of the Incomappleux river.

The Canadian Pacific Railway operates trains as far as Arrowhead, at the junction of the Columbia river and the North-east arm with the Upper Arrow lake. From Arrowhead a steamer connects with the town of Beaton, at the head of the North-east arm, from which place there is an excellent wagon-road for a distance of twelve miles up the valley of the Incomappleux river. From this wagon-road excellent trunk trails have been built up most of the larger tributary creeks, and, from these trunk trails and other parts of the wagon-road, pack-trails have been built to a number of individual mines and prospects. Most of these trails are in fair condition, and a comparatively small amount of work will put the others in good shape.

At present it is possible, in the majority of cases, to ride on horseback to the several mines and prospects that exist in the district.

Above Twelve-mile, on the Incomappleux river, at which point the stream is crossed by an excellent wagon-road bridge, a trail exists along the east bank which at one time extended over the divide at Flat Creek pass, following the latter creek to its junction with the Illecillewaet river, near the main line of the Canadian Pacific Railway. This trail has been little used for a number of years beyond the mouth of Boyd creek, and is therefore in a bad state of repair and much overgrown with weeds and brush, but it would not be an expensive matter to clear it and make the necessary repairs.

TOPOGRAPHY.

The Lardeau Mining Division includes one of the most rugged and picturesque areas in the Selkirk mountains, the higher peaks of which rise to altitudes of 7,000 to 9,000 feet, and are crowned by glaciers and fields of perpetual snow.

The mountain-sides are steep, in many places precipitous, with deep narrow valleys between and are densely timbered with cedar, spruce, hemlock, fir, and balsam to elevations of from 5,500 to 6,000 feet. The underbrush to elevations of 5,000 feet is dense, making transportation and travelling, away from the roads and trails, arduous. Above timber-line the mountains are clothed with grasses and alpine varieties of flowers, some of which are very beautiful. The summits of the higher peaks are either covered with glaciers and snow-fields or consist entirely of bare rock.

Along the valleys flow streams of water which, owing to the steep gradient of their beds, afford splendid water-powers. Many of the creeks and rivers are a succession of cascades and rapids for miles, often running through narrow rocky canyons, forming splendid sites for the construction of dams.

Flowing through the district, from close to its north-east corner, in a southerly direction to the head of the North-east arm of Upper Arrow lake is the Incomappleux river, which occupies a wide, steep-walled U-shaped valley, the floor of which has a gentle slope towards the south through which the stream meanders. (Plates 1 and 2.)

This valley cuts across the strike of the rocks, and tributary to it are a number of streams occupying deep, narrow, V-shaped valleys having their sources in the glaciers and snow-fields which crown the summits of the divide to the north-west and south-east.

These valleys dissect the district into a number of mountain ridges having a general north-west and south-east trend, with offsetting ridges at right angles.

The mountains are large, blocky masses, usually terminating in rough, narrow, serrated ridges, the skyline of which is fairly even, but relieved in detail by a number of pinnacles and spire-like rock-masses.

Speaking of the mountains in this portion of the Selkirk, R. W. Brock* says: "This even skyline, suggestive of a dissected peneplane which is a striking feature in a panoramic view from almost any peak, is remarkable in so mountainous a district. It seems to be due to the sameness in physical and structural conditions of the rocks over a wide area, with, perhaps, planation by the Cordilleran ice-sheet. Where the country-rock is granite or limestone the mountains are loftier and the skyline becomes uneven."

At the northern end of the district is a belt of limestone which forms the most conspicuous feature in the topography. Here the ridges are wedged-shaped, rising precipitously above the surrounding country, weathering into castellated and fantastic forms.

The topographical features are undoubtedly due to the erosion by river-action in a region of uplift, but there is much evidence to show that these features have been modified by ice, the summits of the ridges having been beveled off and basins and cirques scooped out. Many of these latter are still occupied by residual glaciers.

The shape of the larger valleys has been changed from a V-shape to that of a steep-walled U, while the ends of the ridges projecting into these valleys have been truncated, giving them the appearance of enormous cut-banks. The floors of the main valleys have been deepened to a greater extent than those of the tributary, so that the latter often lie above as hanging valleys.

On the mountain-sides and on the summits of the ridges are numerous boulders of rock, foreign to anything in the vicinity, indicating clearly that they have been transported to their present position by ice.

Numerous glaciers and snow-fields, some of which are several miles in extent, occupy the summits of the higher peaks and ridges. These glaciers are rapidly retreating, and there is considerable evidence that the lower parts of many of the valleys were occupied by ice at no remote period.

In Poole creek (Plate 3) as far down as Camp creek (called Hillman on the map) the valley must have been occupied by ice not very long ago (geologically speaking). This portion of the valley is of the steep-walled U-shaped type, and, although a number of tributaries enter it and snowslides are both large and numerous, little rock debris has as yet accumulated.

* Brock, R. W. *Summ. Rep. Geo. Sur. Can.*, 1903, pp. 44, 45.

From the field evidence it is seen that the existing glaciers are the remnants of the large valley glaciers, which, in turn, were the remains of the great Cordilleran ice-sheet at one time covered the whole of southern British Columbia.

The present glaciers, while comparatively small as regards area, are of considerable thickness, often exceeding 200 feet. Their movement is comparatively rapid, as is shown by the turbid condition of the streams issuing from them, produced by the powdered rock, with which they are charged, from the grinding action of the glaciers on their ground moraines.

GEOLOGY.

The rocks forming the Arrowhead section have already been dealt with in the geological report previously spoken of. It is not necessary, therefore, to say anything further about them here, especially as they do not contain any known ore-bodies of commercial importance.

During the examination of the Arrowhead section, a zone of mineralization having a width of 5 feet and occurring between a quartzite and a green schist was noted on the south side of the North-east arm, and had evidently, at one time, been staked as a mineral claim, as, a short distance above the lake-level, there is an open-cut some 15 feet in length, in which may be seen some small bunches of galena and iron pyrites in a quartz gangue. The metallic contents, however, of this material is not sufficient to warrant further work. A sample taken from this point, of the more highly mineralized portion, assayed only a trace in gold and 1.8 oz. in silver to the ton.

Between the head of the North-east arm of the Upper Arrow lake at Beaton and the town of Camborne the rocks consist of dark carbonaceous phyllites, grey siliceous schists, green schists, and a green rusty-weathering schistose rock which is generally considered to be an altered eruptive, and has been classified as a diabase-schist.

These rocks have a general north-west and south-east strike, with a north-easterly dip at angles from 50 to 60 degrees, cut by a series of joint planes having a north-easterly strike and a dip of from 40 to 80 degrees north-westerly.

North of Camborne to Twelve-mile the formation consists mainly of altered sedimentary rocks which are now represented by phyllites, tateose schists, calc-schists, and quartzites, interbanded with the rusty-weathering diabase-schists and bands of a green chloritic schist. These latter are considered to be altered eruptives. These rocks have the characteristic north-westerly strike and north-easterly dip, and are cut by master joints striking at right angles and dipping steeply to the north-west.

Two important bands of quartzite, locally called "quartzite dykes," cross the valley of the Incomapptaux river—one a short distance below the mouth of Men-hinuk creek, and the other below that of Sable creek. This is an exceedingly hard, close-grained, dark-blue rock, cut and seamed in all directions by quartz stringers, and has the appearance of an indurated sandstone.

Above Twelve-mile to within a short distance of McDougal creek the formation consists of crystalline limestones, interbanded with slates and phyllites. Many of the limestone-bands are highly carbonaceous, some of them containing a considerable amount of graphite, while others contain a sufficient amount of chlorite to impart a decided green colour to the rock. This green chlorite has, in some instances, been mistaken for the green carbonate of copper (malachite).

North of this last series of rocks is a coarse-grained porphyritic granite near which occur numerous dykes of aplite and a coarse-grained quartzose pegmatite. It is in connection with the latter rocks that the tin occurs north of McDougal creek.

Owing to the highly altered and metamorphosed condition of the rocks, there is a complete absence of recognizable fossils, but from their general appearance, sequence, and position, they are regarded as a continuation southward of the formation which is exposed along the main line of the Canadian Pacific Railway between the stations of Twin Butte and Glacier, which has been classified as

belonging to the Beltian system* (the Nisconlith and Selkirk series of Dawson) and as being of the Pre-Cambrian age.

The granite which occurs along the north-east portion of the district is generally regarded as being much younger than the sedimentary rocks, and from its resemblance to the Nelson granite is considered to belong to the same intrusion as the Nelson batholith of the West Kootenay sheet, which is tentatively referred to the Jurassic or Post-Jurassic period,† and differing both in structure and composition from the granite occupying the south-western portion of the area examined, and which is regarded as being of Pre-Cambrian age.

MINERAL ZONES.

In the Lardeau Division there are two recognized mineral belts, known respectively as the Central and Lime Dyke series.

The former extends from the head of Sahle creek and the Akololox river in a general south-easterly direction, crossing the valley of the Incomapleux river just north of the town of Camhorne, and continuing across Mount Poole into the Trout Lake Mining Division. This belt is somewhat irregular in width and consists of slates and phyllites cut by the green, rusty-weathering diabase-schist, lying between broad bands of the green schist. It is within this belt that the more important mineral deposits occur.

The second mineral belt, locally spoken of as the "Lime Dyke," extends along the divide between Sahle and McDougal creeks south-easterly across the Incomapleux river, along the divides between Lexington and Boyd, and Boyd and Kellie creeks, across the head of Poole creek over into the Trout Lake District.

CENTRAL BELT.

MINES AND PROSPECTS.

Burniere Group.

This property consists of three claims, the *Bodmin*, *St. Mabyn*, and *Burniere*, situated on the north-east slope of Comaplex mountain, at the head of Scott creek, and at an elevation of 6,000 to 6,800 feet. (Plate 4.) On this property there is a well-defined quartz vein having a strike of N. 65° W., with a dip of 80 degrees south-westerly, lying at the contact between a rusty-weathering diabase-schist and a narrow belt of crystalline limestone containing a large amount of chlorite.

The vein varies in width from a few inches to 2.5 feet, and is particularly well exposed along the gently sloping hillside above the timber-line on the ridge dividing the watersheds of Scott creek and the West fork of Sahle creek; here it shows as a white line through the green grass and alpine flora with which this slope is clothed.

A number of open-cuts and shallow prospect-pits have been made along this outcrop for a distance of 350 feet, and in many places free gold can be seen in the quartz with the naked eye. A sample taken along this outcrop, after rejecting the pieces in which free gold could be seen, assayed: Gold, 0.3 oz.; silver, 0.2 oz.

From a flat below the outcrop a crosscut has been driven to intersect the vein, which it does at a vertical depth of 19 feet. Here the vein is 12 inches wide, and a general sample, taken as nearly as possible at right angles to its strike assayed: Gold, 1.2 oz.; silver, 0.5 oz. Here was noticed some galena scattered through the quartz, which was stated to be very rich in gold, although only on very rare occasions is native gold visible in the galena itself. To confirm this, a sample of the quartz containing a considerable amount of galena was assayed, and found to contain: Gold, 12.32 oz.; silver, 4.7 oz. No assay was made for lead.

A peculiar characteristic of this vein is the presence in the quartz of a bright light-green chlorite, which weathers to a rusty yellow. This chlorite is considered an indicator for gold in this formation, as it has been found that those portions of the vein containing the greatest amount of chlorite are also the richest in gold, outside of the galena, which is the heaviest gold-carrier.

* Daly, R. A. *Surv. Rep. Geo. Surv. Can.*, 1912, p. 159.

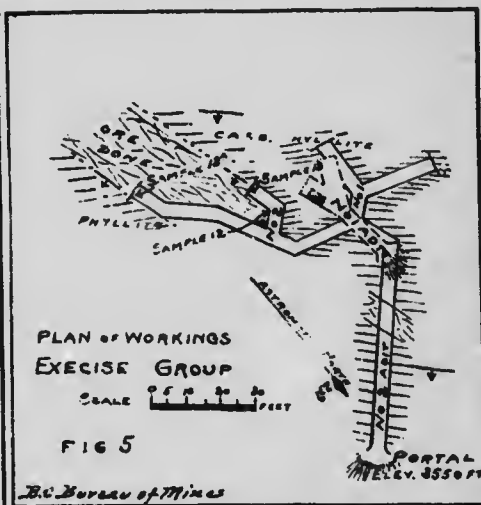
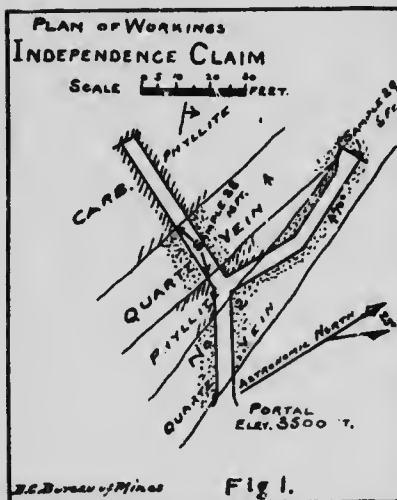
† Le Roy, O. E. *Summ. Rep. Geo. Surv. Can.*, 1911, pp. 143, 144.

This group is situated on a ridge between Menhinick and Scott Nelson Group creeks, at an elevation of 4,000 feet, on the west side of the Incomappleux river. On this property there is a quartz vein having a strike of N. 00° W., with a dip to the south-west at an angle of 50 degrees. A number of open-cuts have been made at various places along the vein-outcrop, which shows a width of from 10 to 18 feet. A short crosscut tunnel has also been driven into the vein, which it intersects at a depth of 40 feet. The vein contains many schist inclusions and is divided into two sections by a well-defined seam. In an open-cut above this crosscut the hanging-wall section has a width of 8 feet, a sample taken across which assayed: Gold, 0.2 oz.; silver, 0.1 oz. A sample of the foot-wall section, taken across 7 feet, assayed: Gold, 0.08 oz.; silver, 0.1 oz.

In the crosscut an assay of the foot-wall section showed it to contain: Gold, 0.02 oz.; silver, 0.6 oz.; and the hanging-wall part: Gold, 0.15 oz.; silver, 0.3 oz.; while a third sample taken across 6 feet of the centre of the vein assayed: Gold, a trace; silver, 0.1 oz.

In a second open-cut, about 150 feet south of the crosscut, a general sample taken across the vein assayed: Gold, 0.1 oz.; silver, 1.16 oz.

These assays from the open-cut samples are not as high as one is led to expect by the manner in which the ore pans, as a very nice "tail" of gold can nearly



always be obtained from a panful of the decomposed ore from the cuts. The explanation probably is that the gold occurs in very thin flakes which, while making a big showing, do not weigh much. The writer had a similar experience in California, where the ore obtained from an open-cut "panned big," it being quite a common thing to get a "tail" of gold an inch long from a pan of dirt; but on running this material through the mill it was found to contain only between \$2 and \$3 a ton, the explanation being that the gold was very thin and light.

The formation in which the Nelson vein occurs is a carbonaceous phyllite having a strike of N. 45° W., and is therefore cut by the vein at a slight angle.

This group consists of two claims and a fraction, situated on the north side of Menhinick creek and west side of Incomappleux river, at an elevation of 3,600 feet. The country-rock is a phyllite cut by a dyke of rusty-weathering diabase-schist. There are two veins on the property. One of these has a strike of N. 45° W. and a north-easterly dip of 60 degrees; it has a width of 4 feet and is known as the No. 1 vein. The second vein has a strike of N. 25° W., with a dip of 70 degrees south-westerly, and is known as the No. 2 vein.

The outcrops occur along a flat where the vegetation is so dense that it is difficult to trace them and so form an opinion as to their relationship.

The No. 1 vein has been opened by a series of surface trenches which show it to be continuous for a distance of between 300 and 400 feet. A sample taken across 3 feet of the quartz in the No. 1 cut assayed: Gold, 0.06 oz.; silver, 0.1 oz.

The No. 2 vein has been opened by an adit (Fig. 1) run in from the flat. The first 30 feet of this adit passes diagonally through the vein, then turns to the west, and, 10 feet farther on, encounters a quartz vein having a strike of N. 10° W., and a westerly dip of 70 degrees. It continues through this vein for a distance of 16 feet and into the hanging-wall phyllites for a further distance of 34 feet. From the turn in the adit a drift was run north 27 feet into the No. 2 vein, then turned to a course of N. 25° W. and continued for a further distance of 27 feet. At the face of this drift a few shots were put into the west side and apparently broke through into the No. 3 vein (?). A sample (No. 29) taken across 6 feet of the quartz exposed in the face of this drift assayed: Gold, 0.02 oz.; silver, a trace; while a sample (No. 28) taken across 16 feet of the No. 3 vein in the main adit showed it to contain 0.5 oz. gold and 0.3 oz. silver.

Sufficient work has not been done in connection with the No. 2 and No. 3 veins to determine whether they are separate and distinct, or whether they are one and the same, the ore-body being split by a horse of country-rock through which the main adit penetrates. Owing to the heavy covering of soil and rocky debris, no outcrops are visible where these veins should come to the surface.

There is a large amount of quartz float scattered about on the surface in both large and small masses, some of the former weighing several tons, a good many of which, upon being broken, show free gold. It is supposed, by the owners of the property, that this float comes from the No. 3 or "big vein," as they call it, but no systematic attempt has been made to prove the correctness of this supposition.

Some 500 feet north-westerly from the adit is a dyke of diabase-schist containing considerable quartz and having a strike of N. 25° W., with a south-westerly dip of 60 degrees. An open-cut has been made across the quartz portion of this dyke, from which a sample obtained over 5 feet of the more highly mineralized part assayed: Gold, 0.1 oz.; silver, 0.28 oz.

One hundred feet farther east from this cut, on the side of a low, narrow ridge, some open-cuts have been made across a series of quartz stringers which occur here in a carbonaceous phyllite. These stringers follow the bedding-planes of the rock and have a strike of N. 45° W., with a dip of 70 degrees to the north-east. A sample taken across 6 feet of the most promising portion of the No. 4 cut assayed: Gold, 0.06 oz.; silver, 1.13 oz. It is quite possible, and in fact probable, that these stringers represent the continuation of the No. 1 vein in this direction.

This group adjoins the *Independence* on the south-east and extends to the valley of the *Incomappleux* river. (Plate 5.) The **Goldfinch Group** ore occurs in a diabase-schist, having the characteristic north-west strike and north-easterly dip. This schist is cut by a series of faults having a strike of N. 25° west, and a dip of 80 degrees to the south-west. There are also a series of flat joint planes having a strike of N. 45° W. and a southerly dip of 20 degrees.

The dyke apparently has been subjected to a considerable amount of movement, which has cracked and faulted the rock in different directions. Many of the fault-planes and cracks subsequently became filled with quartz, more or less mineralized with pyrite, galena, and zinc-blende, with, occasionally, a little visible free gold.

Some of the flat seams, or joint planes, are now occupied by quartz "veins" from 0.5 to 12 inches wide. These are apparently much richer in the precious metals than the other veins and stringers.

So far as development-work shows and can be seen, there is nothing on this property in the nature of a well-defined quartz vein, such as exist in other portions of the district.

A large amount of development work has been done on the property, consisting of numerous open-cuts, adits, drifts, and cross-cuts, aggregating a good many hundred feet.

The property was at one time equipped with a 10-stamp mill, situated near the mouth of Menhiteck creek, in the valley of the Incomappleux river, which was connected with the mine-workings by a wire-rope aerial tram. A forest fire destroyed the tram-line some years ago and it was never rebuilt. The mill building and machinery are still on the ground and in a fairly good state of repair.

The writer was informed that a considerable tonnage of ore from the open-cuts was put through the mill, and that the yield in bullion was satisfactory; but no figures as to tonnage or actual recoveries are available, and, from the general appearance of the material which was put through the mill, it would be surprising if in the unsorted ore the yield was in excess of \$3 or \$4 a ton, and it was probably considerably less, inasmuch as the proportion of quartz to country-rock is exceedingly small.

An upper adit, at an elevation of 3,400 feet, was driven on one of the flat veins previously spoken of; this vein is exposed in the sides of the workings, and has a width of from 4 to 12 inches. In places this ore shows free gold, together with some galena and pyrite; a selected sample assayed: Gold, 1.8 oz.; silver, 0.6 oz. This class of ore, however, occurs in comparatively small patches, and for every ton of material extracted a good many tons of waste would have to be handled.

Two hundred feet vertically below the upper adit a second adit has been driven for a considerable distance. For the first 50 feet it has a course of N. 25° W.; it then turns and follows the formation in a general N. 45° W. direction for some 300 feet, crossing, in its course, two well-defined fault-planes, the farthest one (in from the portal of the adit) of which contained some quartz. A drift was run along this quartz in a N. 25° W. direction for a distance of about 75 feet, and in one place a raise was put up 20 feet. In both directions the quartz terminated in a wedge, and it shows very little mineralization; no samples were taken.

From what can be seen, there is no verification of the existence of a commercial ore-body in this portion of the ground, but the face of the lower adit is very close to the line of the *Independence*, and if it was continued until it cut the "big vein" in that property might uncover an ore-body of considerable value.

This mine is situated on Lexington mountain, on the east side of the Incomappleux river and on the north side of Poole creek, close to the mouth of the latter. (Plates 6 and 7.) The property extends from the river-valley up the mountain-side to an elevation of 3,800 feet. It was upon this property that the first discovery of gold was made in the district. In the year 1850 an inexperienced prospector was searching for silver-lead ores, and found upon what is now known as the *Eva* property a vein containing a few specks of galena, which he staked as a silver-lead claim. On having his samples assayed, however, they were found to contain high values in gold, whereupon he and his partners staked a group of gold claims, and, the news getting abroad, started a little excitement.

A syndicate was formed in Nelson, under the management of A. H. Gracey, for the acquisition and development of this property, since which time a large amount of work has been done and a considerable tonnage of ore put through the 10-stamp mill with which the property is equipped.

The mine has been idle now for several years owing to the fact that the ore is of too low a grade to be profitably handled with a small reduction plant and at the same time keep development-work ahead. However, the mine has made a good showing considering the conditions under which it was worked.

Referring to the local geology, I cannot do better than quote from the report of R. W. Brock* on the Lardeau District, in which he says:—

"The lead consists of two veins, lying in and along two fault-planes connected by numerous cross-veins and stringers. The direction of the lead is about 120 degrees (S. 40° E.), cutting the formation at a low angle. At the camp level (that

* Summ. Rep. Geo. Surv. Can., 1903, p. 59.

is to say, at the level of No. 5A level and No. 6B level) the confining faults are 175 feet apart and dip 80 degrees away from each other. Since they are converging upwards, at the No. 2 tunnel, 500 feet above, they are closer together, being only 90 feet apart.

"The country-rocks are a spotted phyllite cut by the yellow-weathering diabase-schist. The veins are of quartz carrying siderite and sulphides, the latter usually in small quantities only, together with free gold. The sulphides consist of pyrite sometimes crystallized in the form of cubes, and pyritohedra, a little galena, and zinc-blende. The veins vary in width from a few inches to many feet. Gongs along the faults has usually confined the ore-bearing solutions within these planes and the crushed country-rock between them, so that the veins occur along these lines and in the country-rock between them.

"The southern vein is called 'A' and the northerly 'B.' Large masses of quartz may be developed especially where the cross-veins join the 'A' and 'B' veins. The cross-veins have not been observed to extend through the 'A' and 'B' veins out into the country-rock. In many places the lead is of solid vein-matter, sometimes banded, and with divisional planes parallel to the walls or to the stratification of the country-rock. Sometimes the veins hold inclusions of the country-rock more or less mineralized by vein-matter. In other places the quartz is deposited in bands between the lines of stratification. The rock between the 'A' and 'B' veins and the cross-veins is itself often mineralized with quartz and pyrite assaying perhaps \$2.50 a ton in gold. Gold may be panned from the quartz almost everywhere, but the values are not evenly distributed. Gold occurs, visible to the naked eye, both in the solid quartz, in seams in the quartz, and along the selvedge of a vein. It is often concentrated along the walls of the vein or around the inclusions. As the walls and inclusions are often highly carbonaceous, the carbon may be responsible for the enrichment."

In reference to the foregoing statement with regard to the gold visible to the naked eye, it must not be assumed that this applies to the ore-body as a whole. Free gold is only visible in spots here and there in the veins.

The vein has been traced along its outcrop from the top of the ridge to the level of the river-valley, a vertical difference of elevation of some 2,000 feet.

A total of 5,570 feet of development-work has been done on this property, consisting of 3,130 feet of drifts, 2,000 feet of crosscuts, 375 feet of raises, and 75 feet of shaft, in addition to which there are two glory-holes and many open-cuts.

I am indebted to A. H. Gracey, M.E., of Nelson, formerly manager of the property, for the following information regarding the production and recovery from ore produced from the mine during thirty-three working months:—

There was treated a total of 30,595 tons, from which was recovered \$147,553.92, an average of \$4.86 a ton. The average tailing loss during this period was 83 cents a ton, so that the gross value of the ore milled amounted to \$5.69 a ton, showing an extraction of 85.3 per cent. of the valuable metals in the ore.

In order to ascertain the recovery from the treatment of the ore from different portions and levels of the mine (Fig. 2), a series of mill-runs were made, the details of which are as follows: 8,853 tons from the No. 1A level having an assay value of \$6 a ton, mine-car sampling; 467 tons from the cross-vein on No. 5A level assayed \$10 a ton; 355 tons from 3A drift assayed \$4.25 a ton; 2,350 tons from the big stope on No. 5A level assayed \$3.50 a ton; 825 tons from the drift on No. 6A level assayed \$3.50 a ton; 2,163 tons from drift, crosscuts, and raise on the No. 1B level assayed \$4.75 a ton; 737 tons from 1B glory-hole assayed \$3.50 a ton; 2,585 tons from *Highland Mary* glory-hole assayed \$4.50 a ton; 614 tons from drift and glory-hole on 3B level assayed \$6.70 a ton; making a total of 18,889 tons having an average assay value of \$5.22 a ton. The total recovery from the treatment of this amounted to \$83,445.94, an average of \$4.41 a ton, with a tailing loss of 65 cents a ton, showing a gross value of \$5.06 a ton for the ore milled, which checks within 16 cents a ton of the average value according to the mine-car sampling.

On the No. 7 level, which is along the "A" vein, the ore-shoot that shows on the No. 6 level is just being entered. An assay taken across 6 feet of quartz gave

\$2.80 a ton in gold. There is a considerable tonnage of ore blocked out in the mine; this has been estimated at 200,000 tons according to a report made upon the property by Chester F. Lee, of Seattle, and which he further states can be counted to yield, on the average, between \$5 and \$6 a ton.

In addition to the ore-bodies above mentioned, there exist other vein-outcrops but, aside from the fact that they are gold-bearing as shown by assays and panning tests, nothing is known of their commercial value, as no work has been done upon them.

The property is equipped with a 10-stamp mill (1,050-lb. stamps), ore-feeders, rock-crushers, classifiers, and vanners, also a 250-light dynamo and an air-compressor, the whole of which is housed in a substantial building. The plant is operated by water-power derived from Poole creek, the water being conveyed from the dam to the mill through a flume 4,000 feet long and an 18-inch steel pipe-line 1,000 feet long, developing, under the head of 400 feet, 400 horse-power, which can easily be increased by enlarging the flume and pipe-line, as only a small portion of the water flowing in Poole creek is utilized.

The ore is conveyed from the mine to the mill by means of a Riblet automatic aerial tram 4,200 feet long, having a capacity of 10 tons an hour.

This property immediately adjoins the *Eva* on the south-east.

Oyster-Criterion. (Plates 6 and 7.) The principal work has been done upon what is called the *Criterion* vein, which has a strike of S. 60° E. and a dip of 70 degrees north-easterly. This is almost parallel to the

"A" vein of the *Eva*, although converging towards it. There has been a total of 2,550 feet of underground development-work done upon this property, in addition to a number of surface cuts. The bulk of the work has, however, been done on the *Criterion* vein on two levels. No. 1 level cuts the vein at a depth of 100 feet below its outcrop, and approximately 1,000 feet of drifting has been done here upon what proved to be a practically continuous ore-shoot averaging in width approximately 5 feet. Between this level and the surface some 14,000 tons of ore was extracted, yielding bullion to the value of \$52,469.42 or within a fraction of \$3.75 a ton. The figures of the tailing loss are not available, but I think it is safe to say that they were pretty close to \$1 a ton.

The *Criterion* vein is well defined and persistent, and is apparently the result, partly of the filling of an open fissure with quartz, and partly the replacement of the brecciated country-rock by the ore. The country-rock is a dark-coloured carbonaceous phyllite (the colour evidently being due to the presence of carbon in the form of graphite) and can be seen in all stages of replacement.

The quartz not only is developed between the laminae of the phyllites, but has in many places completely replaced that material, though often with remaining included fragments of phyllite. In places the vein consists of, practically, solid quartz from wall to wall, and in others a mass of reticulating veinlets of quartz with phyllite between. The carbon in the phyllite has undoubtedly played an important part as a precipitating agent for the gold contained in the mineral-bearing solutions, as it is not an uncommon thing, in certain portions of the vein, to find gold concentrated around these inclusions; consequently the mottled portions of the vein often yield the highest grade of ore, but it is evident from the gold recovered in the mill that these high-grade spots are of limited extent.

The *Criterion* vein is cut by a fault having a strike of N. 43° E., which is occupied by what is known as the "galena vein," having a width of from 1 to 5 feet, with well-defined and slickensided walls. The galena vein is younger than the *Criterion*, as the latter is not only cut, but is faulted a distance of 15 feet by it. Where the galena vein passes through the *Criterion* it narrows down to a width of 1 foot, but both it and its accompanying gouge continue unbroken through the quartz.

A drift has been run along this galena vein on the No. 1 level, and, 350 feet in from the *Criterion* vein, the galena vein intersects an east-and-west fault having a dip of 8 degrees to the south, which cuts it off completely. A little farther on a second fault is met with. At 525 feet in, a quartz vein about 8 feet wide was

encountered, similar to that on the "A" vein in the *Era* (of which it is supposed to be the continuation), the nearest working on which from this point lies 700 feet to the west. This drift has not yet been continued through to the "B" vein.

One hundred and seventy-five feet vertically below this upper level a No. 2 adit crosscut has been driven to intersect the *Criterion* vein, which it does in a distance of 450 feet. Only a small amount of drifting has been done on this level, and the downward continuation of the ore-shoot which was mined out in No. 1 level has not yet been entered.

About 300 feet north of the *Criterion* vein is the outcrop of what is known as the *Oyster* vein, which has a strike of S. 35° E. and a dip of 65 degrees to the north-east. This vein has been opened by a series of surface trenches and cuts, and has been traced into the *Lucky Jack* property, which adjoins the *Oyster-Criterion* on the south-east. Several other veins exist on the property, but practically no development has been done on any of them, although it is possible to find free gold, visible to the unaided eye, in some of the outcrops.

The property is equipped with a 10-stamp mill, rock-breakers, air-compressor, and vanners, similar to that of the *Era*. The mill is operated by water-power taken from Poole creek below the intake of the *Era* flume. The ore is transported from the mine to the mill by a Hibbet aerial wire tram 3,500 feet long.

This property is situated on Lexington mountain, west of and below the *Era* and *Oyster-Criterion* groups, and extending from their west side lines to the opposite side of Poole creek. There are several quartz veins on this property, all of which are gold-bearing, but, as the property is under the same ownership as the *Era*, it has not been developed to any extent, the resources of the owners having been devoted to the development of the *Era*.

On the *Choller* claim there is a well-defined quartz vein having a north-south strike, with a vertical dip cutting across the enclosing phyllites, which at this point have a strike of N. 70° W. and a northerly dip of 85 degrees. A number of open-cuts have been made along the outcrop for a length of about 100 feet, and showing it to have a width of from 2 to 6 feet. Assays of samples taken from these open-cuts are stated to give values ranging from \$4 to \$15 a ton.

At an elevation of 2,725 feet an adit has been driven on the *Choller* vein for a distance of approximately 100 feet, showing it to have a width of 5 feet. A sample taken across the full width of 5 feet assayed: Gold, 1 oz.; silver, 0.4 oz. A few feet back from the face a winze has been sunk to a depth of 40 feet in the vein, which has the same appearance as in the drift. In driving this adit some ore was encountered which showed iron pyrites and manganese. It has been found that the manganese is a good indicator of gold, and a selected sample of quartz showing considerable of that mineral assayed: Gold, 1.2 oz.; silver, a trace.

One hundred and twenty-five feet lower down the hill a second adit has been run in on the vein, which is here about 3 feet wide, of quartz containing many fragments of phyllite; this material is said to assay 0.4 oz. gold.

On the *Thelma* claim of this group is another large quartz vein with the same general characteristics as the *Choller*. No work has been done on this vein except near its lower exposure at Poole creek, where an open-cut shows it to have a width of 6 feet of solid quartz, containing small assays in gold.

This property is situated on Lexington mountain, and adjoins the *Lucky Jack* the *Oyster-Criterion* and *Choller* groups on the south-east. (Plate Group. 7.) There are several veins upon this property upon which a little prospecting-work has been done, but the only development of any importance has been confined to the vein upon the *Stere Namou* claim, which is a continuation of the *Oyster* vein. This vein is of quartz having a banded structure containing incisions of carbonaceous phyllite, is well mineralized with pyrite, and here has a strike of N. 35° W., with a dip of 35 degrees to the north-east at the surface, with a width, as shown by surface cuts on this claim and on the *Oyster-Criterion* ground (into which it has been proved to extend for a distance of 700 feet), of from 4 to 15 feet.

The gold in this vein appears to be chiefly associated with the iron pyrites, although occasionally it is found native in the quartz and around the phyllite inclusions. At surface, however, where the iron pyrites have been leached, the cavities remaining in the quartz often contain loose specks of gold. In depth the ore becomes more base, only about 25 per cent. of the gold content being amenable to amalgamation, the balance being contained in the sulphides.

In an open-cut made on this vein, not far from the *Oyster-Criterion* line (Plate 8), the vein shows a width of 15 feet, is of a banded structure, and contains phyllite inclusions between walls of carbonaceous phyllites. The bulk of this ore consists of quartz honeycombed from the decomposition of the iron pyrites, and contains considerable free gold. This ore all pans well.

From the floor of this cut, at an elevation of 4,650 feet, a crosscut has been driven through the vein from foot-wall to hanging, showing it to have a width of 14 feet at right angles to its strike and dip. The vein is here divided into three distinct bands by narrow seams of phyllite, the foot-wall band being more heavily mineralized with iron pyrites than either of the others. Three separate average samples taken from this crosscut, representing the three separate bands in the vein and assayed separately, gave the following results: Hanging-wall band, 5 feet wide, assayed: Gold, 0.2 oz.; silver, 1.0 oz. Central band, over a width of 6 feet, assayed: Gold, 0.3 oz.; silver, 0.5 oz.; while the more heavily mineralized foot-wall band, 3 feet wide, assayed: Gold, 0.8 oz.; silver, 1.0 oz.

One hundred feet vertically below and about 125 feet south-east of this crosscut is the No. 2 adit. This is a crosscut through the foot-wall phyllites for about 200 feet, when the vein was cut. A drift was then driven in a north-westerly direction along the foot-wall of the vein for about 40 feet. From this place a crosscut was driven into the vein for 15 feet, when a well-defined wall was encountered which was considered to be the hanging-wall, but there is a question as to the correctness of this supposition, inasmuch as a shot put in this wall showed it to contain a considerable amount of mineralized quartz. In this crosscut the vein is divided into two distinct portions by a narrow band of phyllite, the foot-wall portion being 4 feet wide and the hanging-wall portion 5 feet.

Average samples taken from each portion, separately, assayed as follows: Foot-wall portion, taken across 3 feet of the more heavily mineralized part, assayed: Gold, 0.8 oz.; silver, 0.4 oz. A second sample taken over 4 feet assayed: Gold, 0.34 oz.; silver, 0.4 oz. A sample taken across 5 feet of the hanging-wall portion assayed: Gold, 0.2 oz., with a trace of silver; and a second sample taken from the same place, but a little higher up, gave only traces of either gold or silver.

So far as the eye can detect, there is no difference in the appearance of the ore in either the hanging-wall or foot-wall portions of the vein at this place, but there is a very decided difference in the gold contents of the iron pyrites with which it is mineralized. Samples of the iron pyrites practically free from quartz taken from the hanging-wall section assayed: Gold, 0.6 oz.; no silver. Samples of the same mineral from the foot-wall taken from three separate places assayed, respectively, 1.4 oz., 1.47 oz., and 1.61 oz. in gold and no silver.

At the place where this lower crosscut intersects the vein the latter is cut by a fault having a strike of N. 65° W., with a dip of 70 degrees to the south-east. The extension on the south side of this fault has not been found, but there is reason to believe that the continuation will be found lower down the hill, and it is probable that the vein which outcrops on the *San Joaquin* claim is such continuation, but no work has been done to verify this supposition.

On the *St. Joe* claim, 2,400 feet south of the workings on the *Oyster* vein, is a quartz vein 5 feet wide between walls, carrying galena and having a north-westerly strike. This is a continuation of the vein which has been opened just above the Poole Creek trail on what is known as the *Red Horse* claim. On the *Lucky Jack* properties very little development-work has been done on this vein, and no samples were taken therefrom, it being considered that the results obtained from the sampling of it on the *Red Horse* claim would be sufficient.

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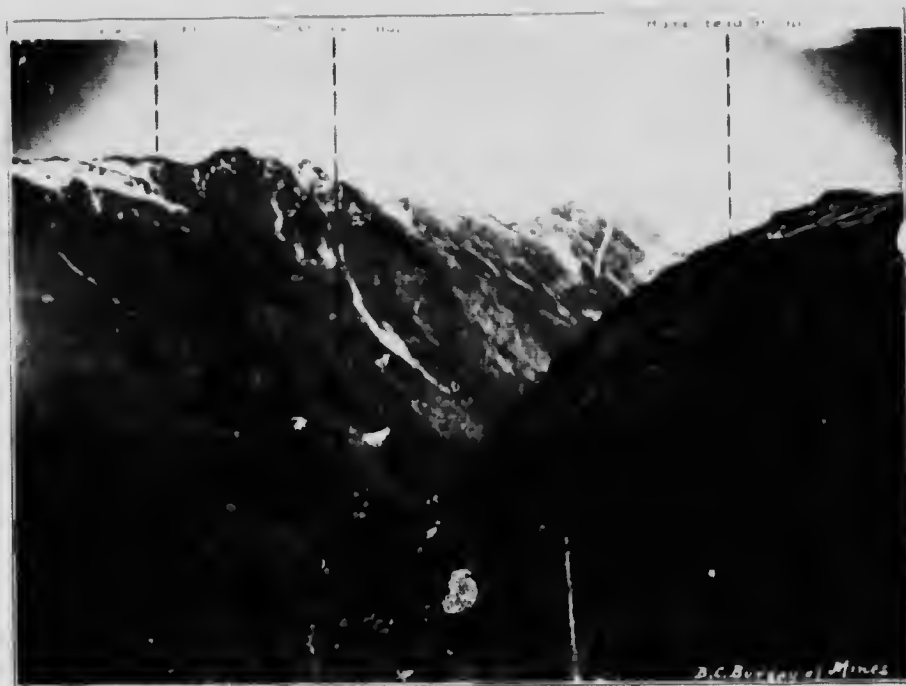


Plate 3, Lardner - Pudee Creek from Mount Thompson



Plate 7, Lardner - Lexington Mountain from Camborne Road.

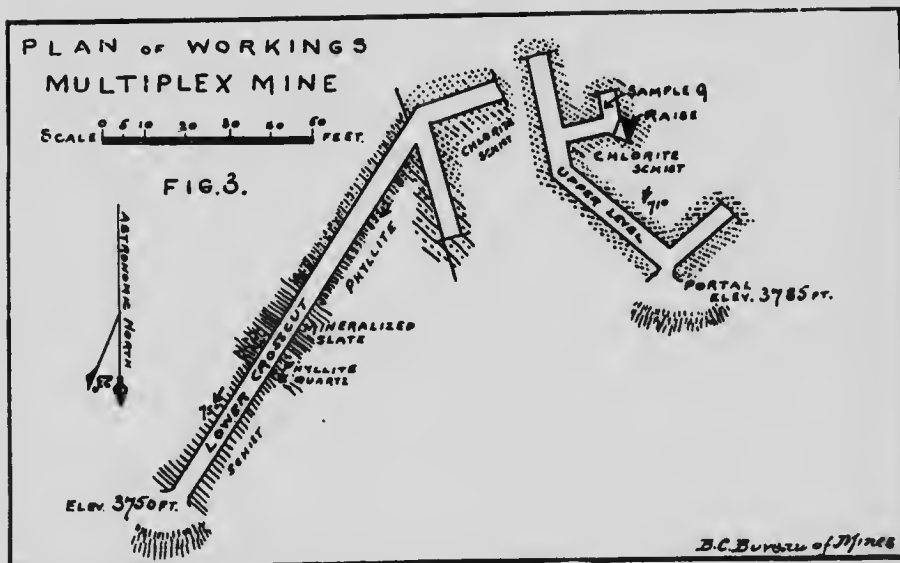


Red Horse Claim.

This is a relocation of the old *Sir Wilfred* claim, and is situated on Poole creek, about a mile and a half from the town of Camborne, at an elevation of 2,700 feet. The vein has been traced for a distance of 200 feet up the mountain-side by a series of open-cuts and trenches. Just above the trail the vein has been "faced up" and an adit started thereon. Here it is 14 feet wide, with a strike of N. 25° W. and dip of 70 degrees north-easterly, divided by a well-defined seam in the centre into two portions, the foot-wall section having a width of 8 feet and the hanging-wall section 6 feet. In character and mineralization it is similar to the *Oyster* vein in the *Lucky Jack* tunnel; its value, however, is very much lower. A sample taken across 6 feet of the hanging-wall section assayed: Gold, a trace; silver, 0.6 oz.; while a sample taken across 8 feet of the foot-wall section assayed: Gold, 0.02 oz.; silver, 2.4 oz. The formation at this place is a phyllite having a strike of N. 45° W., with an almost vertical dip, cut by two series of joint planes, one series having a strike of N. 45° E., with a dip of 80 degrees westerly, and the other having a north-easterly strike, with a dip of 15 degrees north-westerly.

Multiplex Group.

This group consists of fourteen claims extending from the valley of Poole creek in a south-easterly direction to the summit of the ridge. Included in this group is the *Spider* claim, upon which all the underground work has been done. So far as can be seen, there is not, with perhaps one exception, a well-defined vein on the property.



The ore occurs in a chloritic schist which has been subjected to a great deal of pressure, and is consequently fractured and faulted to a considerable extent.

The ore occurs along the seams and fracture-planes, also as bunches at their intersection; it consists of quartz carrying galena, iron pyrites, and zinc-blende. The strike of the formation is N. 45° to 55° W., with a dip of 65 to 75 degrees to the north-east; this is cut by a series of joint planes having a strike of N. 40° E., with a dip of 70 degrees to the north-west. There is also another series of minor joints having a north-and-south strike and a dip of 15 degrees to the east.

Some years ago, a short distance above the *Beatrice* trail, which follows this side of Poole creek, at an elevation of 3,786 feet, some galena was found in an out-crop. A short crosscut was driven in from the hillside, a little lower down, with the intention of opening up what was supposed to be a vein carrying this material. The crosscut is only about 5 feet long (Fig. 3), when a wall was cut

with a little ore on it. A drift was then driven in a direction of S. 50° W. for 17 feet, but, the ore playing out, work in that direction was discontinued. A drift was then made from the crosscut in a direction of S. 50° E. for 27 feet, then turned to a direction of S. 10° E. for another 27 feet. In this last drift several patches of ore were found, but nothing in the shape of a defined vein. Midway in this drift a crosscut 12.5 feet was driven in a direction of S. 80° W., and, from the face, drifts were made S. 3° E. for 7 feet and N. 55° W. for 5 feet. From the face of the latter a raise was put up, coming out immediately underneath the galena showing at surface. In the course of this work there was extracted a quantity of ore, from which a shipment was made in October, 1912, which contained, according to the analysis furnished by the Trail smelter: Gold, 0.1 oz.; silver, 68.6 oz.; lead, 17.2 per cent.; zinc, 15.4 per cent.; iron, 23 per cent.; lime, 8 per cent.; insoluble, 23 per cent.; sulphur (approximately), 16 per cent. In the blacksmith-shop at the mouth of this adit there are several tons of sacked ore, from which a sample taken by the writer assayed: Gold, 0.09 oz.; silver, 66.4 oz.; lead, 22.8 per cent.; zinc, 11.3 per cent.

In the workings above described there still remain some patches of ore. A sample from the richer portions assayed: Gold, 0.24 oz.; silver, 68.9 oz.; lead, 22.8 per cent.; zinc, 14.9 per cent.

Thirty-five feet vertically below this upper crosscut a lower adit has been driven with the intention of cutting on its dip what was considered to be an ore-shoot, and from which the bulk of the ore produced on the upper level was extracted. This adit has a course of S. 33° W. for 115.5 feet; it then turns to a direction of S. 72° W. for an additional 20 feet, and was still being continued at the time of my visit. From the turn in this adit, a drift had been driven along a fracture plane in a direction of N. 15° W. for a distance of 29 feet. The formation cut by the adit consists of bands of schists, slates, and phyllites, all of which have a strike of N. 45° W. and a dip of 75 degrees to the north-east.

At 35 feet in from the portal a band of phyllite mixed with quartz stringers 8 feet wide was passed through, followed by 12.5 feet of a dark-coloured slaty rock much contorted and seamed with quartz containing iron pyrites.

Beyond this there is very little mineralization showing until the chlorite-schist is reached at 115 feet in. In this formation the ore occurs along the joint planes, seams and cracks in the rock, and consists of quartz sparingly mineralized with pyrite, galena, and zinc-blende. There is, however, no continuity to this ore, it occurring in small lens-shaped patches, rarely exceeding a few inches in thickness and wedging out rapidly in all directions.

On the hillside at an elevation of 4,500 feet is an old adit driven along a quartz vein, having a course of N. 15° W. and a width of 15 feet; this quartz is fairly well mineralized with iron pyrites.

Fifty feet higher up the hill a rock-slide has exposed a large quartz-outcrop containing fragments of schist and a little iron oxide and pyrites. This material is said to assay \$2.50 a ton in gold.

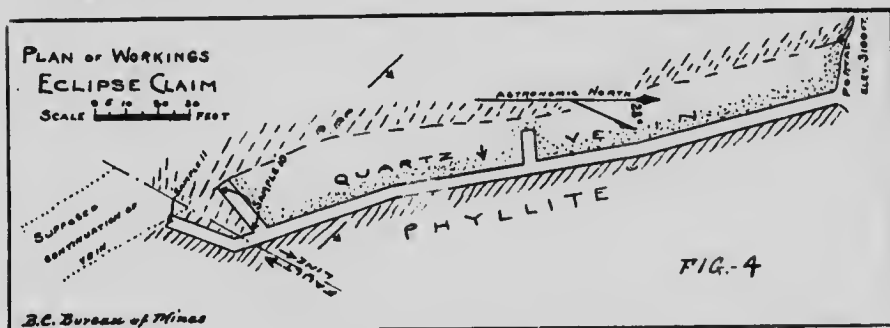
In other places on the property there are numerous quartz stringers and veinlets, but, as previously stated, nowhere was anything observed in the nature of a well-defined vein such as can be seen in other parts of the district.

Adjoining the *Multiplex* group on the north-east, extending from Poole creek up the hill to the south-east, is the *Eclipse* claim. On this property there are three quartz veins having a strike of N. 10° to 25° W. and a width of 6 to 8 feet. They are well defined, following the formation at a slight angle, and are almost vertical in dip. Aside from a little surface prospecting, work has been confined entirely to what is known as the *Eclipse* vein. Here at an altitude of 3,100 feet (100 feet above Poole creek) an adit (Fig. 4) has been driven on the vein for a distance of 208 feet. This adit follows along in the foot-wall of the vein for the entire distance. At the face of this adit is a fault having a north-east and south-west strike which cut off the vein. A drift was started in a S. 20° W. direction along this fault-plane with the intention of picking up the continuation of the vein on the other side. The drift, however, has not been

driven far enough to accomplish this, although near the face, on the floor at the south side, there is some quartz coming in which appears to be its continuation. A sample of this material assayed: Gold, 0.02 oz.; silver, 7.4 oz.

At a distance of 100 feet from the portal of the adit a crosscut was driven through the vein in a westerly direction to the hanging-wall, showing 9 feet of quartz mineralized with iron pyrites. Eighty-seven feet farther on, a second crosscut was made through the vein which proved to have a width of 15 feet, and consisted of quartz sparingly mineralized with iron pyrites and galena. An average sample taken along the south side of this crosscut, representing the cross-section of the vein at this place, assayed: Gold, 0.12 oz.; silver, 2.1 oz.; no assay being made for lead.

The other two veins were not sampled, but are said to pan gold. The formation through which these veins pass is a carbonaceous phyllite. There is a question as to the relationship of these three veins, and it is possible that they belong to the same lode formation, and that further development will show them to contain commercial ore.



This property adjoins the *Eclipse* and *Multiplex* groups on the east, and is situated at the junction of Mohawk and Poole creeks, on the west side of the former. Some years ago an outcrop of galena was discovered on the hillside about 200 feet above Mohawk creek on what is now the *Excelsior* claim.

A little prospecting showed that the ore occurred along a fault having a course of S. 30° W., with a dip of 50 degrees to the south-west. An adit (Fig. 5) was started 13 feet below this outcrop, following along the line of the fault; 10 feet in, a vein was encountered having a strike of S. 15° E. and a dip of 50 degrees to the east. Drifting was continued along this vein for a distance of 15 feet, and along the fault-line for a distance of 14 feet, but the ground being badly broken up, and the ore somewhat scattered, driving was discontinued. A winze was then sunk on the vein to a depth of 12 feet, and some very nice solid galena ore extracted. The owners of the property considered that these workings were on the top of an ore-shoot, so decided to go farther down the hill and drive a level to cut the continuation of the ore at depth.

A second adit (Fig. 5) was therefore commenced at a point 57 feet vertically below, and 40 feet (horizontal measurement) N. 35° E. from the upper tunnel. For the first 59 feet this No. 2 adit is a crosscut and has a course of S. 43° W., from which point it turns to the east of south and continues in a south-easterly direction for a distance of 70 feet, following the formation. The first part of this drift is in a badly crushed and contorted zone of carbonaceous phyllite; the latter part follows a well-defined wall along which occurs more or less ore. In the face of the drift, galena was showing at the time of my visit. This galena is of a fine grain, locally called "steel galena," a sample of which assayed: Gold, 0.02 oz.; silver, 24.2 oz.; lead, 37.3 per cent.

Two crosscuts had been made from this south-east drift looking for the continuation of the ore-shoot exposed in the upper workings, and from these crosscuts drifts have been made at different angles. As will be seen from the plan, the No. 1 crosscut and drift were too far west to have any hope of encountering the downward continuation of the ore found in the upper workings. The No. 2 crosscut and drift, however, are in a very much better position and appear to be fairly close to the downward continuation of the ore-shoot; here a considerable amount of galena is in evidence. An assay of the solid galena from this place showed it to contain: Gold, 0.05 oz.; silver, 40 oz.; lead, 48.5 per cent.; zinc, 5.5 per cent. The No. 2 crosscut passed through 11 feet of quartz and phyllite mixed, mineralized with pyrite and a little galena. An average sample taken across this 11 feet assayed: Gold, 0.08 oz.; silver, 2.0 oz.; lead, 0.8 per cent.

Thirty feet in from the portal of the No. 2 adit a band of carbonaceous phyllite, cut and seams with quartz, mineralized with iron pyrites, was passed through, and probably represents an extension of the ore-bearing zone in a north-westerly direction.

**Mohawk
Group.**

This group is situated at the junction of Mohawk and Poole creeks, on the east side of the latter, and extending from Poole creek up the hillside in a southerly direction for a distance of 4,000 feet. On this property there are two veins, known respectively as the *Mohawk* and *Fresno*.

The *Mohawk* vein has been opened by a short adit commencing within a few feet of Poole creek, driven for a distance of some 20 feet. The vein has a strike of N. 25° W., with an easterly dip at an angle of 72 degrees. It has a well-defined hanging-wall and carries considerable galena, zinc-blende, and iron pyrites in a quartz gangue, with small phyllite inclusions. The country-rock is a phyllite having a strike of N. 45° W., with a north-easterly dip, and is fractured by two series of joint planes, one having a strike of N. 15° to 25° W., and an easterly dip at a high angle, and the other an east-west strike and a southerly dip. Where opened by the adit the *Mohawk* vein has a width of 4 feet and contains a considerable amount of galena and zinc-blende, in addition to iron pyrites. An assay of the clean galena gave: Gold, 0.1 oz.; silver, 50.7 oz.; lead, 65.3 per cent.; while a sample of the clean zinc-blende gave only traces in gold and silver, and zinc 62.8 per cent. The elevation of this adit is 3,100 feet.

The *Fresno* vein has been opened by an adit 40 feet long, driven on its course, which is N. 20° W., with an easterly dip of 80 degrees. The vein is well defined, with a gouge of crushed rock between it and the hanging-wall, and is mineralized with iron pyrites and a little galena. Aside from the galena, however, it does not appear to contain much of value, as a sample taken across the vein at the face of the adit over a width of 5 feet assayed only traces in gold and silver. The country-rock here is a grey phyllite.

**Homestead
Group.**

This is a group of claims adjoining the *Mohawk* on the south-east, and is situated on the east side of Mohawk creek at an altitude of 4,500 to 6,000 feet. On this property there is a series of well-defined and clean-cut quartz veins ranging from 3 to 8 feet in width.

The No. 1 vein is 6 feet wide where it outcrops on the hill at an elevation of 5,150 feet, and stands up above the enclosing rocks like a stone wall. (Plate 9.) It has been opened by a series of surface cuts. A sample taken from the face along the wall shown in the illustration gave only traces in gold and silver, and a sample taken across a cut through the vein, 50 feet to the south, gave: Gold, 0.1 oz.; no silver. About 100 feet north-east of this vein is the No. 2 vein, which has been opened by a series of cuts at elevations ranging from 5,200 to 5,225 feet. It is of quartz, 8 feet wide, with a strike of N. 15° W. and a dip of 80 degrees to the north-east. A sample taken across the vein in the deepest cut, over a width of 8 feet, assayed: Gold, 0.02 oz.; silver, 1.5 oz.

The No. 4 vein is still farther up the hill, and has been opened by a cut at an elevation of 5,500 feet. It is of iron-stained quartz, is well defined, and has a strike

of N. 20° W., with a dip of 70 degrees to the east. An average sample taken across 15 feet assayed only traces in gold and silver. A selected sample containing iron pyrites and a little galena assayed: Gold, 0.5 oz.; silver, 8.3 oz.

One hundred feet higher up the hill is another quartz vein 10 feet wide, having a strike of N. 10° W. and an easterly dip of 65 degrees. This is known as the No. 5 vein. Two hundred feet above this is the No. 6 vein, which has been prospected by two or three cuts along its outcrop. It has a strike of N. 15° W. and an easterly dip, but at this place is much broken over and therefore could not be measured accurately.

Both the Nos. 5 and 6 veins were stated by the owners of the property to carry from \$2 to \$6 a ton gold, but the samples taken by the writer only assayed traces in the precious metals.

This property adjoins the *Homestead* group on the south-east, and extends from the forks of Mohawk creek up the hillside to an elevation of 6,000 feet. On this property there is a quartz vein 6 feet wide, with a north-westerly strike. It has been prospected by a series of open-cuts along its strike, but at surface is so badly broken over that its dip could not be accurately ascertained. At an elevation of 5,900 feet an open-cut has been made across the vein for a distance of some 20 feet, but is in the broken-over portion. A sample obtained from this cut assayed: Gold, 0.14 oz.; silver, 2.3 oz. The quartz is of a banded structure containing a little iron pyrites and included fragments of phyllite, which here forms the country-rock.

Below this cut, one hundred feet farther down the hill, an adit has been driven to intersect the vein. The mouth of this adit is caved in, so it was impossible to make an examination of the vein on this level. There is, however, a great deal of quartz on the dump, so it is evident that the vein was cut by this crosscut, but as to its size and the work done thereon no information could be obtained. The ore on the dump has the same appearance as that in the open-cut above mentioned, but was not assayed.

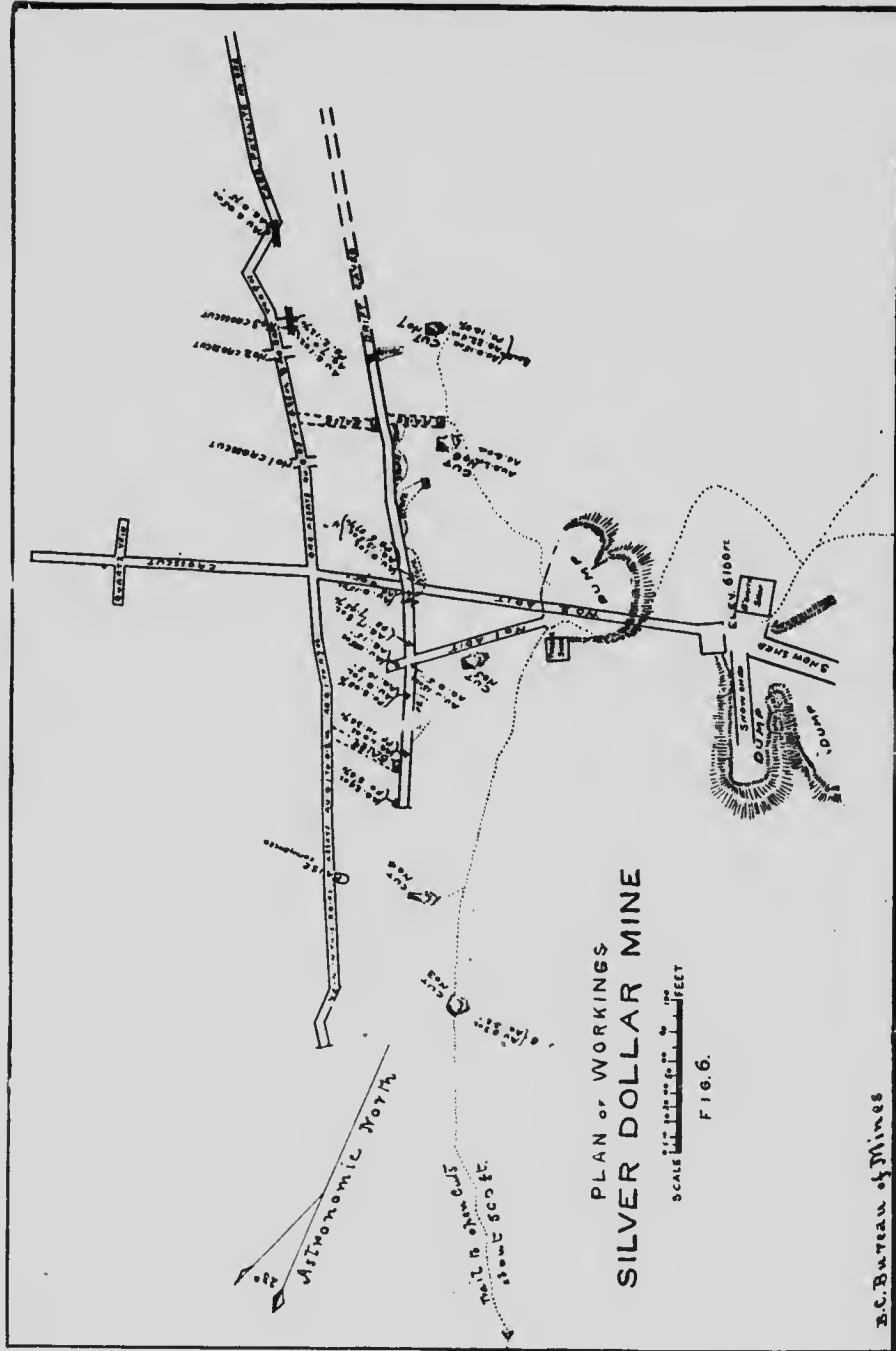
Parties interested in the property state that there is some good ore in these workings, and that there are some parallel veins which also contain good ore, but details are lacking.

The mill, air-compressor, and tram-line originally built for the *Silver Dollar* mine has been acquired for the *Del Rey* mine, across whose property the tram-line passes. (Plate 10.) It was intended to reopen the mine this season, but owing to the European war, active operations have been postponed until financial conditions improve, only the necessary repair-work being done this year.

(Plate 10.) This property is situated on the north side of **Gillman**, the East fork of Mohawk creek, on the southern slope of Mount Poole, at an elevation of 6,000 feet. There is a well-defined quartz vein traversing the property which has a width of 6 feet and a course of N. 15° W., with a dip of 35 degrees to the north-east. The formation is a carbonaceous phyllite having a strike of N. 45° W. and a north-easterly dip. The vein is opened by a few shallow surface cuts, a prospect shaft 6 feet deep, immediately above where the *Beatrice* trail crosses the vein, and a short crosscut driven in from close to the level of the East fork of Mohawk creek. The vein is well mineralized with iron pyrites, a little galena and zinc-blende, and is seamed with phyllite. It is separated from the walls by a narrow gouge, and in a number of places the quartz against the wall is slickensided. An average sample taken from the shaft above the trail, from the crosscut at the creek, and along the outcrop between these two places, a distance of about 100 feet, assayed: Gold, 3.9 oz.; silver, 6.1 oz.

In view of the promising appearance of this vein and its precious metal content, it is to be regretted that more work has not been done upon it.

This property is situated near the head of the East fork of **Silver Dollar**, Mohawk creek, immediately above the *Gillman*, at an elevation of 6,100 to 7,000 feet. On the property there are two veins, one, the *Silver Dollar*, which has been traced by surface cuts for a distance of 1,400 feet, and having a strike of N. 25° W., with a dip of 60 degrees north-easterly. This



PLAN OF WORKINGS
SILVER DOLLAR MINE

SCALE IN FEET

FIG. 6.

vein consists of quartz mineralized with iron pyrites, galena, and zinc-blende, with occasional patches of grey-copper. The mineralization is not uniform, but is more or less confined to streaks along the walls of the vein, and to shoots, the rock between the shoots consisting of a white quartz of small value.

The second vein appears to be a parallel one. It has been opened by surface trenching and a few shallow cuts, in which it appears to have the same general course and structure as the *Silver Dollar*. At this place the rocks are much disturbed and crushed, so that it is possible this second vein is in reality the continuation of the *Silver Dollar*, although it is apparently too far to the north-east, unless it has been so displaced by a fault.

Most of the development-work has been done on the *Silver Dollar* vein, and consists of a number of open-cuts along its outcrop, and two crosscuts from which some drifting has been done. In an old prospect-shaft on the outcrop near the north-west end of the property the vein is 4 feet wide; on its foot-wall a seam of galena 4 inches wide assays: Silver, 59.2 oz.; lead, 68.27 per cent.; while an average sample taken across 2 feet of the hanging-wall portion of the vein assayed: Gold, 0.1 oz.; silver, 0.15 oz.

Fifty feet south-east of this shaft, in an open-cut, at an elevation of 6,240 feet, the vein is 4 feet wide, with a streak of galena ore on the hanging-wall side 1 foot thick. A selected sample of the galena assayed: Silver, 66 oz.; lead, 66.37 per cent.; while the quartz assayed: Gold, 0.05 oz.; silver, 1 oz.

About 650 feet south-east of the old prospect-shaft a cut has been made in the vein, showing it to have a width of 6 feet. An average sample taken at this point assayed: Gold, 0.3 oz.; silver, 3.2 oz. There are four other cuts along the outcrop in which the vein is exposed for a width of from 2 to 10 feet, and assays from 0.2 to 0.3 oz. in gold and 0.3 to 7.75 oz. in silver to the ton.

In the most south-easterly of these cuts there is some solid sulphide ore consisting of a fine-grained mixture of iron pyrites, galena, and zinc-blende. Assays of this material taken from the open-cuts showed it to contain 0.15 to 0.2 oz. in gold, 22.4 to 32.25 oz. in silver, and 10.6 to 15.16 per cent. in lead; no assays being made for the zinc.

Twenty-five feet vertically below the vein-outcrop a crosscut has been driven (Fig. 6), cutting the vein in a distance of 92 feet. From this point drifts were made north-westerly along the vein for a distance of 100 feet and south-easterly for 375 feet. Where this crosscut intersects the vein it has a width of 9 feet, from which a sample representing 5.5 feet of the hanging-wall portion assayed: Gold, 0.05 oz.; silver, 1.5 oz.; while 2 feet of the foot-wall portion assayed: Gold, 0.15 oz.; silver, 0.5 oz.

Twenty-five feet north-west of the crosscut the vein narrows down to 2 feet, from which a sample was taken, representing an 8-inch streak of ore along the foot-wall side; this assayed: Gold, 0.1 oz.; silver, 16.5 oz.; lead, 8.05 per cent. Forty feet farther on, the foot-wall section widens to 10 inches, and assays: Silver, 44.0 oz.; lead, 14.36 per cent. A short distance farther along this drift the vein narrows down again and becomes mixed with the country-rock for a distance of 15 feet, when it again widens out, and in the face of the drift, 100 feet from the crosscut, there is a streak of ore against the hanging-wall, 8 inches wide, which assayed: Silver, 29 oz.; lead, 8.6 per cent.

In the south-east drift, 10 feet south of the crosscut, there is a 12 inch streak of ore against the hanging-wall which assayed: Gold, 0.1 oz.; silver, 17.8 oz.; lead, 7.95 per cent.; while an average sample taken across the full width of the vein, which is here 3 feet, assayed: Gold, 0.25 oz.; silver, 1.05 oz. Forty feet south-east of the crosscut is a stope 35 feet long and 15 feet high at the highest point above the level. Here the vein is 30 inches wide, and a sample taken across the ore showing the north-west end of the stope assayed: Gold, 0.15 oz.; silver, 0.95 oz. Between the vein and the foot-wall in this stope is a streak of fine-grained sulphide ore 4 inches wide which assayed: Gold, 0.1 oz.; silver, 13.5 oz.; lead, 5.57 per cent. From this stope the drift continues along the vein for a further distance of 330 feet, but is inaccessible beyond the 200-foot mark owing to a "cave." In this part

of the level the vein varies in width from 2 to 4 feet, and assays from 0.1 to 0.10 oz. in gold and 0.8 to 2.5 oz. in silver, with here and there patches of ore containing galena which assayed: Gold, 0.1 oz.; silver, 13 oz.; lead, 5.5 per cent.

Sixty-five feet vertically below the No. 1 adit a second adit has been driven at nearly right angles to the strike of the formation, intersecting the vein in a distance of 250 feet, passing through the vein, which is here 26 feet between walls, and continuing on for a further distance of 180 feet, with the idea of cutting another vein which is supposed to parallel the *Silver Dollar*. In this crosscut, at a distance of 120 feet beyond the *Silver Dollar* vein, is a well-defined wall against which lies a quartz vein 8 to 12 inches wide, slightly mineralized with iron pyrites; it does not, however, show any ore of commercial value.

On the *Silver Dollar* vein drifts have been made in a north-westerly direction for a distance of 325 feet, and in a south-easterly direction for a distance of 375 feet from the crosscut. In the north-west drift the vein varies in width from 3 to 5 feet, and average samples taken in various places range in assay from: Gold, 0.1 to 0.2 oz.; silver, 0.1 to 11.7 oz. Along this level, 106 feet from the crosscut intersection, a raise was put through to the No. 1 level. This raise is 90 feet long on the slope of the vein, but comes out 10 feet inside the hanging-wall of the vein on the upper level. The quartz on which this raise was started extends only 25 feet above the lower level, where it becomes broken up and mixed with the country-rock.

In the south-easterly drift the vein varies in width from 8 to 48 inches in the workings, but, as the level is carried along the hanging-wall portion of the vein, this does not represent its full width. Assays of samples taken from various places along this level gave values ranging from 0.05 to 0.25 oz. in gold and 0.05 to 0.9 oz. in silver. Three crosscuts have been made in the foot-wall portion of the vein at different places along the level, showing its contents to range from 0.2 to 0.4 oz. in gold and 0.3 to 0.5 oz. in silver. One hundred feet south-east of the main crosscut a raise was made connecting with the No. 1 level above, but, like the raise put up from the north-west drift, it also came out inside the hanging-wall of the upper level. At a point 20 feet above the No. 2 level the quartz upon which the raise was being driven is cut off by a slip, and no more ore shows until within a few feet of the level above; what was carried as the foot-wall of this raise forms the hanging-wall to the No. 1 level. This leads to the suggestion that the two ore-bodies along which the respective levels have been driven are separate and distinct, the one lying a few feet north-east of the other. This supposition is further strengthened by the No. 3 crosscut in the south-east drift on the No. 2 level, in which a vein 26 inches wide was found inside the foot-wall of the *Silver Dollar* vein, a sample of which assayed: Gold, 0.1 oz.; silver, 7 oz.; lead, 2.12 per cent.

At 600 feet south-east from the main crosscut the vein is cut off by a slip having a very flat dip to the south-east. Thinking that the vein had been faulted here, the drift was turned to the south and continued for a distance of 40 feet, where it intersected a small quartz vein 8 inches wide, a sample of which assayed: Gold, 0.05 oz.; silver, 0.75 oz. This is probably the same vein as that which was encountered in the No. 3 crosscut. From this point the main drift was again turned to the south-east, following this small vein, which plunges down to a seam a few feet farther on. The drift, however, was continued for 100 feet farther without encountering any ore-body.

This property was equipped with a mill situated on Mohawk creek, and connected with the mine by means of a wire-rope aerial tramway a little over 7,000 feet long. In the mill are two 3-stamp batteries of the Merrill type, L, which each stamp works in an individual mortar and has a quadruple discharge, together with rock-breakers, ore-feeders, concentrating-tables, etc., driven by water-power obtained from Mohawk creek. This plant has now been purchased by the *Del Rey* company. The mill was operated for a short time, but was not successful in saving the values. An examination of the ore at present lying in the mill-bins and the ore-bins at both the upper and lower terminals of the tram-line show it to contain an indeterminate mixture of phyllite, quartz, solid iron pyrites intermittently mixed galena and zinc-blende, and some galena containing grey-copper. It is obvious that the putting

through the mill of solid sulphide ore is a useless waste of good material, especially where such ore contains grey-copper, which under the action of the stamps would be crushed to a fine powder and carried away with the tailings. In the mill is some 75 tons of concentrates which assayed: Gold, 0.3 oz.; silver, 18.8 oz.; the lead was not determined. This material contains a large proportion of sand, due to poor milling. A sample of the tailings obtained from the "tailings launder," through which the waste material was allowed to flow to the creek, assayed: Gold, 0.1 oz.; silver, 6.3 oz. This probably does not represent the average tailings, as they actually ran to waste while the mill was in operation, as this material has been lying there for some years and has perhaps become somewhat concentrated through the action of the rain and melting snow. It is certain, however, that the tailing losses were a great deal higher than they ought to have been, owing to poor milling methods, and it is certain that a low-grade ore-body such as that of the *Silver Dollar* requires the most up-to-date and careful milling in order to make it pay a profit.

This property is situated at the head of the East fork of **Beatrice Mine.** Mohnwk creek, covering the summit of the divide between it and the North fork of Goat creek, which flows into Lardenn creek, in the Trout Lake Mining Division. On this property there are two veins, one from 2 to 5 feet wide carrying a fine-grained solid sulphide ore, consisting of an intimate mixture of galena, zinc-blende, iron pyrites, and grey-copper, assaying: Gold, 0.25 oz.; silver, 120.72 oz.; lead, 17.42 per cent.; zinc, from 10 to 23 per cent.

A considerable amount of work has been done on this property at different times, and a considerable tonnage of ore has been shipped to Trall, but owing to the distance the ore has to be rawhided (seven miles before reaching the wagon-road), and its high zinc content, which is penalized by the smelter, it has not been a paying proposition. The vein also is badly contorted, and the phyllite formation in which it occurs is badly broken, and therefore requires considerable timbering. The mine is opened by means of two adits, the lowest one of which is at an elevation of 7,000 feet and is above timber-line; the upper adit is some 300 feet in length and connects with an old prospect-shaft by means of a raise. In doing this work there was some 300 tons of ore sorted and sent to the smelter. This particular lot formed a part of the ore-body comparatively free from zinc, so that it was possible to keep that metal down to within the limit allowed by the smelters, but when the property was operated three or four years ago the zinc content of the shipments was in excess of 15 per cent.

The second vein, called the "Gold lode," lies to the west of that carrying the galena; it has a strike of N. 25° W. and dips at a steep angle to the north-east. It has been opened by a number of surface cuts, in which it shows a width of from 4 to 6 feet, mineralized with iron pyrites and a sprinkling of galena. Assays show it to contain: Gold, 0.15 oz.; silver, 0.95 oz. Sufficient work has not been done on this vein to fully determine either its extent or economic value. There are a number of other quartz-outcrops on this property, one of which shows at the edge of the ice of the Poole glacier, north-east of the *Beatrice* workings, and at an elevation of 8,000 feet. Others occur to the south-west of the *Gold Lode* on the *Beatrice*, but have not been prospected.

LIME DYKE BELT.

MINES AND PROSPECTS.

As previously stated, this mineral belt extends from the head of Sable creek in a general south-easterly direction across the Incomapplex river and the heads of Lexington and Poole creeks over the divide into the Trout Lake District.

The rocks comprising this belt consist of bands of limestone, slate, and phyllites, with a few intrusive dykes of diabase and porphyry. So far as development has gone, the mineral deposits appear to be largely confined to the limestone-bands or to their contact with the adjacent rocks.

Owing to the mineral discoveries, thus far made, being situated high up on the divides at the headwaters of the various creeks, their long distance from trans-

portation, and the rough steep trails which connect them with the valley of the Incomappleux river, the ore must be very rich in order to stand the heavy transportation expense. The energies of the miners and prospectors therefore have been devoted to the discovery of high-grade ore, and little attention has been paid to the large low-grade ore-bodies which are known to exist in this mineral belt. An condition which has retarded the development and operation of these deposits is the long winter and the snowslides. At the high altitudes in this district—that is, say, from 5,500 to 7,500 feet—the first snow falls during the latter part of September and does not go off until about the middle of July.

The slopes of the mountain-sides in this belt are considerably steeper than in the Central Belt, and in consequence are subject to snowslides, some of which are of large proportions and sweep everything from their path. While these conditions add to the expense of operating, they are not by any means prohibitive, as soon as the mine is equipped with the necessary plant and buildings (a safe spot the location of which can always be found), the ore-deposits opened by underground workings, and proper transportation facilities provided which can be protected from the snowslides by means of snow-sheds or snow-fences, operations can be carried on throughout the year. There are a large number of Crown-granted claims located along this belt in the Lardeau Division, but, on the majority of them, no work has been done for a number of years owing to the fact that the ore-deposits developed are of too low a grade to admit of their being operated under existing conditions of transportation, and because their owners in most instances are not mine operators and lack both the means and the knowledge to successfully open up and operate a low-grade ore-body. Chiefly owing to the above reasons, only a few of the prospects in this belt were visited by the writer. A brief description of these follows:—

This property is situated near the head of Lexington creek at an elevation of 5,900 to 6,500 feet (4,000 to 4,600 feet at the level of the valley of the Incomappleux river at the mouth of the creek), and is reached by a steep, rough trail, with an average grade of 1,000 feet to the mile. At the contact between a green chloritic schist and a band of siliceous blue limestone containing numerous quartz and calcite stringers is a vein 7 feet wide, locally known as the "Limestone lead."

This vein has a strike of N. 40° to 50° W. and a dip of 62 to 75 degrees to the eastward, conformably with that of the enclosing rocks. It has been opened up on the surface cut at an elevation of 5,953 feet, made at right angles to the strike. It shows a width of 7 feet and consists of iron pyrites, galena, and zinc-blende gangue of limestone and quartz. Against the hanging-wall of this vein is a streak 6 inches wide, much more heavily mineralized than elsewhere. A sample taken from this cut across the full width of 7 feet assayed: Gold, a trace; silver, 0.6 oz. while a sample from the more heavily mineralized hanging-wall streak assayed: Gold, 0.15 oz.; silver, 49.5 oz.; lead, 49.8 per cent. At surface along the outcrop the vein is much oxidized and the iron and lead leached out, leaving behind a honeycombed shell; this zone of oxidation, however, only extends a short distance below the surface. Several other cuts have been made along the strike of this vein, and several of them show ore of a similar character, but nowhere has there been any considerable quantity of ore opened up.

One hundred feet south-west of the cut from which the sample was obtained a crosscut has been commenced (Fig. 7) to cut the vein at a vertical depth of 30 feet. The length of this crosscut, allowing for the dip of the vein, will be approximately 105 feet, of which 70 has already been driven. The idea of the owners in driving this crosscut is to get underneath the galena showing in the cut above, with the hope that it is the apex of an ore-shoot, and that the crosscut will develop sufficient ore to enable them to make shipments to the smelter. From the limited amount of work done it is impossible to form an accurate idea as to the mineralization of the vein in depth, but on general principles it would have been far better to have sunk a prospect-shaft on the "showing" in the cut, to a depth of 25 or 30 feet, which could easily be done with a windlass, rather than to drive a crosscut for a distance

the valley of the heavy transference have been paid to the belt. Another deposit is the district—that is to part of September

steeper than in one of which are these conditions prohibitive, as when (a safe spot for by underground e protected from can be carried d claims located in, no work has posits developed ng conditions of mine operators, p and operate a of the prospects follows:—

Lexington creek 1,600 feet above at the mouth of with an average oritic schist and enaite stringers

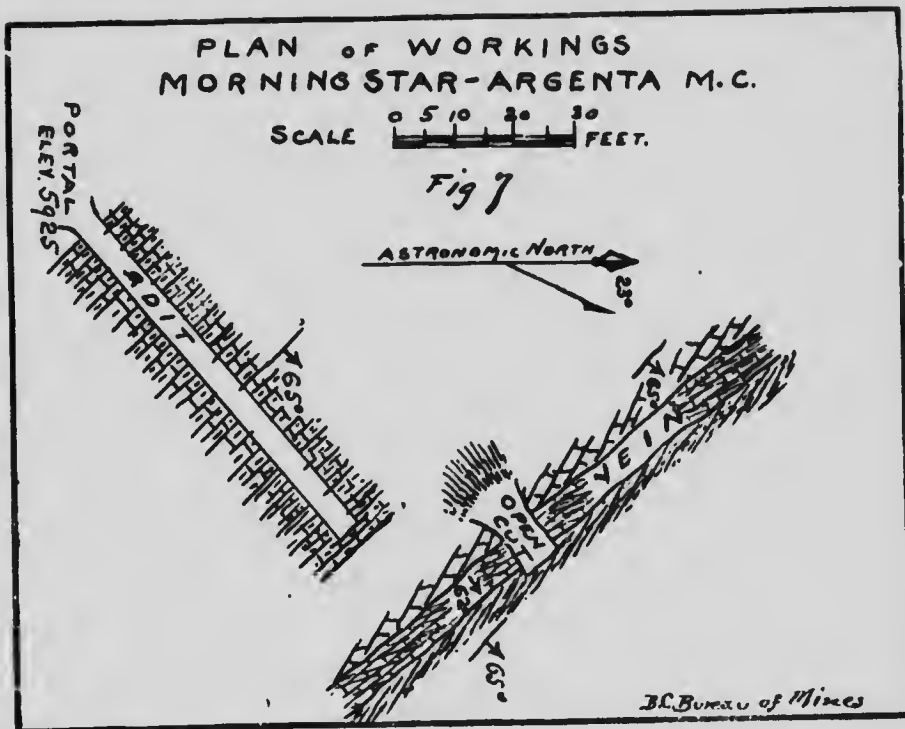
5 degrees to the en opened by a strike. It here zinc-blende in a vein is a streak sample taken in silver, 0.6 oz.; streak as ed: ong the oncrop aving behind a short distance e strike of the where has there

was obtained a depth of 30 feet. e approximately rners in driving above, with the evelop sufficient alted amount of alization of this er to have sunk 30 feet, which t for a distance

of over 100 feet through a hard siliceous lime on the chance of finding an ore-body when the vein is cut. In other words, the old adage, "follow your ore if it climbs a tree," is an excellent one in the first stages of the development of an ore-body, and if it were generally adhered to by prospectors considerably better results would be attained.

North-east of the hanging-wall chloritic schist, about 200 feet farther up the hillside, is a band of white crystalline limestone containing patches of graphite, and between this and a band of schists beyond is another vein which has been opened by a series of surface trenches and a short prospecting-drift, but no ore-body of commercial importance has been developed.

On the south side of the basin at the head of Lexington creek is a band of mineralized limestone containing galena and iron pyrites. It is stated that a con-



siderable amount of development-work has been done on this, but owing to its being covered by snow at the time of my visit an examination was not possible. It is, however, generally considered to be a continuation of the mineralized limestone-belt which has been opened at the head of Poole creek.

This property is situated on Goat mountain, on the east side of the Incomapleux river, twelve miles north of the town of Camborne, at an elevation of 5,600 to 7,800 feet. The wagon-road along the valley of the Incomapleux river has been built as far as Twelve-mile where the stream is spanned by an excellent bridge. From here to the lower Scout cabin (elevation 2,000 feet), two miles farther on, is a good trail on a wagon-road grade. From the lower Scout cabin to the upper the trail climbs a narrow ridge by a series of exceedingly steep switchbacks. This is considered to be one of the roughest and steepest trails in the district, second only to the Mammoth. It having an average grade of 1,500 feet to the mile. (Plate 11.) From the upper Scout cabin

(which is built on a shelf cut in the hillside) to the valley of the Incomapleux river the slope angle of the mountain-side is 40 degrees. Above the cabin the mountain-side is even steeper, and in places consists of almost vertical bluffs.

The formation is a dark-coloured metamorphosed lime, veined with calcite and quartz stringers, of a schistose structure, and containing inclusions of white crystalline lime and graphite. Between the lime-bands occur narrower bands of green chlorite schist. The whole rock-mass shows evidence of lateral pressure, the layers being badly contorted and twisted.

On the south side of the property there is a zone or band of siliceous lime from 6 to 15 feet wide, heavily impregnated with iron pyrites, which at surface have been converted into hematite and limonite by atmospheric agencies. At an elevation of 5,900 feet an adit has been driven on this mineralized belt in a course of S. 25° E. for a distance of 185 feet, and from this adit a crosscut has been made in a north-easterly direction across the mineralized zone, showing it to have a width of 18 feet, and to consist of lime, heavily impregnated with iron oxide and pyrites, containing galena in seams and patches. An average sample taken across the face of this adit over a width of 5 feet assayed: Gold, 0.02 oz.; silver, 2.6 oz.; and a sample of the solid galena taken near the crosscut assayed: Gold, 0.02 oz.; silver, 79.5 oz.; lead, 74.4 per cent.

Associated with and included in this mineralized zone are seams and patches of a green chlorite mineral. Six hundred feet vertically below this adit the mineralized band is exposed in a rock-slide. Here a second adit has been commenced, but has only been driven a few feet. The ore-body has the same general appearance as in the upper workings, except that it contains considerably more quartz heavily mineralized with large cubical crystals of iron pyrites in various stages of alteration, and siderite, with only a little galena. Several surface cuts have been made at other places along the outcrop of this mineralized band, which can be traced for several hundred feet in either direction along its strike from the main adit.

At the upper end of the property, close to the summit of the divide (Plate 12) between the Incomapleux river and Boyd creek, at an elevation of 7,500 feet, are some narrow quartz stringers from 2 to 12 inches wide, having a strike of N. 20° W. and a dip of 50 to 40 degrees to the north-east, sparingly mineralized with galena and grey-copper. These stringers occur in a light-coloured lime to which they are frozen. They have been opened by a number of shallow surface trenches, but no ore-shoot of commercial importance has been discovered.

This property adjoins the *Scout* group on the south-east, and covers the summit of Goat mountain from an elevation of 7,000 to 8,400 feet. The formation here consists of a metamorphosed dark-coloured limestone tilted at a high angle, and cut by two

series of fractures, one having a north-easterly course and almost vertical dip, and the other having a south-easterly strike and a dip of 5 to 10 degrees to the north-east. It is in connection with the latter that the ore-bearing seams occur.

At an elevation of 7,400 feet on the narrow mountain ridge is the outcrop of one of the flat mineralized seams above referred to. A drift has been driven along the strike of this ore for a distance of some 600 feet in a general south-easterly direction, and from this main drift shorter drifts have been made more or less at right angles along the upward and downward dip of the ore-body. Several of these lateral drifts break through to daylight on either side of the ridge, those on the east coming out on the mountain-side sloping down to the valley of Boyd creek, and those on the western to that sloping down to the Incomapleux river. The ore-seam followed in these workings varies greatly in thickness, narrowing down in some places to the width of a knife-blade, and in others opening to a width of 10 inches. The mineralization chiefly consists of grey-copper and galena, with, in a few places, argentite. That portion of the ore containing the latter mineral assays as high as 1,000 oz. of silver to the ton, but the average of the ore as sorted at the mine, several tons of which was shipped years ago, assayed approximately 400 oz. a ton in silver. From a scientific standpoint this deposit is interesting, but commercially it is of not very much importance owing to its small size, its inaccessibility, and

the irregular manner in which the ore occurs. The workings are situated above timber-line, and it is stated that the wood used for heating and cooking purposes in the cabins cost \$40 a cord.

The expense of packing supplies to the mine was also excessive, mainly owing to the exceedingly bad trail leading up from the valley of the Incomapleux river. In places this trail is nothing more than a narrow path across a sheer rock-slope, where a slip means a fall of 2,000 feet down the precipitous mountain-side. More than one unfortunate pack-horse has lost its life by falling from this trail.

In mining the ore, also, it was necessary to take out several tons of waste to every ton of ore, and, judging from the appearance of the vein in the workings, I think it is safe to say that not over 5 per cent. of the vein-matter broken could be sorted up to a grade high enough to ship. In addition to the vein upon which the adit is driven, there are several parallel seams further up the mountain-side at elevations ranging from 7,700 to 8,600 feet. A considerable amount of surface work has been done on these and a few short adits driven, but while they showed galena and grey-copper in small patches, there is no ore body of any size.

This property is situated in a narrow V-shaped canyon down **Big Showing**, which flows Goldsmith creek, a tributary of the Incomapleux river, on the north-west slope of Goat mountain. The floor of this canyon is very steep, and in the winter-time is swept by snow-slides. The east side of the canyon is a sheer rock wall 1,000 feet high, having an average slope of 60 degrees. The west side rises in three benches, upon the tops of which there is a slight growth of brush and stunted trees.

The formation is a green chloritic schist and a dark crystalline limestone. The ore-body occurs in a heavily mineralized limestone-belt lying between bands of the chloritic schist. The west schist-belt is over 100 feet wide and is in turn bounded on the west by a dark-coloured schistose lime. The easterly chloritic schist is only about 20 feet wide, in places much narrower, and lies next to a great width of crystalline limestone ranging in colour from a cream to a dark blue, which forms the precipitous east wall of the canyon. The mineralized lime-belt, or *Big Showing* lead, as it is locally called, forms the lower bench on the west side of the creek above referred to. At various places along the outcrop shots have been put in and a little stripping done, showing it to have a width of from 30 to 40 feet, to be of a schistose structure, dark in colour, containing patches of chloritic schist, and irregularly mineralized with iron pyrites, galena, and zinc-blende. It has a course of N. 35° to 40° E., with a dip of 50 degrees easterly, and is cut by a series of joint planes having a strike of N. 60° E., with a steep westerly dip. The mineralization is not uniform throughout the rock, but is heavier along the joint planes. This lime-band has been subjected to a great deal of pressure and crushing. Along the joint planes and along the schist walls the rock is slickensided in many places.

At an elevation of 5,525 feet, where the outcrop has been stripped, the mineralization is very pronounced, and a good deal of galena can be seen disseminated through the rock. At an elevation of 5,025 feet an adit has been started on the *Big Showing* lead and has been driven for a distance of some 230 feet. The course of this adit is S. 10° E. and crosses the strike of the vein at an angle of 20 degrees, so that the greater part of the adit is in the foot-wall.

Two-thirds of the way in, a crosscut was made to the east in an endeavour to get back into the ore-body. In driving this crosscut a slip was encountered with a little ore on it, and, mistaking this for the "vein," crosscutting was discontinued and a drift started towards the south-east. From a rough survey it is evident that this crosscut was not continued far enough to reach the "vein," but still has to be driven 10 or 15 feet farther.

The workings are reached by a trail branching off from the *Scout* trail, and are in an exceedingly bad place for the workings of a mine, as the canyon is free from snow for only about three months of the year, and during the winter months is

subject to snowslides at all times. No samples were taken for assay by the writer, as the small amount of work that has been done does not show anything definite in the shape of an ore-body.

McDOUGAL CREEK.

This creek enters the Incomappleux river about eighteen miles north of the head of the North-east arm of Upper Arrow lake, having its source in the glaciers at the summit of the Incomappleux-Illcillewaet divide, almost directly opposite the head of Albert creek. This is one of the steep-walled U-shaped valleys having a low gradient, excepting at its upper end, similar to that of the main Incomappleux valley.

McDougal creek roughly follows at its lower end the line of contact between the Linc Dyke series formation and granite, the latter crossing the Incomappleux river near the mouth of McDougal creek, across the spur of the mountain to Kelle creek, and then along the top of the divide between Kelle and Boyd creeks. (Plate 10.)

Some two years ago a prospector discovered tin (cassiterite) in pegmatite float, and, not knowing what the mineral was, brought it out and showed it to an assayer. On being informed that it was tin ore, the prospector interested some Cranbrook gentlemen in the find, with the result that a party was sent up there and located six claims on what they called Crystal creek, a tributary of McDougal, which creek is pretty well up towards the head of the valley. For the past two seasons a considerable amount of prospecting has been done in this section looking for a commercial ore-body of the tin-bearing rock, but so far without success, which is partly due to the fact that those engaged in the search are not familiar with the mode of occurrence of tin ores.

While several discoveries of tin-bearing rock have been made on the North American continent, there is as yet no mine making a regular production, nor are there many localities in which tin has been discovered at all. The majority of the commercial tin-deposits of the world occur in, or associated with, granite containing lepidolite or lithia mica, a light-grey or pinkish coloured mica with a pearly lustre. The mineral tourmaline, which usually occurs in black glossy columnar crystals, also occurs in the tin-bearing granites. Pegmatite dykes, which are often found cutting the granite, and as dykes in the adjacent formation, and greisen, are also favourable formations in which to look for tin ores. Pegmatite is essentially a coarse-grained rock composed of potash feldspar and quartz, with only a little mica, and that is usually very light in colour, and the scales are often crowded together in groups. Greisen is an alteration product of granite and is composed mainly of quartz and mica, the latter usually having a red or green tint. This is not a very plentiful rock, but is the formation in which tin has been found in the Black Hills of South Dakota.

From the foregoing it will be seen that the place to search for workable bodies of tin ore is in the granite near its contact with the other rocks, because it is usually at these places that the pegmatite dykes occur.

About five or six miles up from the mouth of McDougal creek, on the north side, is a creek having its source in a snow-field close to the summit on the east side of the Illcillewaet-Incomappleux divide. This creek crosses the granites, and in the rocky debris brought down by it there has been found some pegmatite float containing cassiterite. Up near the head of the creek, at an elevation of close to 8,000 feet, there are some pegmatite dykes crossing the creek having an east-west strike with almost vertical dip. In width they vary from 4 to 10 feet, and the lower one, having a width of about 4.5 feet, shows a few scattered crystals of cassiterite and a little light-coloured pearly mica.

No serious work has been done on these dykes, all the energies of the prospectors being devoted to the finding of dykes containing tinstone in larger quantities. It was exceedingly difficult to obtain any information as to where they were prospecting, but apparently they have been working along the divide at the head of Albert creek, a tributary of the Illcillewaet, and Isaac creek (marked Akolkolex river on

the writer, definite in the maps, in addition to the headwaters of McDougal creek, but with poor success, as, beyond the discovery of some float and the previously mentioned dyke, no deposit of importance has yet been found.

This part of the country is an exceedingly difficult one to prospect in, the valleys and side-hills being covered with a dense growth of brush, devil's-club, and timber, with no trails, so that the question of getting from one place to another, where everything has to be carried on one's back, is a serious one; also, the formation is only exposed in the canyons and high up on the mountain-side, where for the major portion of the year it is buried under snow. Under these circumstances prospecting becomes a difficult matter, and it is to be regretted that the prospectors engaged on this hunt for tin are so exceedingly mysterious, as the knowledge of geology would be of the very greatest assistance in ascertaining the most likely places in which to look for tin.

Owing to the small amount of cassiterite visible in the dyke above referred to, and to the fact that no work was being done upon it, no samples were taken for assay, as the writer had expected to make another trip up McDougal creek in company with one of the owners of the property to where it was believed a larger amount of tin-bearing rock had been discovered. Unfortunately, the prospectors in the field did not give sufficiently encouraging reports of what they had accomplished during the months of June, July, and August to warrant the owner in making the somewhat arduous journey; therefore the second trip was never made, there being no one to act as guide to take the writer to the place where the work was done.

Beyond the fact that there is a belt of coarse-grained porphyritic granite extending in a general north-westerly direction across the Incomappleux river in the vicinity of Kelle and McDougal creeks, that associated with this granite and emanating from it are dykes of pegmatite and small areas of greisen, and that cassiterite has been found associated with the pegmatite, no further information is obtainable, but it is believed that the most promising localities in which to prospect are along the lines of contact between the coarse-grained granite, its dykes, and the adjacent rocks, also in the greisen.

ACKNOWLEDGMENTS.

In the making of the examination of the Lardeau District the writer is particularly indebted to the following gentlemen for assistance and information: Mr. A. H. Gracey, Mr. Cory Menhinick, Mr. T. V. Downing, Mr. E. B. Drew, Mr. O. T. Bilb, Mr. Geo. Goldsmith, Mr. Rowlands, and Mr. N. A. Wallinger.

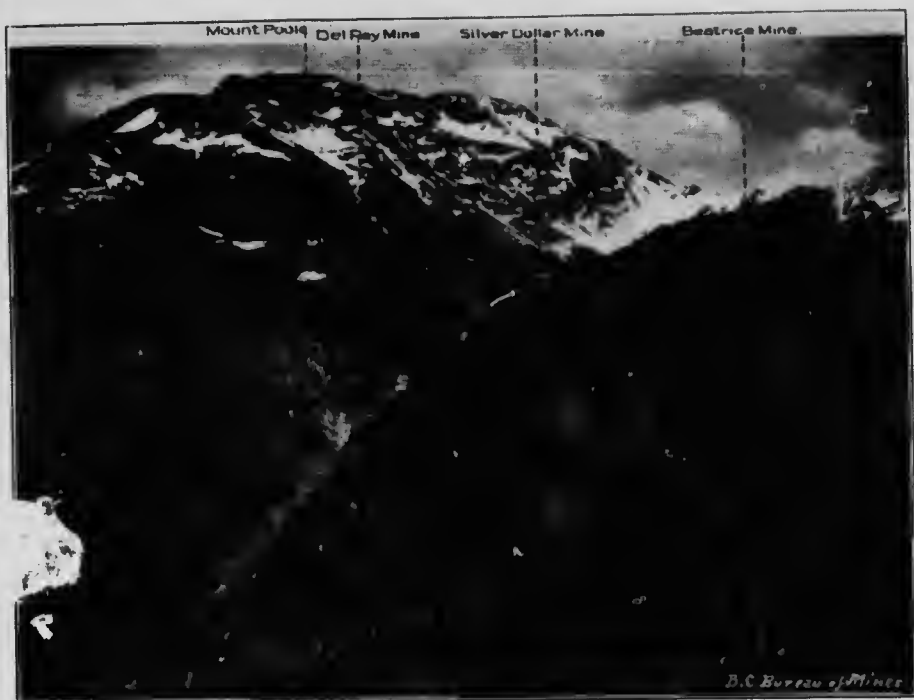


Plate 10. Lardeau—Del Rey and Silver Dollar Mines.

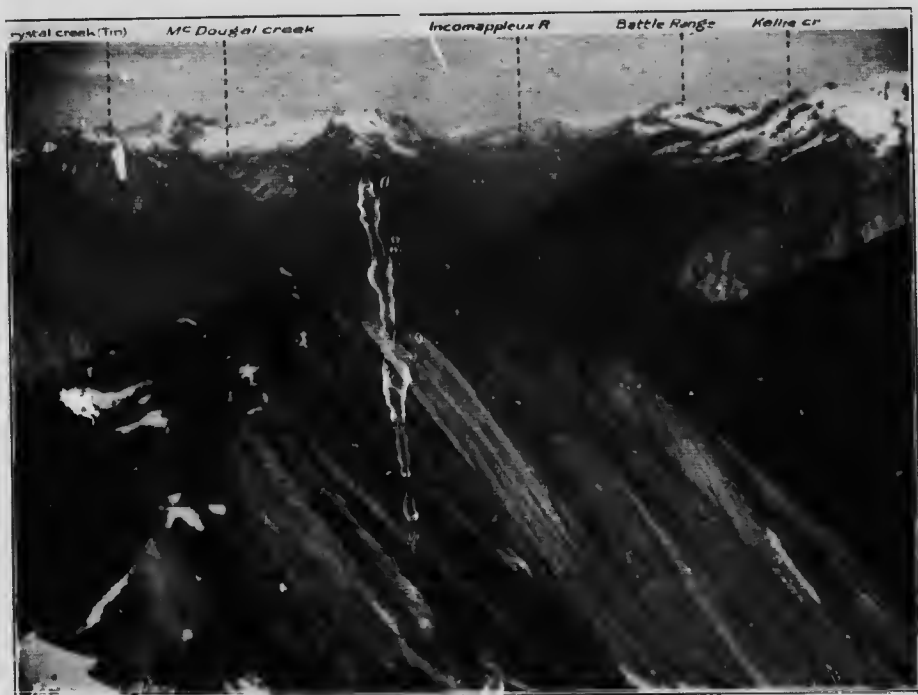


Plate 12. Lardeau—McDougal Creek from Goat Mountain.

MINERAL RESOURCES OF THE TROUT LAKE MINING DIVISION.

REPORT BY NEWTON W. EMMENS, M.E.

THE northern boundary of the Division has a north-easterly course, following the summits of the ridges dividing the watersheds of the North-east arm of Upper Arrow lake and Incomappleux river from those of Trout and Lardeau creeks; on the south it follows the summits of the transverse ridges dividing the waters of Poplar and Cascade creeks, crosses the Lardeau river, then follows the ridge immediately south of Lake creek; the eastern boundary follows the summits of the ridges dividing the watersheds of Lake creek, Trout lake, and the upper part of the Lardeau river from those of the Duncan river; while on the west it follows the summits of the divide between the Trout Lake and Upper Arrow Lake watersheds.

While this Division is one of the smallest in West Kootenay, it includes some excellent mineral "showings," and gives promise of becoming an important producer of metallic ores when thoroughly developed and provided with suitable milling plants and adequate transportation facilities.

ACCESSIBILITY.

The Division is divided near its centre by a wide, deep valley occupied by Trout lake and the Lardeau river, having a general north-west and south-east direction. The Lardeau branch of the Canadian Pacific Railway follows the river to the town of Gerrard, at the lower end of the lake; from here a steamer connects with the town of Trout Lake, where is located the Mining Recorder's office for the district. The Canadian Pacific Railway operates a tri-weekly service from the city of Nelson to Trout Lake, the route being from Nelson to Lardeau, at the upper end of Kootenay lake, by steamer; thence by rail to Gerrard and steamer to Trout Lake. The district can also be reached by way of Revelstoke, by train to Arrowhead; thence nine miles by boat to Beaton, and then by stage over a good and exceedingly picturesque road, twelve miles to Trout Lake.

From the town of Trout Lake there is a splendid road to Ferguson, a distance of four miles north-easterly, and from that town to Ten-mile on Lardeau creek (South fork), at the mouth of Galner creek, is a wagon-road, over which it is possible to drive at the present time; but next year the improvements which were being made this summer will have been completed, and it will be possible to run an automobile over it. From the town of Trout Lake an excellent trunk trail has been constructed following the north-east shore of the lake to Six-mile creek; thence by a series of long switchbacks on an easy grade past the *Winstow* mine on to the summit of the Silver Cup ridge, which it crosses at the head of the North fork of Brown creek, following this stream to Lardeau creek (South fork), and then along its north side to the wagon-road at Ten-mile. This trail was only completed this summer, and is in every respect an excellent piece of work and a credit to the British Columbia Government, by whom it was built, and to the man who located it, as the grade is uniform throughout and there are no steep pitches. From this trunk trail a number of branch trails have been constructed leading to individual mines and prospects. From Ten-mile there is a trunk trail up Galner creek, with branches to the several prospects tributary to that stream.

From the town of Ferguson there is a good trail up Ferguson creek (North fork of Lardeau creek) to its source on the divide between it and the headwaters of Poole and Boyd creeks, streams flowing into the Lardeau Division. From this main trail are branch trails leading to the several properties located upon Surprise creek and on the divide between Ferguson and Silver Tip creeks; there is also a first-class trail branching off the North Park trail, a little less than a mile from the town of Ferguson, leading on to the Great Northern mountain, where are located the *Broadview*, *Great Northern*, and *True Fissure* mines.

From the wagon-road at Eight-mile a trail follows Cup creek to the *Silver Cup* mine, and from the same road near Five-mile is a wagon-road to the *Nettie L.* mine situated on *Nettie L.* mountain. From the town of Trout Lake excellent trails lead to the several properties located on Trout mountain.

At the southern end of the district there are numerous trails from the valleys of the Lardeau river up its main tributaries, notably those of Canyon, Tenderfoot Rapid, Poplar, Haley, and Lake creeks.

The majority of these trails are in a sufficiently good state of repair to ride a horse over, although, as some of them have not been used for several years, it is always advisable to carry an axe, so that trees which have fallen across the trail may be cut out in order to let the horse by.

TOPOGRAPHY.

In this respect the country is similar to that of the Lardeau Division, which is described in the report covering that section. The mountains are perhaps, as a whole, higher in altitude and a little more rugged and alpine in character than those in the Lardeau. The main valleys are of the steep-walled U-shape. The tributary valleys are narrow, steep, and V-shaped, the majority debouching through narrow canyons.

The most important valley is that occupied by Trout lake and the Lardeau river, which has a general south-easterly course, following closely the strike of the rocks. Trout lake is eighteen miles long and from half to one and a half miles wide. It is a narrow, flood-like body of water whose bed, as shown by soundings, is flat transversely, and basin-shaped longitudinally. At the upper end of the lake there is a gravelly beach which continues for some distance along the west shore. The shores along the other parts of the lake are steep and precipitous, except at the mouths of the entering streams, where fans project out into the lake. Soundings show a maximum depth of 736 feet off Five-mile creek, and a depth of 300 feet half a mile below the upper end of the lake. Towards its outlet the lake narrows up and gets much shallower, being only 96 feet deep just above the channel through which it flows as the Lardeau river.

The ridge bordering the lake on the north-east has an average height of 7,000 feet, with individual peaks exceeding 8,000 feet in elevation. It is known as the Silver Cup mountains, and its highest peak lies between the headwaters of Otter and Haskins creeks, attaining an altitude of 9,300 feet, and is known as Fay's peak. The ridge on the south-west side of the lake is known as the Lardeau mountains. The peaks of which, being composed of granite, are very rugged and present an uneven skyline. The altitude of these peaks ranges from 8,000 to 8,770 feet and the highest point of what is known as Trout mountain, near the town of Trout Lake.

At the northern end of the district, near the headwaters of Ferguson and Gainer creeks, is a belt of limestone, forming a range of wedge-shaped precipitous mountains reaching altitudes of 8,000 to 10,000 feet, which, from their castellated and fantastic weathering, form the most conspicuous feature in the topography. The higher peaks of this range, notably Badshot, Mohlem, Templeman, and Wagon, form conspicuous landmarks which can be seen from the summits of the mountains in almost any part of the district.

The description of the topography and the effects of the erosive action of atmospheric agencies, and the Cordilleran ice-sheet thereon, as described in the report on the Lardeau Division, applies equally to the Trout Lake Division.

GEOLOGY.

The rocks included within the Trout Lake Mining Division are the south-eastward extension of those in the Lardeau, which have been fully described in the report on that section. They consist of a fine-grained, light-coloured granite at the south-western end; that of a coarse-grained porphyritic granite on the north-east, a little way beyond the district's boundary. South-west of this latter granite lies the "Lime Dyke" series of rocks, composed of crystalline limestones interbanded with slates and phyllites.

South-west of these the formation consists of chlorite-schists, conglomerate, slates, and calcareous schists. South-west of these, again, occur the carbonaceous phyllites, slates, and quartzites cut by the yellow-weathering diabase-schist, and diorite, with occasional developments of serpentine, and between these and the south-west granite-belt occur slates and siliceous lime-bands.

The whole rock complex has been subjected to intense folding, and the formation everywhere has been highly altered by metamorphic action, resulting in the development of a number of secondary minerals, such as chlorite, arragonite, asbestos, etc.

Evidence is abundant throughout the district of the presence of the Cordilleran ice-sheet, and it would appear that even the summits of the higher peaks were buried beneath this enormous glacier. The majority of the higher ridges and summits show striations caused by ice movement, and glacial erratics are common everywhere on the mountain-sides, and even on the top of the mountains.

MINERAL ZONES.

There are three recognized mineral belts within the Trout Lake Mining Division, of which the Central is the more important, and extends from the Lardeau Division on the north-west in a south-easterly direction, crossing the Lardeau river between the towns of Gerrard and Poplar Creek, and continuing thence into the Alnsworth Division. It is within this belt that the greatest development of minerals has taken place.

The Lime Dyke Belt parallels the Central as far south-easterly as Lake creek, beyond which it loses its individuality. South-west of the Central Belt, on the south-west side of the Trout Lake-Lardeau valley, lies the South-west Mineral Belt, which consists of a series of bands of siliceous lime, slates, and a little serpentine lying against the granite forming the divide between the Trout Lake-Lardeau and Arrow Lake watersheds.

In describing the several mines and prospects situated in the Trout Lake Mining Division, they will be classified under four headings:—

(1.) Those situated within the Central Mineral Belt, extending from the summit of the Goat-Mohawk divide, on the north-west, to the head of American creek at the lower end of Trout lake, on the south-east.

(2.) Those situated within the Lime Dyke Mineral Belt, from the head of the North fork of Lardeau creek, or Ferguson creek, as it is named on the new maps of the Surveyor-General's Department, on the north-west, to Wagner mountain and the headwaters of Hall creek, on the south-east.

(3.) The prospects situated within the South-west Mineral Belt in the vicinity of the town of Trout Lake and the group of properties situated within the drainage area of Canyon creek.

(4.) The prospects situated in the neighbourhood of Poplar; that is to say, those situated on Johnson mountain, Poplar, Rapid, and Tenderfoot creeks.

By this arrangement it will be easier to trace out the sequence of the properties on the accompanying maps. All bearings mentioned in this report are astronomic, and all elevations in feet above sea-level. On the accompanying maps, where assays are given, the chemical symbols for the metals are used, in which Au, signifies gold; Ag, silver; Pb, lead; Cu, copper; and Zn, zinc. All assays quoted are in percentages of the several metals in the ore or in ounces troy of the metals contained in a ton (of 2,000 lb.) of the ore.

CENTRAL MINERAL BELT.

The dividing line between the Lardeau and Trout Lake Mining Divisions follows the divide separating the watersheds of Mohawk and Goat creeks, a short distance south-east of the *Beatrice* mine. With the exception of a large quartz-outcrop which stands out prominently as a bluff some 60 feet high on the north-west slope of a spur from Great Northern mountain, and upon which very little work has been done, no veins occur until the properties of the True Fissure Mining and Milling Company, Limited (N.P.L.), are reached.

These are situated on the eastern slope of Great Northern mountain, on the west side of Ferguson creek, at an altitude of 5,500 to 6,720 feet. On this property there are two series of veins, one of which has a strike of N. 50° W., and the other having a course of N. 32° W., both having a north-easterly dip of 40 to 60 degrees. The country-rock is a highly carbonaceous (graphitic) phyllite, which has a strike of N. 45° W. and a north-easterly dip of 50 degrees.

On the *St. Elmo* claim a vein belonging to the first series has been opened by an adit (Fig. 1) on its course for a distance of 175 feet. In this adit the vein varies in width from a few inches to 6 feet, and consists of galena, grey-copper, iron pyrites, and zinc-blende, with phyllite inclusions, in a quartz gangue. The average zinc content of this ore is so high that, under existing smelter regulations, only a comparatively small proportion of the ore mined can be shipped, owing to there being a penalty of 50 cts. a ton for each unit of zinc contained in the ore over 8 per cent.

Fifty feet from the portal of the adit a raise 40 feet long was made on the vein to surface. For the first 6 feet this raise passed through ore consisting of zinc-blende, iron pyrites, and galena, assaying: Silver, 44.05 oz.; lead, 4.8 per cent.; zinc, 27.1 per cent. Lying immediately upon this was a body of galena ore carrying grey-copper and a little zinc-blende, extending up to the grass-roots, from which 200 tons was stoped and shipped to the smelter, yielding an average of: Gold, 0.09 oz.; silver, 79.34 oz.; lead, 26.6 per cent.; zinc, 9.07 per cent. In places in this stoppe were masses of practically clean grey-copper, samples of which assayed: Silver, 515.0 oz.; copper, 10.37 per cent.; but, as there was only a comparatively small amount of this material, it was mixed in with the galena ore and shipped with it. In mining this 200 tons a large amount of ore was extracted whose zinc content was too high to permit of its being shipped. This material was stored in the stopes and on the dump; average samples assayed show it to contain: Silver, 44.05 to 72 oz.; lead, 4.8 to 20.7 per cent.; zinc, 27.1 to 32.62 per cent.

A winze was sunk 20 feet below this level, in which the vein was divided into two sections by a streak of phyllite; the hanging-wall portion being of a very fine-grained galena of a dull black colour, the colour being due to the presence of a quantity of finely disseminated carbonaceous phyllite. This ore assayed: Gold, 0.06 oz.; silver, 42.64 oz.; lead, 37.7 per cent.; zinc, 10.28 per cent.

The foot-wall portion is a finely crystalline, cubical galena, assaying: Silver, 46.82 oz.; lead, 47.15 per cent.; zinc, 8.30 per cent. Owing to the heavy flow of water it was impractical to sink any deeper without a pumping plant, so work was discontinued with the intention of driving a new level from a point lower down the hill to come under this ore-shoot.

Down the mountain-side from the *St. Elmo* a vein, known as the *True Fissure* lode, belonging to the second series, outcrops prominently. This has been traced for a distance of 2,500 feet along its strike. Near the southern end of the property this vein, which dips with the slope of the hill, is exposed over an area of 500 by 1,000 feet on its dip and strike (Plate 1), the softer over-lying phyllites having been eroded away. Much of the ore here exposed consists of a fine-grained galena, samples of which assayed: Gold, 0.06 oz.; silver, 11.44 oz.; lead, 6.4 per cent.

A considerable amount of prospecting has been done along this exposure on the *True Fissure* claim, and three crosscuts have been driven into it at different levels from the hillside, with a vertical difference of elevation between the highest and

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Plate 1. Roubidou, Co. 1908. U. S. Geol. Surv. Min.

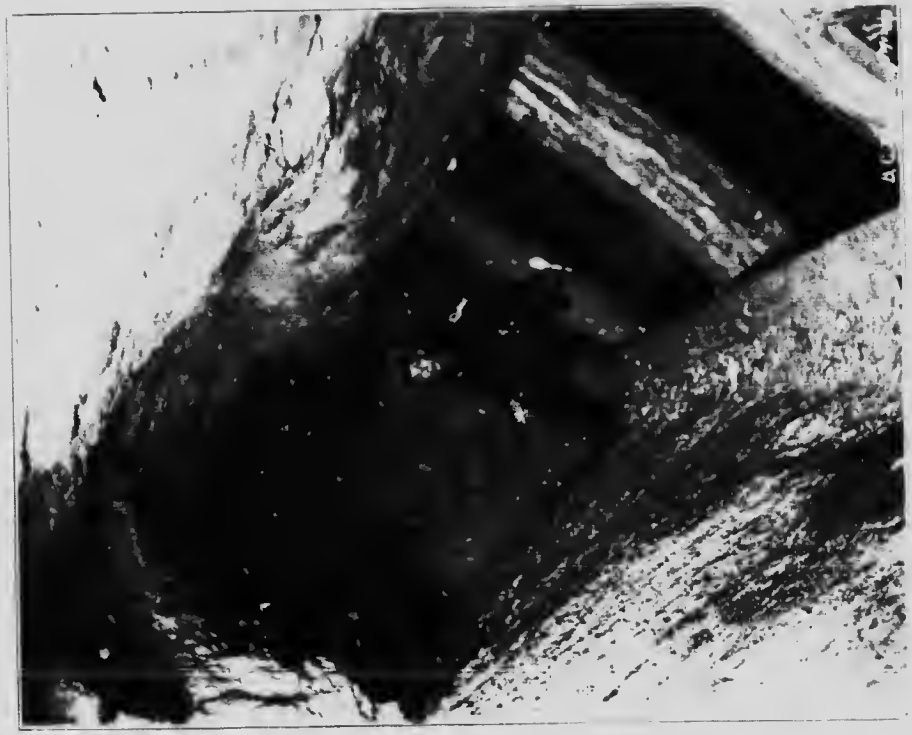


Plate 2. Stop in Adit, Blue Bell Mine

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lowest of 200 feet, and a maximum horizontal distance along the strike of the vein of 500 feet. The upper of these crosscuts is the only one which has been driven completely through the vein. Here it is shown to have a width of 20 feet, and to assay: Gold, 0.09 to 0.3 oz.; silver, 3.0 to 9.0 oz.; lead, 5 per cent.; zinc, 10.0 per cent.

A short distance north-west of this exposure a small creek cut through the vein, exposing an outcrop of coarsely crystalline galena. An open-cut was made here and 10 tons of ore mined, consisting of galena and iron pyrites containing grey-copper; the galena portion assaying: Silver, 68.8 oz.; lead, 68.5 per cent.; while the iron pyrites carrying grey-copper assayed: Gold, 0.1 oz.; silver, 12.0 oz.; copper, 0.07 per cent.

North-west of this cut, and at a lower elevation, a crosscut known as the *Blue Bell* adit (Fig. 1) was driven from the hillside to the vein, which it cut in a distance of 160 feet. At this place there is 19 feet of quartz, 3 feet of which assays: Gold, 0.25 oz.; silver, 7.05 oz.; the balance of the material being of a lower grade. From this crosscut drifts have been made both to the north and south along the strike of the vein for a distance of 95 and 70 feet respectively, both of which were carried along the hanging-wall. Between the vein and the hanging-wall was a streak of galena ore assaying: Gold, 0.05 oz.; silver, 32.25 oz.; lead, 38.7 per cent.; zinc, 7.1 per cent. A raise was put up on this ore in the south drift and considerable of it was stoped and shipped to the smelter, assaying: Silver, 38.0 oz.; lead, 35 per cent. In the north drift this streak was followed by an overhead stope until the material became too high in zinc contents to be shipped at a profit, and by an underhand stope (Plate 2) until the water prevented deeper sinking. From these stopes 40 tons of ore—assaying: Gold, 0.15 oz.; silver, 18.0 oz.; lead, 30.0 per cent.; zinc, 8.7 per cent.—was shipped to the smelter. Selected samples of the galena from the underhand stope assayed: Silver, 76.25 oz.; lead, 75.5 per cent.; while a selected sample of grey-copper and iron pyrites from the same place assayed: Gold, 1.0 oz.; silver, 69.2 oz.; copper, 3.78 per cent.

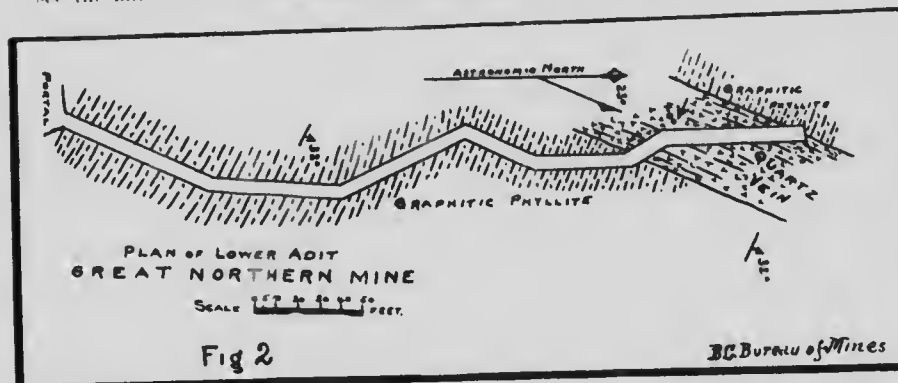
The ore in the top of the north raise assayed: Gold, 0.04 oz.; silver, 30.36 oz.; lead, 7 per cent.; zinc, 28.65 per cent.; copper, 2.45 per cent. Forty feet north of this shoot a second ore-shoot was cut, from which a shipment of 35 tons was made, which assayed: Gold, 0.15 oz.; silver, 45.2 oz.; lead, 22.4 per cent.; zinc, 9.1 per cent. Outside of the ore-shoots the vein assays: Gold, 0.25 oz.; silver, 20.4 oz.; lead, 5 per cent.; zinc, 3 per cent. The ore in the floor of the level, both north and south of the crosscut, is more mineralized than in the roof.

The ore shipments spoken of above were made during the winter months on the snow, the ore being sacked at the mine and rawhided to the wagon-road at Ferguson, from which place it was transported on sleighs to the Canadian Pacific Railway terminals at Trout Lake. Plate 2 shows the rawhides leaving the camp at the mine.

This property adjoins the *True Fissure* on the south-east. The principal work has been confined to the *Great Northern* vein, which has a strike of N. 25° E., with a south-easterly dip at an angle of 40 degrees. Locally this has been considered to be a continuation of the *True Fissure* lode, which outcrops on the adjoining claim, but it will be noted that they differ both in strike and dip. However, the narrow ridge upon which the *Great Northern* property is situated is badly broken and shows evidence of much local disturbance. There is a fault-line passing a short distance south-east of the *Great Northern* workings, along the valley of Broadview creek, and there has undoubtedly been a considerable amount of displacement of the rocks in this section, so that, without additional work, the continuation of the various veins through the *Great Northern* property from those adjoining cannot be positively traced, but it will probably be found that the continuation of the *Great Northern* vein on the *True Fissure* claim lies some distance above the *True Fissure* lode.

The *Great Northern* vein lies in graphitic phyllite having a north-westerly strike and a dip of 32 degrees to the north-east. The whole rock-mass as exposed by the

underground workings is badly broken and twisted, requiring close timbering in places. In 1897 this vein was opened by a short adit, and some 300 tons of ore containing galena, iron pyrites, zinc-blende, and a little grey-copper was mined; out of this, 37 tons was shipped to the smelter, yielding \$47 a ton. The balance of the ore was piled on the dump as being of too low a grade to ship. The property was allowed to remain idle for some years and the workings caved in. In 1906 this adit was reopened, and it was found that the vein from which the above-mentioned ore was extracted had a width of 3 feet, and an average sample of which assayed: Gold, 0.1 oz.; silver, 26.25 oz.; and a trace of copper; while a selected sample assayed: Gold, 0.1 oz.; silver, 30.5 oz.; lead, 4 per cent. A selected sample from this vein containing grey-copper assayed: Gold, 0.08 oz.; silver, 150.32 oz.; copper, 4.66 per cent. The ore as a whole was considered to be of too low a grade to mine under the existing conditions, so work was discontinued, and the property lay idle until September, 1913, when, under the management of H. McPherson, the lower adit, some 50 feet below the one above mentioned, was cleaned out, retimbered, and continued into the vein. This adit (Fig. 2) is 365 feet long and cuts the vein at 280 feet in, crossing it diagonally at a low angle for a distance of 85 feet. The vein consists of quartz, mineralized with iron pyrites, galena, zinc-blende, and grey-copper, and contains a great deal of phyllite. Owing to the graphitic nature of the wall-rocks and the flow of water the side of the workings are everywhere blackened, so that it is difficult to distinguish the vein from the country-rock, or to see the mineral in it, unless freshly broken, and, as there has been no crosscutting,



It is somewhat difficult to determine accurately the exact width of the ore-body. The hanging-wall is well defined, but the foot-wall has no distinct line of demarcation so far as could be seen; the foot-wall phyllites contain many quartz stringers and bunches.

The ore in the vein is not evenly disseminated through the mass, but occurs as stringers, veinlets, and lenticular masses. A sample taken across the north-east side of the drift of the more heavily mineralized portion of the vein assayed: Gold, 0.08 oz.; silver, 14.8 oz.; and lead, 5.7 per cent. In doing this work a considerable amount of ore has been extracted and is now piled on the dump at the mouth of the adit. Some of this material contains a great deal of grey-copper and galena, a selected sample of which assayed: Gold, 0.13 oz.; silver, 139.2 oz.; lead, 57.9 per cent. The elevation of this adit is 5,950 feet, and that of the summit of the divide between this property and the *Le Fissure* 6,100 feet. This vein is certainly worthy of additional development work, as it evidently contains some high-grade ore, and the formation is distinctly favourable for the existence of an ore-shoot.

The next property to the south-east is that known as the **Broadview**. *Broadview* (Plate 4), which was originally owned by the Horne-Payne Syndicate, by whom much work was done, but to poor advantage. In 1905 a syndicate composed of local people secured a lease on the

property and shipped 215 tons, for which they received \$30.75 a ton, the ore assaying from: Gold, 0.06 to 0.12 oz.; silver, 32.3 to 40 oz.; lead, 30.0 to 37.8 per cent. In the fall of 1906 this property was acquired by the Ohio Mines Development Company, Limited (N.P.L.), and a large amount of development-work done.

The *Broadriver* vein has a strike of N. 25° W., with a dip of 60 degrees north-easterly. The hanging-wall is well defined, often showing slickensides, with more or less of a gouge between it and the country-rock. The foot-wall is not so well defined, as the enclosing phyllites on that side contain a good deal of quartz. The outcrop of the *Broadriver* vein is quite prominent, and can be easily followed from the level of the No. 3 adit to the shaft near the top of the hill, a distance of 1,000 feet, with a vertical difference in elevation of 300 feet. At the top of the hill, at an elevation of 6,350 feet, there was a galena-outcrop upon which a shaft was sunk. It was from here that the ore shipped to the smelter was obtained. The shaft (Fig. 3) itself is 120 feet deep on the dip of the vein, and is in quartz practically all the way, as it passed through the galena-ore-shoot a few feet below the surface. A sample of the quartz taken across the shaft about 60 feet below the collar assayed: Gold, 0.2 oz.; silver, 1.49 oz. From the 60-foot level in the shaft a drift was driven north-westerly to find the downward continuation of the galena ore showing at surface; this was found in a distance of about 100 feet. Here the galena-shoot proved to have a width of 5 feet and a length of 18 feet.

Between this level and surface the ore was stoped and the richer portion sorted and shipped. In the winter of 1906-1907 further shipments amounting to 73 tons were made of ore from the level taken out below the 60-foot level. This had an average content of: Gold, 0.06 oz.; silver, 40 oz.; lead, 38 per cent. Associated with this lead ore is an appreciable amount of copper in the form of chalcopyrite. In order to ascertain the value of this material when sorted as cleanly as possible, two trial shipments were made. The first, weighing 1,524 lbs., yielded: Gold, 0.26 oz.; silver, 220.9 oz.; copper, 4.48 per cent.; lead, 14.9 per cent.; zinc, 9.3 per cent. The second, consisting of 23 tons, yielded: Gold, 0.06 oz.; silver, 24.6 oz.; copper, 3.42 per cent.; zinc, 16.9 per cent. From this it is evident that the smaller shipment contained some grey-copper which would account for its high silver content. Owing to the high percentage of zinc and the fact that when an ore containing lead is shipped as a copper ore the lead is not paid for, and if the ore is shipped as a lead ore the copper contained therein is not paid for, it was deemed advisable to discontinue shipments until the mine was further developed and equipped with a separating plant.

In extracting the ore from which the shipments were made and in the sinking of the shaft (Plate 5), there has been accumulated on the dump some 1,200 tons of low-grade ore, a sample of the more heavily mineralized portion of which assayed: Gold, 0.12 oz.; silver, 7.0 oz.; lead, 4.7 per cent.

In order to develop the vein along its strike and at the same time open this ore-shoot at depth, the No. 3 adit was driven, at an elevation of 6,050 feet. This was originally started by the Horne-Payne Syndicate, who drove it a total distance of 180 feet, but, for some unknown reason, swung off into the foot-wall phyllites after the first 50 feet (Fig. 3), and the farther they continued driving, the farther they were getting away from the vein. When the present owners acquired the property the No. 3 level was turned sharply to the south-east and continued to the vein, which it cut in a distance of 95 feet. At this point a crosscut was made through the vein, which proved to have a width of 16 feet, to be of a banded structure, mineralized with iron pyrites, galena, zinc-bleende, and chalcopyrite, in a gangue of quartz and feldspar with phyllite inclusions, and an occasional sprinkling of grey-copper. Between these bands occur narrow streaks of fine-grained galena and iron pyrites. A sample taken across 15 feet of this crosscut assayed: Gold, a trace; silver, 5.5 oz.; lead, 0.7 per cent.; copper, 0.5 per cent.; while samples from the heavy sulphide streaks assayed: Gold, 0.2 oz.; silver, 12 oz.; lead, 7.5 per cent.; copper, 2.4 per cent. From this crosscut the level was extended north-westerly for a distance of 550 feet along the course of the vein, and crosscuts made at

intervals of 50 to 75 feet. Near the No. 7 crosscut a narrow streak of grey-copper was found between the foot-wall of the vein and the country-rock, a selected sample of which assayed: Gold, 0.25 oz.; silver, 495 oz.; copper, 7 per cent. A raise was put up on this ore, but it was only found to extend a few feet above the level. The objective point for which this level was driven, namely, the cutting of the galena ore-shoot developed in the shaft, at depth, has not been reached, there being still a short distance to drive.

Near the portal of this level some ore was found in the vein containing chalcopyrite. The ore extracted has been stored on the dump at the mouth of the adit, a sample of which, containing chalcopyrite but no galena, assayed: Gold, 0.04 oz.; silver, 17 oz.; copper, 10.4 per cent.; while a sample containing galena in addition to chalcopyrite assayed: Gold, 0.04 oz.; silver, 45.6 oz.; copper, 10.2 per cent.; lead, 3 per cent. This ore came from a shoot which apexes within a few feet of the portal of the adit (called the "Oxide shoot"), and, inasmuch as for practically the first 325 feet this level is in the foot-wall of the vein, it was deemed advisable to go down the hill and drive a new level. This adit, known as the No. 4 level, commences at a point 145 feet vertically below, and 450 feet north of the portal of the No. 3. For the first 295 feet it crosscuts the hanging-wall phyllites diagonally to the vein, which it then follows in a south-easterly direction for a distance of 100 feet. The vein here is very badly broken and the formation much disturbed. A sample taken across 2 feet on the north-east side at the face of the adit assayed: Gold, 0.08 oz.; silver, 18.8 oz.; copper, 0.8 per cent. A sample taken across 5 feet near the roof at the face assayed: Gold, 0.13 oz.; silver, 1.6 oz.; copper, 0.7 per cent. Fifty-two feet back from the face a crosscut has been made in an easterly direction for a distance of 21 feet. The whole of this crosscut is in quartz, sparingly mineralized; a sample taken across 15 feet assayed: Gold, a trace; silver, 0.2 oz.; copper, 0.1 per cent. Between the vein and the hanging-wall there is 5 feet of crushed quartz, a sample of which assayed: Gold, a trace; silver, 0.4 oz.

Eighty feet back from this crosscut a streak of galena ore was cut, two samples from which were taken; one assaying: Gold, 0.06 oz.; silver, 9.2 oz.; lead, 30 per cent.; and the other: Gold, 0.14 oz.; silver, 4.8 oz.; lead, 11 per cent. This level has not yet been driven far enough to intersect the downward extension of the copper ore-shoot from the No. 3 level previously mentioned.

In addition to this large vein, there is another, locally known as the "Copper vein," which has a strike of N. 65° W., and makes junction with the large vein a short distance north of the shaft. This vein has been developed by a series of cuts and an adit 200 feet long, known as the "A" level, at an elevation of 6,290 feet. In width it varies from a few inches to 2 feet, and has a slight northerly dip. From this vein a shipment of 20 tons of ore was made, which yielded: Gold, 0.12 oz.; silver, 6.2 oz.; copper, 5.7 per cent. A selected sample taken of the more heavily mineralized portion assayed: Gold, 0.04 oz.; silver, 19.04 oz.; copper, 24.25 per cent. A few feet back from the face of the adit a winze was sunk to a depth of 15 feet on the vein, which at this place is 2 feet wide, and an average sample of the ore assayed: Gold, 0.04 oz.; silver, 4.13 oz.; copper, 5.86 per cent.

In a surface cut (elevation 6,310 feet) a short distance north-west of its junction with the *Broadview* vein is a streak of solid sulphide ore 6 inches wide, a sample of which assayed: Gold, 0.04 oz.; silver, 20.6 oz.; copper, 9.67 per cent. From the No. 3 level a crosscut was started in a westerly direction to ascertain if, at depth, this small copper vein was any larger and contained ore. The crosscut has been driven a distance of 55 feet, but not far enough yet to intersect the downward extension of this copper streak. The entire ground passed through by this crosscut consists of carbonaceous phyllites, containing stringers of quartz more or less mineralized with iron and copper pyrites. There is a good deal of water seeping through the rock which has in many places coated the walls with patches of malachite, showing that there is decomposing copper sulphides between this point and the surface.

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Nettle L. and Broadview Mines



Plate 6 Silver Cup Mines



(Plate 4.) This mine is situated on Nettie L. mountain, on the opposite side of Ferguson creek (North fork of Lardeau creek) from the Great Northern mountain, on which the *Broadview* mine is situated. The elevation of the *Nettie L.* workings is 5,200 feet, and the mine is connected with the town of Ferguson by a wagon-road. The ore occurs in a graphitic phyllite along a zone of crushing which afforded an avenue for the circulation of the ore-forming solutions, and resulted in the cementing together of the rock fragments by mineralized quartz, and in the partial replacement of the phyllite breccia by similar material. Between the years 1900 and 1904 a large amount of work was done on the property, and over 2,200 tons of ore shipped to the smelter, which contained in the neighborhood of: Gold, 0.17 oz.; silver, 140 oz.; lead, 20 per cent. The property was then shut down and remained idle until 1912, when it was again worked for a short time. The mine is owned by the Ferguson Mines, Limited, who also operated the *Silver Cup*, a description of which is given further on.

In the *Nettie L.* there are two series of veins, one of which parallels the strike of the formation, and the other cuts across it at varying angles; some of these latter eventually turn almost parallel to the first series, into which they merge. There has been in the neighbourhood of 7,000 feet of work done on this property in the shape of adits, drifts, crosscuts, raises, and winzes, the majority of which, however, has been confined to two veins, known respectively as the "Main Lead" and the "Cross Lead." In the latter a shoot of high-grade galena ore was discovered from which large shipments were made. This shoot dips into the Main Lead, where the solid sulphide ore becomes somewhat scattered, although it is generally thought that, in depth, another shoot will be found. In the Main Lead the ore-bodies occur as lenticular masses, which, being somewhat scattered, give the vein a very spotted character. The vein between these lenses does not contain much mineral; therefore only a small proportion of the ore mined is sufficiently rich to allow of its being sent to the smelter without previous treatment. Consequently, in extracting the ore which was shipped, a large tonnage of lower-grade material was accumulated on the dumps and in the stopes, there to await the erection of a plant which would concentrate it to a grade sufficiently high to ship, or some plant which would extract the valuable metals on the spot.

The mineralization consists of iron pyrites, zinc-blende, galena, and grey-copper, the latter being rich in silver, and some of the zinc-blende rich in gold. These sulphides are usually intimately mixed, making it a difficult ore to treat by the ordinary wet methods, as, in the crushing, much of the grey-copper silmes and floats off with the tailings, carrying with it much of the silver. It is probable, however, that one of the flotation processes of ore-treatment which have been developed within the last few years would successfully treat this ore.

In 1912 this property was worked under a lease, and some 30 tons of ore shipped from the upper levels. The high-grade ore above the level of the lowest workings, so far as discovered, has now been all mined out, and it is a question of doing a considerable amount of development-work to find and open up new ore-bodies before shipments can be resumed and steadily maintained; to do this meant the expenditure of more capital than the lessees had at their command; work was therefore discontinued.

The property is equipped with camp buildings, an air-compressing plant, and an aerial wire tramway to Five-mile, on Lardeau creek (South fork), where is situated the *Silver Cup* mill.

Adjoining the *Nettie L.* to the south-east is the *Ajax*,† where a continuation of the *Nettie L.* ore-bodies has been opened up. This claim is one of the *Nettie L.* group and belongs to the same owners, but was not included in the lease previously mentioned.

Considerable development-work was done on this claim during the period when the *Nettie L.* was in active operation, but for six or seven years prior to 1912 it

* Brock, R. W. *Summ. Rep. Geo. Surv. Can.*, 1903, p. 65. Robertson, W. F. *Ann. Rep. Min. of Mines, B.C.*, 1903, pp. 120, 121.

† Brock, R. W. *Summ. Rep. Geo. Surv. Can.*, 1903, p. 65. Robertson, W. F. *Ann. Rep. Min. of Mines, B.C.*, 1903, pp. 120, 121.

lay idle. In that year, however, a few men were put to work repairing the old adits and drifts, and a body of silver-lead ore was found above the No. 1 level. This shoot proved to have a length of 140 feet and a width of from 5 to 12 feet. From it was shipped some 550 tons, assaying: Silver, 40 oz.; lead, 60 per cent. Some very rich ore was found in the *Ajax* drift in the early days; some of the quartz, containing a chocolate-coloured zinc-blende, iron pyrites, and a sprinkling of galena, assayed \$100 in gold to the ton, and occasional specimens as high as 20 oz. of that metal. Along the outcrop where the grey-copper has become weathered wire-silver was sometimes found.

In this and the other claims of the *Nettie L.* group the high-grade ore-shoots—that is to say, ore sufficiently rich to admit of its being shipped direct to the smelter—occur more or less as lenticular masses within a mineralized fracture-zone, but are of no great extent in any one direction. This necessitates the employment of a number of men in development-work, looking for new bodies of shipping-ore while the extraction of those already opened up goes on; this adds materially to the mining costs and has proved a serious detriment to the successful operation of the property. Associated with these higher-grade masses, and between them, is a large amount of second-grade ore—that is to say, ore which contains from: Gold, 0.15 to 0.4 oz.; silver, 30 to 50 oz.; lead, 3.5 to 4 per cent.; zinc, 4.5 to 20 per cent.; copper, 1 to 1.5 per cent.—which, if it could be concentrated, might be counted on to keep a 50-ton mill in steady operation, and to yield sufficient to pay all operating expenses and leave a margin of profit, in which case the higher-grade lenses would be clear gain. The difficulty in the way of treating this ore is the separation and saving of the grey-copper and the separation of the zinc from its associated minerals. This problem, however, is not insurmountable, and I believe a series of concentration tests with a combination of the flotation and electrostatic processes would successfully solve the problem.

On the south-east side of Lardau creek (South Fork), **Canadian.** opposite *Nettie L.* mountain, is the *Canadian* mine, upon which has been discovered an outcrop of galena. The formation is a carbonaceous phyllite, having a strike of N. 60° W., with a vertical dip, cut by a quartz vein having a strike of N. 10° E., with an easterly dip of 80 degrees.

A shaft (elevation 3,825 feet) was sunk on the galena to a depth of 55 feet, where a flow of water was encountered too great to be handled by hand. Thirty feet below the collar of the shaft a drift has been driven southward on the vein for a short distance. The vein is here 4 feet wide, and on its hanging-wall side there is a streak of decomposed material containing much iron oxide, with occasional bunches of solid galena. A sample taken across the vein in the shaft at this level assayed: Gold, a trace; silver, 1.6 oz.; no assay being made for lead. A selected sample of the galena from the drift assayed: Gold, 0.04 oz.; silver, 63.6 oz.; lead, 72.6 per cent. Associated with this galena is a considerable quantity of iron pyrites, a fairly clean sample of which assayed: Gold, 0.46 oz.; silver, 6.6 oz.

Between the vein and the hanging-wall is a gouge about 6 inches wide composed largely of crushed quartz, a sample of which assayed: Gold, a trace; silver, 1 oz. One hundred and twenty-five feet vertically below and a short distance north-east of the shaft an adit has been driven on the vein with the intention of getting below the bottom of the shaft, raising to it, and thus draining the water, so as to enable the downward extension of the galena-shoot to be opened. This adit has been driven on the vein for a distance of 100 feet. The rock is very badly broken, and near the face of the level there are some open seams, from which a heavy flow of water comes; there is also a great deal of water coming in from the roof. The face of the adit seems to be about through the wettest portion of the ground, and a few feet farther should carry it beyond the heavy flow into more solid ground, where the workings will be comparatively dry. The level has not been driven far enough yet to reach a point directly underneath the shaft, nor has there been any crosscutting done, looking for the downward extension of the galena-shoot, although in the vein itself occasional bunches of galena have been found.

At surface the formation is much broken, and the vein outcropping near the bottom of a draw probably accounts for the heavy flow of water, which, owing to the open nature of the ground, flows beneath the surface in this depression and along the vein.

About 300 feet south-east of the shaft is a belt of quartzite which can be traced through the country for a long distance, and is locally known as the *Cromicell* dyke.

(Plate 6.) This property is situated on the north slope of **Silver Cup.*** Silver Cup mountain, south of Jardean creek (South fork), at an elevation of 6,500 feet. The ore occurs in a belt of carbonaceous phyllite, approximately 1,000 feet wide, lying between a band of siliceous lime and one of quartzite, locally called the *Cup* and *Cromicell* dykes respectively.

There are two veins in this mineralized belt, roughly parallel with the formation, which here has a strike of N. 45° W. and a north-easterly dip at a steep angle. The ore occurs as lenticular masses, usually connected together by quartz stringers, lying parallel to the bedding-planes of the enclosing rocks. The two veins are known respectively as the *Cup* lode and the *Blind* lode, the latter having been found while driving a crosscut to intersect the *Cup* lode at a vertical depth of 135 feet, and does not outcrop at surface.

This mine is by far the most extensively developed in the district and has produced the largest quantity of ore. The first shipment was made in the year 1896, and from that time until the end of 1901 a total of 1,286 tons of ore had been shipped, having an average metallic content of: Gold, 0.2 oz.; silver, 150 oz.; lead, 35 per cent.

The total amount of development, consisting of adits, crosscuts, drifts, shafts, winzes, and raises, amounts to approximately 12,000 feet. The main adit is known as the *Sunshine* tunnel, which cuts the vein at a depth of 750 feet below its outcrop. From this level an underground shaft was sunk to a depth of 450 feet, and levels were driven at intervals. In this work a number of ore-lenses were discovered and mined. The ore was hoisted to the adit level, trammed to surface and sorted, the first-class ore being shipped to the smelter, and the balance stored on the dump for future treatment; the ore being first roughly sorted in the stopes and only the better-mineralized portion hoisted. There is, therefore, stored in the stopes and on the dumps a very large tonnage of ore which is of too low a grade to ship to the smelter without previous treatment, but which contains approximately: Gold, 0.3 oz.; silver, 25 to 35 oz.; lead, 4 to 5 per cent., together with some zinc.

In addition to the two main lodes, there is a series of subsidiary veins connecting the two. In some of these good-sized masses of ore were found. All known ore-shoots in the upper levels have been mined out and the working costs have materially increased with depth, owing to the fact that the ore has to be hoisted several hundred feet, and there is a good deal of water to be pumped. In order to overcome this and reduce the costs of mining, it would be necessary to go farther down the mountain-side, and drive a long crosscut to the vein, and, as the portal of this crosscut would be several hundred feet below the upper terminal of the existing tram, it would necessitate a rearrangement of the mine plant and involve the expenditure of a large amount of capital, which the management did not consider advisable without first doing additional prospecting, and this, under present conditions, is not possible. The mine is therefore closed, except for a few leasers who are taking out what little ore remains in the workings. The proportion of shipping-ore to the actual tonnage of rock broken is very small, and, as in the case of the *Nettie L.*, the real value of this property lies in its larger masses of comparatively low-grade ore.

This was realized by the Silver Cup Mines, Limited, predecessor to the present owners, which, under the advice of its engineers, erected a milline plant at Five-mile,† which was intended to treat the low-grade ore, not only from the *Silver Cup*

* Brock, R. W. *Summ. Rep. Geo. Surv. Can.*, 1903, pp. 66, 67. Robertson, W. F. *Ann. Rep. Min. of Mines, B.C.*, 1903, pp. 116-119. Jacobs, E. *Ann. Rep. Min. of Mines, H.C.*, 1909, pp. 116, 117.

† Robertson, W. F. *Ann. Rep. Min. of Mines, B.C.*, 1903, p. 120. Hadow, E. G. *Ann. Rep. Min. of Mines, B.C.*, 1904, p. 116.

mine, but also that from the *Nettie L.* The process installed here consisted in first crushing and wet-concentrating the ore, giving the concentrates a chloridizing roast, and then amalgamating in pans. Unfortunately the tailing losses were exceedingly high, owing partly to the silting of the grey-copper, which, as previously stated, is a heavy silver-carrier, and partly to the serious losses in mercury from the amalgamating-pans. The plant was operated for about a year, and some 10,000 tons of ore was treated, but the results being unsatisfactory the plant was shut down and has since remained idle.

For such an ore as that produced by the *Silver Cup* and *Nettie L.* mines, containing a fairly intimate mixture of iron pyrites, galena, zinc-blende, and grey-copper, the process outlined above is obviously unsuited. The solution of the problem is more likely to be found in a first concentration by water over jigs and tables, with regrinding and retreatment of the coarse, followed by separation of the fines by one of the flotation processes, which would undoubtedly save the grey-copper. Three concentrates should be produced, galena, iron sulphide, and zinc-blende, from the jigs and tables, and the fine concentrates from the flotation section containing the bulk of the grey-copper and such iron pyrites, zinc-blende, and galena as went over with them. These concentrates could then be finally separated by means of an electrostatic separator, or perhaps with a pneumatic jig.

It should be possible to design a process for the treatment of this ore, which would save the bulk of the metallic minerals, and to separate them, that each would be a marketable product. A process which will successfully concentrate this type of ore is a necessity for this portion of the Trout Lake Division, as between the *True Fissure* mine on the north-west and the *Silver Cup* mine on the south-east there is a tremendous tonnage of low-grade ore available, but the plant installed must be one suited to the ore, and not try to make the ore suit the process, which is an impossibility, as the old *Silver Cup* Company found out. It is generally stated that the plant at Five-mile cost \$250,000, rather an expensive experiment.

This property is situated on the north slope of Trilune mountain, which forms the divide between the headwaters of Trilune and the North fork of Brown creek, and is at an elevation of 7,500 to 8,000 feet. The ore outcrops in the face of a precipitous bluff beneath a small glacier which occupies the basin at the head of Trilune creek. The portal of the upper adit is only a few feet below the glacier, under which it has been driven; consequently the temperature never rises above freezing-point, and even in the middle of summer the ground remains frozen and the walls of the adit covered with frost crystals. If this level is not used for any length of time it becomes filled with ice, and was so filled at the time of my visit. In the winter-time there is a constant danger from snowslides.

The formation is a dark slate, having a north-westerly strike and a dip of 70 degrees to the north-east, much broken and twisted by local disturbance. Associated with it are a number of dykes of the rusty-weathering diabase-schist, between one of which and the slate occurs the main *Trilune* vein, which varies in width from 2 to 8 feet, but is very irregular. Three adits have been driven, the two upper ones of which are in the ore, and the third is a crosscut commenced some 250 feet vertically below them, from a bench cut in the solid rock of the hillside, upon which a small bunk-house has been built in such a manner that any snowslide coming down (which is liable to happen at any time during the winter) will be carried over the building without harming it. This crosscut was never completed to the vein, the property having been shut down in 1905 and has since remained idle.

Between the years 1901 and the end of 1905, 534 tons of ore was shipped, assaying approximately: Gold, 0.9 oz.; silver, 250 to 400 oz.; lead, 33 to 50 per cent. An aerial wire-rope tram was built in 1901 from the bunk-house to a lower terminal at the end of the wagon-road on Lardeau creek, but, as it was constructed down the Trilune basin and creek, the snowslides of the following winter carried away several of the towers, wrecking the tram, which was never rebuilt. It would

* Brock, R. W. Summ. Rep. Geo. Surv. Can., 1903, pp. 69, 70. Robertson, W. F. Ann. Rep. Min. of Mines, B.C., 1903, p. 122.

be possible to build a tram along the sides of the basin in such a place and at such an elevation that it would be safe from slides.

The ore produced from this property is of as high a grade as any produced in the Trout Lake District, and there is every reason to believe that additional development will open up new ore-shoots. This property and its workings have been described in detail in the references given in the foot-note, and very little additional work having been done since that time, it is not necessary to repeat those details here.

(Plates 7 and 8.) This property is situated in the side of **Morning Star.** a glacial cirque on Trinne mountain, on the east side of Trinne pass, at an elevation of 7,750 feet. There are two veins upon this property, both of which have a strike of N. to N. 10° W., and one a vertical dip and the other a dip of 45 degrees easterly. The formation in which these veins occur is a belt of siliceous lime containing a good deal of green chlorite, and having a strike of N. 45° W. and a north-easterly dip of 70 degrees. The vertical vein, known as the *Morning Star* vein, has been opened by two adits, driven on its course, from the face of a bluff where it outcrops. The upper adit shows the vein to consist of a series of quartz stringers, following a line of fissuring through the lime. These stringers vary in width from a few inches to a foot, and contain galena, grey-copper, iron pyrites, and a little zinc-blende. This level being close to surface, the grey-copper has been largely weathered to a carbonate, forming quite showy specimens, with the brilliant blue and green hues of that mineral. A sample taken across 4 inches of ore in the face of the upper adit, at a distance of 50 feet from the portal, assayed: Gold, 0.6 oz.; silver, 107.8 oz.

About 15 feet above this adit, on a little bench in the bluff, occurs the second vein, which is locally known as the "Flat" vein. This occupies a joint plane in the lime and was undoubtedly formed at the same time, and by the same solutions, as the other. In a small cut made in the outcrop there is exposed 4 to 6 inches of ore containing galena and grey-copper, a sample of which assayed: Gold, 0.25 oz.; silver, 137.4 oz.; lead, 44.6 per cent. A short distance down the mountain, in the direction of the dip of this flat vein, at the side of a draw, a prospect-shaft was sunk some years ago, in the bottom of which the continuation of the vein was cut, and found to contain galena, iron pyrites, and grey-copper. About 100 feet below this shaft, occupying the bottom of the basin, is a small mass of ice, all that now remains of the glacier which once covered this mountain.

On the opposite side of the cirque is situated the *Chance* mine **Chance.** (Plates 7 and 8), the lower adit on which has an elevation of 7,550 feet. The vein here has a strike of N. 25° W., with a dip of 72 degrees north-easterly, occurring in a belt of carbonaceous phyllite having a strike of N. 45° W. and a north-westerly dip at a low angle. Between this phyllite and the *Morning Star* lime-belt is a dyke of diorite in which the hornblende is of a decided green colour, and occurs in good-sized individual crystals and clusters, giving the rock a porphyritic appearance. This diorite dyke extends from the head of Trinne pass to, and across, the South fork of Brown creek, beyond which it has not been traced.

The *Chance* vein has been opened by two adits, the upper one of which is 100 feet vertically above the lower. For the first 65 feet this upper adit is a crosscut to the vein, upon which a drift has been made in a southerly direction for 165 feet. In these workings the vein is well defined, with slickensided walls, and consists of quartz containing inclusions of phyllite, and is mineralized with galena and iron pyrites, which in places form bunches of solid ore, while the minerals occurring in layers give it a banded appearance; grey-copper occurs sparingly in these workings. A sample taken across the face of the south drift over a width of 18 inches, where the vein consists of quartz and phyllite, well mineralized with iron pyrites, galena, and a little grey-copper, assayed: Gold, 0.08 oz.; silver, 161.2 oz.; lead, 12 per cent. A sample taken from the east side of the south drift 15 feet back from the face, where there was 3 inches of solid galena ore containing some iron pyrites, assayed: Gold, 0.38 oz.; silver, 97.1 oz.; lead 31 per cent. In the face of the north drift the

vein is only 8 inches wide, and consists of a white quartz containing fragments of included phyllite, and is sparingly mineralized. An average sample taken from this place assayed: Gold, a trace; silver, 2.2 oz.

The lower adit (Plate 9) commences in a rock-slide, and then continues as a crosscut through the phyllites to the vein, which it enters in a distance of 100 feet. From the point of intersection a drift has been driven in a northerly direction following the vein, the idea being to come under the downward continuation of the ore showing in the south drift of the upper level. In the face of the north drift in the lower adit there is about 4 inches of quartz mineralized with galena and chalcopyrite, but it has not yet been driven far enough to reach its objective point.

Timber is difficult to obtain at this altitude; consequently in that part of the lower level requiring timbering the sets have been placed rather far apart, and the sides of the level between them have been walled up with flat slaty rock obtained from the rock-slide. A retaining-wall made of the same material has been built at the portal of the adit and is well shown in the accompanying photograph. The owner of the property, David Morgan, deserves a great deal of credit for the careful and neat manner in which he has done this work, and the ingenuity which he has displayed in making the rock-slide material take the place of timber for supporting the workings.

Both this property and the *Morning Star* are situated several hundred feet above timber-line, and, owing to their altitude, are covered by snow during the greater portion of the year; the cost of mining and development is consequently high. They are easy of access during the summer, the British Columbia Government having built a trail along the North fork of Brown creek, on an easy grade, over which a horse can be ridden with comfort. These trails are shown in the accompanying photographs.

The veins in the *Morning Star* and *Chance* properties are supposed to be the continuation of those which occur in the *Triune*, which in turn are generally believed to be a continuation of those from the *Cup*. Sufficient work has not been done to definitely decide this one way or the other, but there is no doubt that they all occur in the same belts of phyllite and limestone.

This property is situated on the north side of the North fork of Brown creek, on the slope of Triune mountain below the *Morning Star* property, which it adjoins. The formation here consists of a greenish talc-schist, having a strike of N. 45° W., with a north-easterly dip of 75 degrees. The vein has a north-south strike, with a dip varying from 25 to 70 degrees to the east, and is undoubtedly the southerly extension of the *Morning Star* vein. On the *I.X.L.* the vein outcrops in the precipitous side of a very steep draw, where it has been developed by two adits (Plate 8) and some surface prospecting, the uppermost cut being at an elevation of 7,500 feet. The upper adit (elevation 7,050 feet) follows the vein in a northerly direction for 50 feet, showing it to have a width of from 6 to 18 inches, and to consist of quartz well mineralized with galena, iron pyrites, zinc-blende, and grey-copper. Some years ago several tons of ore are stated to have been stoped from this level and shipped to the smelter with satisfactory results, but particulars are not now available.

About 20 feet back from the face of this level a winze was sunk to a depth of 6 feet, in the sides of which the vein has a width of 12 inches, and an average sample taken of this assayed: Gold, 0.2 oz.; silver, 24.8 oz.; lead, 9.5 per cent. At the head of a raise, immediately over the winze which comes to surface in the draw about 30 feet vertically above the level, is a seam 6 inches wide of oxidized ore on the foot-wall side of the vein, showing little unaltered sulphides. A sample of this material assayed: Gold, 1.2 oz.; silver, 20.6 oz.

One hundred and fifty feet vertically below the upper adit a second level has been driven on the vein from its outcrop in the side of the draw. This level has been driven a distance of 200 feet in a northerly direction along the strike of the vein, which here has a width of 12 to 18 inches, with well-defined walls. The ore consists of galena, iron pyrites, chalcopyrite, zinc-blende, and a little grey-copper in a gangue of quartz containing some green chlorite. The vein at this level has a

dip of 70 degrees to the east, and a sample taken across it at the face assayed: Gold, 1.46 oz.; silver, 12.0 oz. Between the vein and the foot-wall is 6 inches of crushed, oxidized rock, a sample of which assayed: Gold, 0.7 oz.; silver, 10.3 oz.

This property is situated below timber-line and is connected with the trunk trail along Brown creek by a branch trail, which, however, is both steep and rough and will need repairs before it can be safely used for "packing," there being a few places where it would be dangerous to take a horse.

This property is situated on the south side of the North fork of Brown creek, on the north slope of the narrow ridge forming the divide between the two branches of Brown creek. This ridge is well shown in Plate 10, and, as will be seen, consists of a wedge-shaped mass of bare rock largely devoid of timber, and in the winter-time continually swept by snowslides. The formation is a carbonaceous calc-phyllite having a strike of N. 45° W., with a dip of 67 to 75 degrees north-easterly, the strike of the rocks being almost at right angles to the trend of the ridges.

The *Noble Five* vein follows pretty much the strike of the enclosing rocks and is exposed at several places in the bluff, where, at an elevation of 6,250 feet, a cut and drift 30 feet long has been made on it. In this cut the vein has an average width of 18 inches and consists of quartz mineralized with galena, iron pyrites, and grey-copper. An average sample taken across the vein, over a width of 18 inches at the face of the drive, assayed: Gold, 0.36 oz.; silver, 117.3 oz.; lead, 16 per cent. Fifty-five feet vertically below and a short distance east of this level a diagonal crosscut has been commenced to come under the "ore-showing" at depth. This has, however, not as yet been driven far enough to cut the vein.

In a few other places on the precipitous mountain-sides ore along the outcrop of this vein has been found. The means of getting to these places was to climb an almost vertical cliff from ledge to ledge, and at one time bars of iron had been driven into the rock, from which ropes were hung to assist in such climbing. Most of these ropes have not been renewed or used for several years, so it was not deemed safe to visit these places along the outcrop, especially as there was no additional information of material importance to be obtained by so doing.

In the draw a short distance west of this vein, just above the top of a rock-slide, there are a number of stringers occupying fracture-planes in the phyllites. These stringers have a north-south strike and dip to the east at an angle of 80 to 85 degrees. They are of quartz, well mineralized with galena and iron pyrites, a sample of which assayed: Gold, 0.46 oz.; silver, 19.6 oz.; lead, 14.3 per cent. Just above these stringers is an open fissure conforming to the general strike of the formation, but dipping at a slightly steeper angle. This fissure varies in width from a few inches to 2 feet, and is lined with crystalline calcite; it can be traced for a distance of over 1,000 feet. Near the foot of the mountain, in Brown Creek valley, north-west of the *Noble Five* vein, and in the timber, an outcrop of quartz has been found containing galena and iron pyrites.

Owing to the amount of talus which covers the ground at this place the vein has not been traced out, so that its course and dip cannot be stated with any degree of accuracy. It appears, however, to be striking in a south-easterly direction and to be cutting the formation at a low angle. Very little work has been done on this as yet, and no samples were taken.

The diorite dyke mentioned in connection with the *Chance* prospect crosses Brown creek on the south side of the draw above mentioned, and constitutes the steep bluff upon which the I.X.L. cabin is situated, and shown in Plates 8 and 10. On the north side of this dyke, between it and the *Noble Five* phyllites, is a band of crystalline limestone containing green chlorite; this is the south-east extension of the limestone which occurs in the *Morning Star* property. Where it crosses Brown creek the diorite dyke has a width of 200 feet. On its south side is a wide belt of serpentine containing asbestos in the cross-seams and along the slips. This rock is much disturbed and has been subjected to a great deal of pressure. To the south of this serpentine, going up the valley of Brown creek, occur belts of black slates and phyllites.

In the latter is situated the *Cromwell* property, where a quartz vein 6 inches to 4 feet wide, having a strike of N. 15° E. and a dip of 74 degrees easterly, outcrops along the precipitous mountain-side. It has been developed by a few surface cuts and an adit along its course for a distance of 70 feet. The elevation of this adit is 7,400 feet, and in order to reach it an exceedingly steep rock-slide has to be climbed, across which there was at one time a trail. This has become pretty nearly obliterated by the action of the rain and snow carrying the loose rock down over it, and, as little work has been done here during the past two seasons, the trail has not been rebuilt. One of the owners of the property, however, informed me that they expect to resume work next year, when a new trail will be built.

In the adit above mentioned the vein is well defined, with smooth walls, and at the face has a width of 15 inches. It is of quartz, mineralized with iron pyrites and a little chalcopyrite, an average sample of which assayed: Gold, 0.32 oz.; silver, 2.5 oz.; copper, 2.7 per cent. Near the mouth of the adit the vein had a width of 3 feet, from which 11 tons of ore was mined and sent to the smelter, yielding: Gold, 5.33 oz.; silver, 5.64 oz. This ore was of course sorted. Average samples taken from the vein exposed in the floor of the level over the first 45 feet in from the portal assayed: Gold, 1.16 oz.; silver, 1.15 oz. Plate 11 gives a good idea of the appearance of the vein at this place.

Owing to the difficulty in getting to the adit and the frequent interruption to the work during the winter months, caused by snowslides, a new level has been started farther down the mountain-side. This will in the crosscutting approximately 100 feet before the vein is reached, but, by driving north along the course of the vein it is expected that the downward extension of the ore from which the shipment was made will be found, and that shipments of good-grade ore can then be resumed. The workings are situated well above timber-line, but the ground in which the vein occurs is firm, and therefore requires little artificial support.

On the summit of Silver Cup ridge, about a mile south-east of the head of the North fork of Brown creek, is situated the **Alpine Group**, where a quartz vein 3 feet wide outcrops along a comparatively level stretch of ground. The vein has a north-south strike, with a dip of 84 degrees to the east, and has been prospected by several open-cuts over a distance of 200 feet, and by a prospect-shaft sunk to a depth of 40 feet, at an elevation of 7,075 feet.

The ore consists of iron pyrites, galena, and zinc-blende in a quartz gangue, an average sample of which assayed: Gold, 0.1 oz.; silver, 3.3 oz.; lead, 4.6 per cent. Owing to the fact that this ore is comparatively low grade, and because of its situation that it must be developed by means of shafts (unless a prohibitively long crosscut be driven), and its distance from the main lines of transportation, the property has been allowed to lie idle for several years.

About two miles farther south-east, on the *Jewell* property, at an elevation of 7,300 feet, along the north slope of an ancient glacial basin, in a schist formation striking N. 45° W., with a north-easterly dip, is a quartz vein 2.5 to 4 feet wide, having a strike of N. 55° E. and a dip of 70 degrees to the north-west.

The vein is well defined and cuts the formation at nearly right angles. It has been developed by a series of surface cuts and prospect-shafts for a length along its course of some 300 feet. The mineralization consists of galena, iron pyrites, and a little zinc-blende. An average sample taken across the vein in the bottom of one of the prospect-shafts, over a width of 2.5 feet, assayed: Gold, 0.12 oz.; silver, 1.9 oz.; and a selected sample of the solid galena from the cuts assayed: Gold, 0.06 oz.; silver, 54.0 oz.; lead, 78.3 per cent. This vein can be developed by means of adits to a depth of probably 800 feet below its outcrop, but the lower level will require a somewhat long crosscut, as the dip of the vein is into the mountain; therefore, the deeper the workings, the greater the distance between the surface of the hill and the vein.



Plate II Cromwell Vein in Adit

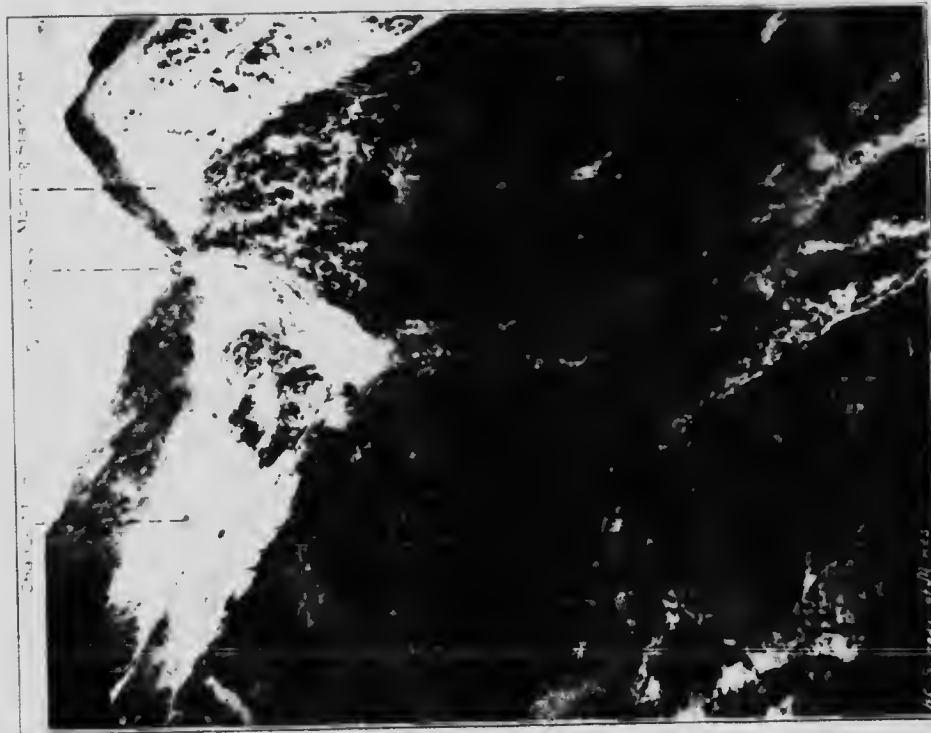


Plate S Morning Star Mine



Five miles farther south east, along the summit of the divide, between the head of Ottawa and Haskin creeks to the north, and Stobart and Nell creeks to the south, at an elevation of 8,000 to 8,600 feet, on what is known as the *Skyline* property, is a belt of schist having a strike of $N. 10^{\circ} W.$, with a dip of 70 degrees to the north-east, cut by a series of joint planes striking $N. 25^{\circ} E.$ and having a south-easterly dip of 65 degrees.

Between this schist belt and a carbonaceous phyllite lying next to it on the north-east is an irregular vein from 2 inches to 4 feet wide, containing some pyrites with a little galena. This vein has been developed as a series of surface cuts along the steep mountain-side on which it outcrops. An average sample taken across 4 feet of quartz in one of these cuts assays: Gold, a trace; silver, 0.2 oz.; and a selected sample of the galena, which occurs sparingly in small bunches in the vein, assays: Gold, 0.8 oz.; silver, 25.6 oz.; and, 18 per cent. The work has been done along a narrow ridge of bare rock, having a general north-south trend, sloping to Trout lake on the south and to Henry creek on the north. Several prospect-cuts through the ridge 100 feet below the vein outcrop beyond which it again rises steeply, forming the divide between Ottawa and Haskin creeks, reaching an elevation of 9,300 feet in a peak locally known as Fay's peak. On the slope of this peak is a belt of calc-schist having a strike of $N. 10^{\circ} W.$, with a northerly dip of 70 degrees, cut by a series of fissures striking north-eastward, along the larger of which, ranging in width from 4 to 12 inches, there has been developed some quartz mineralized with iron pyrites, chalcopyrite and a little galena; these towards the centre of the schist-belt are rather more conspicuous than elsewhere. The schist itself is slightly mineralized with iron pyrites and sulphides.

At an elevation of 8,800 feet, just above the head of Henry creek, on the south-east slope of Fay's peak, a surface outcrop of quartz, along this copper-bearing schist, and near the centre, over a width of 100 feet, has been developed. An average sample taken across 8 feet assays: Gold, a trace; silver, 0.2 oz.; copper, 0.2 per cent. Several other prospect-holes have been made at various points on the mountain-side of well-mineralized quartz have been found. An assay of one of these showed it to contain: Gold, 0.1 oz.; silver, 7.0 oz.; copper, 3.0 per cent. This copper-bearing formation has been traced down the slope of the mountain into the basin at the head of Ottawa creek (Plate 12), at an elevation of 7,100 feet, where a 50-foot prospecting-adit has been driven along the more mineralized portion. A selected sample assayed: Gold, 0.13 oz.; silver, 5.0 oz.; copper, 3.0 per cent.

At the foot of the south-east slope of Fay's peak, in the Bonanza basin at the head of the Middle fork of Haskin creek, is the *Bonanza* claim (elevation 6,800 feet). Here a vein from 1 to 3 feet wide occurs, conforming in both strike and dip to the enclosing carbonaceous phyllite, which has the prevailing north-westerly course and north-easterly dip.

The vein consists of quartz mineralized with iron pyrites and a sprinkling of galena. It has been developed by an adit 160 feet long and several surface cuts, from which average samples from which assay: Gold, 0.2 to 1.8 oz.; silver, 1.5 to 6.0 oz.

This property is situated about half a mile south of the head of American creek, and three miles north-west of the town of Gerrard, on the north-east side of Trout lake, at an elevation of 6,800 feet. On this property there are two veins, one consisting of quartz from 5 to 8 feet wide sparingly mineralized with iron pyrites, conforming in strike and dip to the enclosing schists, and the other consisting of quartz mineralized with iron pyrites and galena, having a more northerly strike, cutting the formation at a low angle, the galena occurring as a streak from 4 to 6 inches wide between the vein and the hanging-wall.

Development consists of a series of surface cuts and an adit driven in from the outcrop for a short distance. In this adit the vein lies almost flat, but is getting steeper towards the face. The workings are in the side of an ancient glacial cirque, and it is probable that the rocks have been bent over by the weight of the

ice-mass. In the years 1912-13 this property was operated under lease, and, from the adit, ore was mined, sorted, and the following shipments made:—

25 tons assaying: Gold, 0.22 oz.; silver, 52.7 oz.; lead, 45.1 per cent.; zinc, 1.8 per cent.

23.84 tons assaying: Gold, 0.18 oz.; silver, 70.0 oz.; lead, 61.2 per cent.

10 tons assaying: Gold, 0.26 oz.; silver, 58.1 oz.; lead, 51.4 per cent.

The zinc content of the last two shipments was traces only. The galena is fine-grained, with a silky texture, and contains antimony.

The nearest railway point to this property is Gerrard, the ore being transported to that place by means of rawhides on the snow.

This property is situated on the Middle fork of Stobart creek. **Golden Crown.** on the south-west slope of a spur from the Silver Cup mountains, on the north-east side of Trout lake, at an elevation of 6,000 to 6,500 feet. The vein consists of a highly crystalline quartz, having a strike of N. 25° W. and a dip of 70 degrees to the north-east, cutting the enclosing carbonaceous phyllites at a low angle in both strike and dip.

The vein-outramp forms one side of a draw formed by the erosion of the softer phyllite hanging-wall rock. The vein is well defined and stands out prominently like a stone wall. It has been prospected to a small extent by means of surface cuts across it and two short adits. The upper cut, at an elevation of 6,500 feet, shows the vein to have a width of 18 feet, and to consist of highly crystalline quartz, sparingly mineralized with iron pyrites. An average sample taken across 12 feet on the foot-wall side of the vein in this cut assayed: Gold, a trace; silver, 0.5 oz. A sample taken across 15 feet from the hanging-wall side assayed: Gold, 0.25 oz.; silver, 0.15 oz.

Below this cut, a few feet farther up the draw, an adit has been driven, but the mouth of which having caved rendered it inaccessible. The ore on the dump at the mouth of this adit is much more mineralized than is the vein in the cut above mentioned. About 300 feet south-east of the cut, down the draw along the strike of the vein, at an elevation of 6,350 feet, a second adit has been commenced to crosscut the vein. This adit, however, is in a rather bad condition, and it was not considered safe to venture far into it, as there was a good deal of loose rock overhead which a slight jar would probably bring down. However, an average sample was taken across 5 feet of the hanging-wall portion of the vein as exposed in this working, and assayed: Gold, 0.7 oz.; silver, 0.9 oz. Associated with the vein at this place is some galena, of which there is several hundred pounds on the dump. Two samples were taken of this galena, which assayed: Gold, 0.2 and 0.12 oz.; silver, 57 and 61.4 oz.; lead, 59.15 and 68.5 per cent, respectively.

There is a trail from the lake-shore up Stobart creek to the *Arallu* cabin on a fairly good grade; this trail passes within about half a mile of the *Golden Crown* workings; the property is therefore favourably situated.

This property is situated near the head of Burg creek, on the north-east side of Trout lake, at an elevation of 5,500 to 6,800 feet. The vein is of quartz from 6 to 12 feet wide, having a strike of N. 25° W. and a north-westerly dip of 53 degrees, outcropping along a steep hillside, upon which it has been opened by a number of surface cuts and four adits driven from different levels.

The two upper adits are only a few feet below the outramp and within the zone of oxidation. In these the quartz vein is about 8 feet wide, well mineralized with iron pyrites, a considerable proportion of which has been leached, giving the rock a honeycombed appearance. Free gold can be frequently seen in the little cells left by the oxidation of the iron pyrites. From the ore extracted in driving these adits a quantity was sorted and sacked in readiness for shipment to the smelter, the object apparently being to make a smelting test of this class of ore. These sacks, however, have rotted and most of them burst open. An average sample was taken from the ore thus exposed, which assayed: Gold, 5.4 oz.; silver, 4.6 oz.

About 100 feet below these workings another adit, known as the No. 4, has been driven on the vein at an elevation of 6,300 feet. For the first 30 or 40 feet this

is a crosscut through the country-rock to the vein, which it then followed in a south-easterly direction for some 300 feet. This portion of the adit is entirely within the vein, and, as no crosscuts have been made, it is difficult to say how wide it is, but, as near as can be judged, it will average 10 feet. The ore from this adit was stated to contain from 0.4 to 0.6 oz. gold to the ton. In order to check this statement, a large sample was taken, representing as nearly as possible an average of the vein exposed in the level, crushed and quartered down. The resultant sample assayed: Gold, 0.4 oz.; silver, 0.6 oz. The quartz at this level is well mineralized with iron pyrites, and it is possible here and there to detect particles of free gold, not only associated with the iron pyrites, but also in the quartz. An examination of the dump at the mouth of the adit, where there is a considerable tonnage of ore, showed several pieces of quartz in which free gold could be seen.

Near the floor of a basin at the base of the hill, some 700 feet below, a main working-adit had been started to develop the vein at depth, but, owing to lack of finances, was stopped before the objective point was reached. This is much to be regretted, as there is every reason to believe that with systematic development this property would become a profitable producer of bullion.

There is a heavy flow of water from the No. 4 adit, carrying in solution considerable iron, as shown by the deposit of iron oxide formed along the bottom of the level, and the bottom of the little stream made by this water as it issues from the level, indicating the presence of decomposing iron sulphide in the rock through which it percolates.

Just over the summit of the ridge above the *Winslow*, at the **Okanagan** head of Silver Cup creek, at an elevation of 7,200 to 7,300 feet, is situated the *Okanagan* property, where there is a well-defined quartz vein from 1 to 3 feet wide, having a north-south strike, with a dip of 70 degrees to the east, cutting across a belt of siliceous schists which strike N. 50° W. and dip 55 degrees north-easterly. This schist-belt lies between the *Cromwell* quartzite dyke on the south and a second quartzite dyke on the north. These dykes are only about 400 feet apart.

The *Okanagan* vein has been prospected along its outcrop by a series of surface cuts and trenches for a distance of 200 feet, and by a prospect-shaft 10 feet deep. The quartz is mineralized with iron pyrites, which occurs both in bunches and as disseminated particles, and was said to be very rich in gold. To determine this, a sample free from quartz was obtained from the surface cuts, and examined carefully for visible gold, without finding any, but on being assayed proved to contain: Gold, 13.7 oz.; silver, 7.9 oz. An average sample taken across the vein exposed in the prospect-shaft over a width of 3 feet assayed: Gold, 1.9 oz.; silver, 2.9 oz.

In a shallow draw a short distance south of the shaft a crosscut has been started to cut the vein at a vertical depth of 40 feet. This crosscut has been driven a distance of 150 feet, but has not reached its objective point, although it is expected that this will be accomplished in a few feet more driving. In addition to this vein, there are a number of others, also seams and bunches of quartz, the majority of which conform to the strike of the enclosing schists, while others occupy joint planes at angles thereto. Some of these are said to be gold-bearing, but have had no work done on them and were not sampled.

The property is situated above timber-line, and must be developed by means of shafts, owing to this part of the summit being comparatively level.

In addition to the mines and prospects described, there are a number of others at various places along the Silver Cup mountains upon which more or less work has been done. Among these may be mentioned the *Copper Queen*, near the head of Six-mile creek, where a vein has been developed by an adit and a shaft; the *U and I*, situated at the head of Cup creek, where a small gold-bearing vein has been developed by means of a prospect-shaft, close to the northerly quartzite dyke previously mentioned, towards which it dips; the *Silver Plate*, on the summit at the head of Neil creek; the *American*, at the head of the Middle fork of Haskin creek; the *Kootenay Belle*, at the head of the South fork of Haskin creek; and several others.

These prospects are situated at high elevations, ranging from 6,400 to 7,600 feet, and have more or less showings of ore; but their owners were looking for ore sufficiently rich to ship direct to the smelter without previous treatment, and this, owing to the locations of the properties and their distance from transportation, required an ore having a value of not less than \$75 a ton. Ore, therefore, which would only assay \$10 to \$30 a ton was disregarded.

There are without doubt several veins on the Silver Cup mountains worthy of further development; notable among these are the *Golden Crown* and *Winslow*, which give promise of supplying a large tonnage of ore containing a sufficient amount of gold to yield a fair profit if treated in a mill on the ground.

LIME DYKE MINERAL BELT.

This belt is the south-easterly continuation of the same series of limestones, slates, and phyllites that occur at the head of Lexington and Poole creeks, in the Lardeau Division. In the Trout Lake section they have their greatest development along the upper portion of Ferguson, Galner, Lardeau, and Hall creeks.

Between this and the Central Mineral Belt series occurs a belt of chlorite-schist much altered and showing evidence of having been subjected to enormous pressure. This is particularly well developed along the headwaters of Surprise creek, a tributary of Ferguson creek, into which it flows near Circle City, about six miles north of the town of Ferguson.

About two miles up Surprise creek is the *Surprise* group of claims, where there is a vein occupying a fissure in the chlorite-schist, having an east-and-west strike with a northerly dip of 80 degrees. The schists themselves at this place have a strike of N. 60° W., with a north-easterly dip of 75 degrees, and are cut by a series of joint planes having a N. 20° E. strike and south-easterly dip of 80 degrees. The vein-filling consists of iron pyrites and galena in a calcareous gangue containing inclusions of the chlorite-schist, together with calcite.

The vein has been prospected by a number of surface cuts and two shallow shafts along its course for a distance of 500 feet, and in the south bank of the creek it has been crosscut for 12 feet, showing it to be well defined, with slickensided walls. An average sample taken across this 12 feet assayed: Gold, a trace; silver, 2.8 oz.; lead, 9.6 per cent.

At the source of Surprise creek, above a glacier on the northern slope of the summit of Nettle L. mountain, the belt of chlorite-schist is well exposed in a series of perpendicular bluffs, caused by the weathering along the steep dip and jointing of the rocks. In the rock debris at the foot of these bluffs the presence of copper has been noted from time to time, and some years ago a group of claims was located and some development-work done, with, it was claimed, satisfactory results. Owing to lack of transportation, however, and the difficulty of access to this part of the country, the claims were allowed to lapse, and the ground remained open until 1912, when it was restaked, and, at an elevation of 6,050 feet, a crosscut driven into a bluff, showing some copper-stain, for a distance of 22 feet. It was claimed that the whole of this rock contained copper in workable quantities, and in support of the statement an assay certificate was shown, said to have been the result from an average sample taken across the face of the crosscut, showing it to contain: Gold, 0.01 oz.; silver, 0.5 oz.; copper, 5.7 per cent. Another analysis was produced, made by J. O'Sullivan, of Vancouver, from a sample supplied him, which was stated to be a representative sample of the copper-bearing chlorite-schist outcropping along the ridge for a distance of 3,000 feet. The analysis showed the sample to contain: Gold, 0.01 oz.; silver, 2.5 oz.; copper, 3.5 per cent.; iron oxide, 10.39 per cent.; alumina, 6.61 per cent.; lime, 3.5 per cent.; sulphur, 1.3 per cent.; insoluble, 70.6 per cent.; water and carbonic acid, 3.7 per cent. It was also stated that this mineralized belt had a minimum width of 500 feet and a maximum of 1,500 feet, and that there were thousands of tons of this class of material in the talus at the foot of the bluffs. Samples were produced showing specks said to be copper-glance scattered through the chlorite-schist, and others showing quartz and calcite containing the same mineral.

On investigation it was found that the chlorite-schist belt has an average width of 1,000 feet; lying between a dark-coloured carbonaceous calc-schist containing iron pyrites on the hanging-wall, and a rusty-weathering, much-decomposed schist (where exposed) on the foot-wall. The crosscut above mentioned was very carefully sampled along both sides from its portal to the face, a measured distance of 18 feet. The samples were combined, crushed, and quartered down, and on being assayed proved to contain: Gold, a trace; silver, 0.6 oz.; no copper. Another sample was taken at the face of the crosscut over a width of 5 feet, by cutting two parallel grooves across it, spaced 18 inches apart; the rock thus obtained was crushed and sampled down, and on being assayed showed it to contain: Gold, a trace; silver, 0.1 oz.; no copper.

These results are quite in accordance with what was expected from an examination of the rock, as there is a notable absence of copper-stain, except along some of the small quartz-filled seams. The rock, however, does contain some specks of an iron-coloured mineral having a metallic lustre, which, when accompanied by a green stain, might be mistaken for copper-glance (chalcocite), and as in the rock from the crosscut in question these mineral particles are very small, it is difficult to make tests in the field to determine its real character, especially by those not familiar with mineralogy. Samples of the rock taken from this crosscut, and since examined, show the mineral in question to be ilmenite, or titanite iron ore.

Some 2,000 feet south-east of this crosscut, in a draw at an elevation of 6,900 feet (Plate 13), which cuts the formation, and at the head of a talus-slope, a side-hill cut has been made showing a number of narrow stringers occupying cracks in the rock. These stringers consist of quartz, mineralized with copper-glance and bunches of crystalline ilmenite. It was stated that a sample taken across the full length of this cut gave a good assay in copper. A sample taken by the writer across 50 feet along the face of the cut (being careful to reject the seams which showed copper-glance), on being assayed, gave traces only in gold and silver, and no copper. From these results it is evident that the samples previously assayed did not represent an average of the schist-belt over its entire width, and that in taking these samples pieces of copper-glance must have got into them.

In the talus-slope above mentioned a number of boulders and fragments of conglomerate were observed, the pebbles in which were elongated, and some of them broken, indicating that it had been subjected to squeezing. The cementing material of this conglomerate is rich in chlorite, and the whole rock has a dark colour. In weathering, the chlorite is first carried away, leaving the pebbles standing out in a conspicuous manner. The rock from which these boulders came was not seen in place, but is stated to outcrop in an ancient glacial basin at the head of the draw. Boulders of a similar conglomerate rock were noted in the valley of Poole creek above Hillman.

At the head of Ferguson creek, on its east side, at an elevation of 7,200 feet, is the *Little Robert*, on which there is a quartz vein from 2 to 5 feet wide in a band of lime. In its strike the vein conforms to the enclosing rocks, but on its dip cuts the lime towards a belt of slate which lies next it on the south.

The ore consists of bunches of galena and grey-copper in a quartz gangue. Development-work consists of a surface cut and a shallow pit at the foot of a bluff above a small glacier, at an elevation of 7,250 feet, and a crosscut started, at an elevation of 7,000 feet, from the hanging-wall side, with the intention of cutting the vein at depth. It has not yet been finished.

Two small shipments were made of sorted ore from these cuts and pit, one of which weighed 200 lb. and the other 5,000 lb. The former assayed: Silver, 110.8 oz.; lead, 21.5 per cent.; and the latter assayed: Silver, 114.0 oz.; lead, 24 per cent.

On the east side of Ferguson creek, at an elevation of close to 8,000 feet, is the *Big Fire* property, where, it is stated, there is a belt of limestone impregnated with galena, which is not only disseminated through the rock, but also occurs in masses. This ore, however, is considered of too low a grade to permit of its being mined under existing conditions.

and the property is idle. Owing to the bad condition of the trail leading to this property it was not visited by the writer.

There are a few other prospects in this part of the Lime Dyke Belt, but, as they have had no work done on them for a number of years, were not visited.

On Gold gulch, a tributary of Galner creek, which enters that stream two miles above Ten-mile, there is a belt of lime 100 feet wide, having a strike of N. 50° to 55° W. and a southerly dip at an angle of 80 degrees. On the foot-wall of this lime is a grey-spotted phyllite, beyond which is another belt of lime containing chlorite.

About a mile up Galner creek from its mouth is located the **Hidden Treasure.** *Hidden Treasure* property, a group of claims on the south side of the creek, and extending nearly to the summit of the divide. The

mineralization occurs along fracture-planes in the lime, parallel to its strike, and also along a series of joint planes which have a strike of N. 65° W. and a north-easterly dip of 23 degrees. At the intersection of the fractures more or less replacement has taken place, and it is not unusual to find bunches of galena at these places. A narrow canyon crosses the formation, made by a small tributary stream having its source in the glacier crowning the summit of the divide. Where this canyon cuts through the lime it shows it to be heavily impregnated with iron over its entire width, and to contain galena in bunches and disseminated through it.

At an elevation of 5,900 feet on the hanging-wall side a short adit has been driven into the mineralized lime, a sample of which, taken across a width of 5 feet, assayed: Gold, a trace; silver, 1.4 oz.; lead, 8.7 per cent. Some 1,500 feet south-east of this cut along the strike of the vein, at an elevation of 6,250 feet, a prospect-shaft has been sunk on the outcrop near the hanging-wall to a depth of 8 feet. (Plate 14.) The lime here is heavily impregnated with iron oxide, and contains, in addition, iron pyrites and galena, and a sample taken across 5 feet in this shaft assayed: Gold, a trace; silver, a trace; lead, 4 per cent.

On the foot-wall side of this lime-belt, below the shaft, at an elevation of 6,200 feet, is a fault occupied by a light-coloured dyke containing much quartz and calcite, mineralized with galena and iron pyrites. This is 18 inches wide, and a sample taken across it, where exposed in a cut, assayed: Gold, a trace; silver, 0.2 oz.; lead, 1.5 per cent. Some 500 feet north-west of this cut, on the foot-wall side of the lime, at an elevation of 5,850 feet, a crosscut has been made for a distance of 10 feet, showing the lime to be of the same character as elsewhere, but here apparently more heavily mineralized. A crosscut is being driven through the foot-wall phyllites at a place 3,000 feet south-west of the ore-exposure in the small creek above mentioned. The object of this crosscut is not only to develop the mineral-bearing lime in this part of the property and at a depth of 200 feet below its outcrop, but also to have the workings where they will not be interfered with by snowslides in the winter; the upper part of Gold gulch being particularly bad in this respect. The portal of the crosscut is in a patch of timber, as is also the cabin, so they are reasonably safe.

This mineralized lime-belt has been traced across Galner creek, and over the ridge shown in the photograph, into the basin at the head of Poole creek. The general appearance of this mineralized lime-belt on Gold gulch is very similar to that on Surprise creek and on the *Scout* property, in the Lardeau Division, of which it is claimed to be the continuation. While the percentage of mineral contained in the rock is low, there is apparently a great deal of it, and if it be found that the entire mass will average 5 or 6 per cent. lead, together with some silver, it could no doubt be profitably worked, as it can be mined at a low cost from the valley of Galner creek and concentrated on the spot, there being ample water available for a mill, plenty of timber, and a mill-site free from snowslides. It is to be regretted that at no point has there been a crosscut made completely through the mineralized lime-belt, from one wall to the other. This, however, will probably be done when the crosscut now being driven reaches the ore-bearing formation.

Near the head of Galner creek, on its west side, at the foot of a precipitous mountain composed of limestone seamed with quartz (Plate 15), is situated the *Badshot* mine, where there is a quartz vein several feet wide, having a south-easterly strike and north-westerly dip at an angle of 45 degrees.

Some 300 feet of development-work has been done on this vein, consisting of a crosscut, an incline shaft some 70 feet deep, and drifts in both directions therefrom. The ore consists of galena, containing grey-copper, iron pyrites, and a little zinc-blende, in a gangue of quartz and calcite.

Two shipments have been made from the property, one of which consisted of 22 tons of ore, assaying: Silver, 157.0 oz.; lead, 56 per cent.; zinc, 4.6 per cent.; and the other of 32 tons, assaying: Silver, 177.0 oz.; lead, 56 per cent. Selected samples of coarse-grained galena from this vein assayed: Silver, 140 to 144.2 oz.; lead, 80 per cent. Samples of fine-grained galena from the same place assayed: Silver, 345.1 oz.; lead, 69 per cent. This latter evidently contained grey-copper, which would account for its high silver content.

The property is situated above timber-line, and is difficult of access in the winter owing to snowslides.

On the opposite side of Gainer creek, at an elevation of 6,500 to 7,500 feet, is the *Mohican* property, where quartz veins have been discovered in a belt of carbonaceous calc-schist lying alongside and south of the Badshot lime dyke.

The principal vein has a strike of N. 75° W. and a southerly dip of 70 degrees, occupying a fault-fissure, cutting the enclosing schists, which strike N. 50° W. and dip almost vertically. The vein varies from 6 inches to 5 feet in width, and is composed of quartz mineralized with iron pyrites, galena, and zinc-blende. Near the summit of the divide upon which this property is situated this vein breaks up into a series of quartz stringers, which spread out through the enclosing schists for a width of some 30 feet, giving the mass the appearance of a big ore-body, but from an examination of the rock it is evidently of a low grade, the mineralization not being very pronounced. In the narrower parts of the vein the ore-bearing solutions, having been confined to a smaller space, caused a heavier mineralization.

The vein is well exposed along the side of a small creek, where a number of cuts have been made along its outcrop for a distance of 200 feet. At an elevation of 6,400 feet an adit has been driven (Plate 16) in a south-easterly direction along the vein for a distance of 375 feet. At the face the vein is approximately 4 feet wide and 125 feet vertically beneath the outcrop. The ore is much leached owing to the fractured conditions of the rock, and the creek which flows alongside the vein-outcrop, much of whose water finds its way down through the vein.

While driving this adit some 8.8 tons of ore was sorted out and shipped to the smelter. This proved to contain: Gold, 0.01 oz.; silver, 56.3 oz.; copper, 1.5 per cent.; lead, 27.8 per cent.; zinc, 10.9 per cent. A sample of ore taken from this adit by the writer assayed: Gold, a trace; silver, 3.0 oz.; lead, 7.8 per cent. Samples of the less mineralized part of the vein assayed: Gold, a trace; silver, 0.85 oz. A selected sample of solid galena showing grey-copper from this level assayed: Gold, 0.05 oz.; silver, 118.58 oz.; copper, 7.93 per cent.; lead, 54.64 per cent.

In order to get below the zone of oxidation and at the same time open the ore-body at depth, a crosscut has been commenced some distance down the hill, 300 feet vertically below the vein-outcrop. It was estimated that this level would have to be driven 700 feet in order to come under the ore-shoot in the upper adit, from which the ore shipped was mined. This crosscut has been driven a distance of 300 feet, but, owing to lack of funds, was discontinued; it is stated, however, that work will be resumed shortly.

There are several other outcrops on the property, one of which shows in the bed of the creek previously mentioned, having a strike at almost right angles to the main vein. A selected sample from this assayed: Gold, 0.07 oz.; silver, 148.6 oz.; lead, 73.8 per cent.

Adjoining the *Mohican* on the east is the *Black Prince* property (Plate 16), where a vein similar to that occurring in the *Badshot* has been found in the lime. The workings are at the base of the mountain shown on the right of the photograph, but, as no work has been done for a number of years, was not visited by the writer.

From information obtained it is evident that the ore occurrence here is similar to that in the *Badshot*, and the mineralization consists of galena, grey-copper, and

a little zinc-blende, in a quartz gangue containing calcite. Owing to the location of the property and its distance from transportation, at present the expense of getting the ore to the railway for shipment to the smelter is excessive, so that only high-grade ore can be profitably mined; and, as the quantities of this are limited, the properties in this part of the mineral belt remain idle until such time as capital is forthcoming to thoroughly explore and develop the ore-bodies at depth, and to provide such concentration and transportation facilities as may be necessary to profitably work them.

Several other outcrops of galena ore occur along the south-eastward extension of this lime-belt, upon which more or less work has been done. The more prominent are the *Wagner*, on the divide between Lardean and Stevens creeks, at an elevation of 8,400 feet, where the ore outcrops on a small knoll projecting through a glacier. This property has been previously described in the Annual Report of the Minister of Mines of British Columbia for 1897, and in W. Fleet Robertson's report on Hall creek, which was published in the Annual Report for the year 1900, on page 100. As no important work has been done on the property since that time, it was not visited by the writer.

In this immediate vicinity are also the *Bannockburn* and *Red Elephant* groups of claims, which are described in the same report by Mr. Robertson. These are in the Almsworth Mining Division, just over the dividing line between it and the Trout Lake Division.

SOUTH-WEST MINERAL BELT.

As previously stated, this consists of a series of siliceous lime-bands, interstratified with slates lying next to a lime-grained granite. Associated with these rocks are occasional masses of serpentine. So far as at present explored, this belt extends along the south-west side of Trout lake from Stanbert creek on the north-west to the head of Poplar creek on the south-east, but the greatest amount of development has been done upon the mineral showings discovered on Trout mountain and those at the head of Canyon creek.

On the north-west slope of Trout mountain, at an elevation of 4,900 feet, is the *Copper Chief* group of claims, on which a vein of massive pyrrhotite from 8 to 14 feet wide outcrops in a series of bluffs, and has been traced by surface cuts for several hundred feet up the mountain-side. This vein has a strike of N. 30° W. and a dip of 80 degrees north-easterly, conformable to that of the enclosing formation. From a cut on this vein at an elevation of 4,950 feet a sample was taken across a 10-foot face of pyrrhotite, which assayed traces only in gold, silver, and copper. A second sample, taken from a cut higher up on the same vein, assayed: Gold, a trace; silver, 1 oz. Here and there in this pyrrhotite specks of chalcopyrite can occasionally be seen, but, so far, no ore of commercial value has been developed.

In addition to this vein, there are three narrow veins, having a north-south strike and dipping to the east at an angle of 11 to 15 degrees. These are from 3 to 8 inches wide, mineralized with galena, grey-copper, and zinc-blende, which at surface decompose to their respective carbonates. The minerals occur as a streak in the centre of the veins, which is usually less than an inch wide, but occasionally expanding to 4 inches. These veins occur in a belt of siliceous lime and are about 100 feet apart. On the middle vein two short adits have been driven and some surface trenching done. This work shows the vein to have a width of from 3 to 8 inches, frozen to the walls, with little stringers of quartz branching off from it into the enclosing rocks, which near the vein is very siliceous and slightly mineralized with iron pyrites. A sample taken across 4 inches of the ore exposed in the face of the lower of these two adits assayed: Gold, 0.02 oz.; silver, 141.4 oz.; copper, 2.1 per cent. A sample of the unmineralized wall-rock at this place assayed: Gold, a trace; silver, 2.2 oz.; no copper. Several small shipments have been made of ore sorted from the narrow veins, one of which, consisting of 3 tons, assayed: Silver, 225 oz.; lead, 16 per cent.; copper, 1.71 per cent.; zinc, 17 per cent.

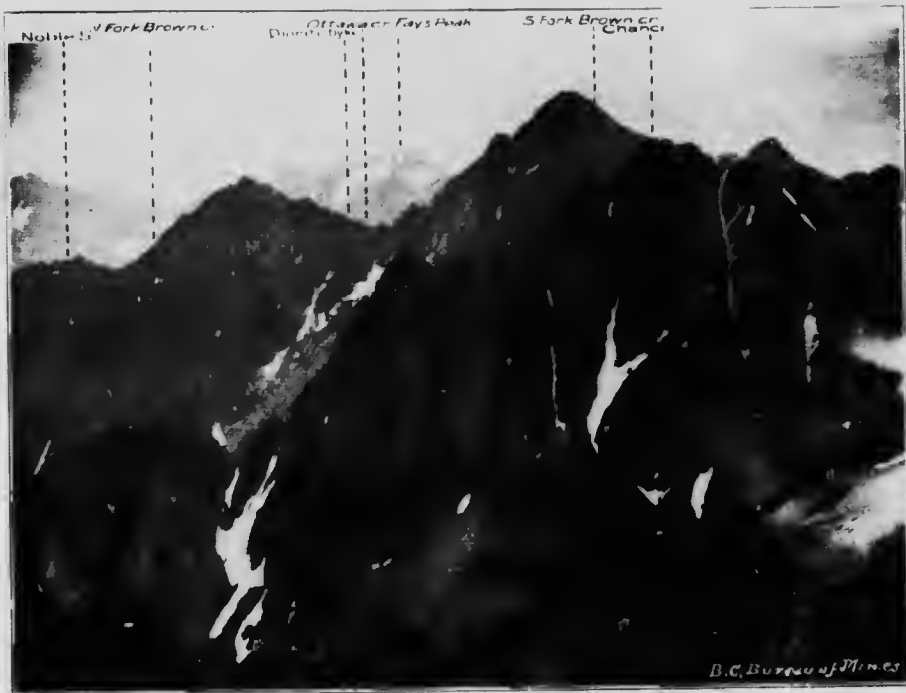


Plate 14. Noble Five Ridge.

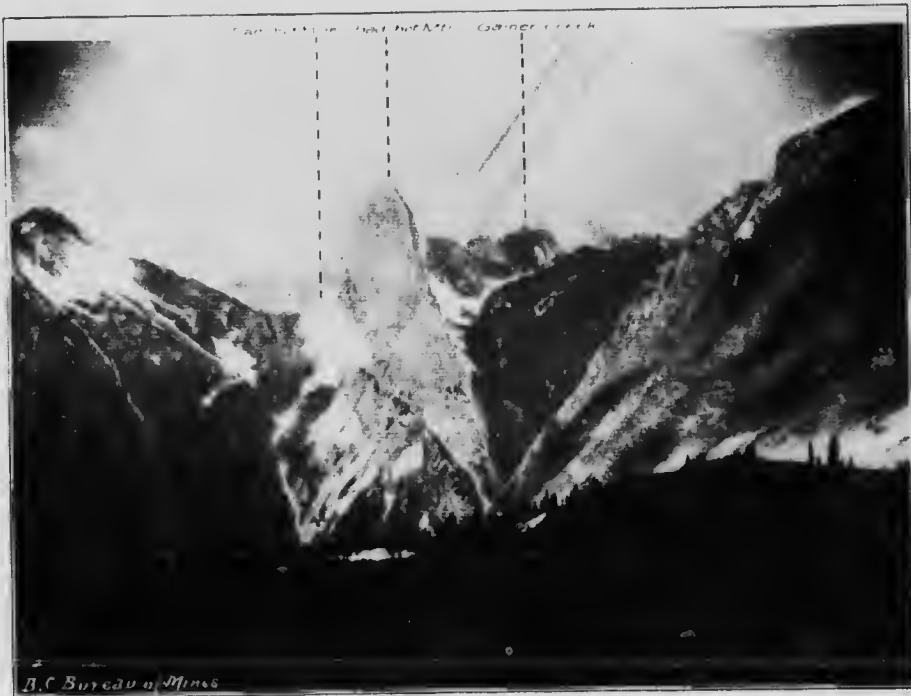


Plate 15. Badshot Mountain.

A short distance north of these adits and 100 feet farther up the mountain-side the outcrop of a second of these small veins has been exposed by stripping for a distance of 200 feet along its strike. This vein is from 4 to 10 inches wide, and, like the one below it, frozen to both walls, with the mineralization concentrated in a streak near its centre. A sample taken from several places along this outcrop assayed: Gold, a trace; silver, 180.8 oz.; copper, 1.1 per cent.; lead, 5.4 per cent. These workings are all on the south-west side of the pyrrhotite vein. On the north-east side of this vein the upper of the high-grade flat veins has been developed by an adit and an open-cut, disclosing a similar type of ore to that in the two adits previously mentioned. The distance between these workings is approximately 1,500 feet.

Adjoining this property on the north-east, but lower down the mountain, at an elevation of 4,400 feet, is the *Horseshoe* group, where there is a quartz vein in a belt of white crystalline lime, having a strike of N. 45° W. and a dip of 70 degrees north-easterly. Two shafts about 30 feet apart have been sunk on the vein to a depth of 100 and 150 feet respectively. On the 50-foot level of the west shaft a drift has been driven for a distance of 25 feet north-westerly along the vein, which is here well mineralized with iron pyrites and galena. A sample taken across 2 feet of the ore assayed: Gold, a trace; silver, 79.4 oz.; lead, 42.3 per cent. In the other shaft a similar class of ore occurs, but the mineralization is not uniform throughout the vein, occurring more or less in isolated bunches. A sample taken from the more heavily mineralized portion near the collar of the shaft assayed: Gold, 0.04 oz.; silver, 80.2 oz.; lead, 41.4 per cent.; while a sample taken from the bottom of the shaft at a depth of 100 feet assayed: Gold, 0.02 oz.; silver, 65.4 oz.; lead 55.6 per cent.

Immediately adjoining this property to the south-east is the *Lucky Boy*. *Lucky Boy*, where a quartz vein occurs in a silicified schist containing some lime. The mineralization consists of galena, grey-copper, iron pyrites, and zinc-blende, with some calcite, in a quartz gangue, and varies in width from that of a knife-blade to several feet. It has an east-and-west strike, with an average dip of 50 degrees to the south, but in places becomes almost horizontal and at others quite steep. It apparently follows the major jointing of the enclosing rocks.

The vein has been developed by a number of surface cuts, adits, and an incline shaft sunk to a depth of 200 feet. From this shaft drifts have been made in either direction along the strike of the vein, and a considerable tonnage of ore extracted, from which 400 tons was sorted and shipped, having an assay value of: Silver, 200 to 300 oz.; lead, 20 to 35 per cent.

The property is owned by a Philadelphia (U.S.A.) company, and remained idle from 1906 to 1912, when it was reopened and some ore extracted, of which 28 tons was shipped, assaying about the same as the former shipments. From the shaft on the 100-foot level drifts have been made in either direction along the strike of the vein for a distance of 100 feet, and stopes opened. Near the face of the west drift is a streak of ore 6 inches wide containing much grey-copper; a sample of this ore assayed: Gold, 0.1 oz.; silver, 191.2 oz.; copper, 3.3 per cent. At the head of the stope on this level, 20 feet above it, and 50 feet back from the face, the ore contains a considerable amount of galena and shows a width of 10 inches. A sample of this ore assayed: Gold, 0.4 oz.; silver, 76.8 oz.; lead, 47.2 per cent.

In addition to the vein above described, there are others occupying parallel fissures, but are not so well mineralized, and have had little work done on them. Where the vein widens out it contains inclusions of the country-rock, and there is evidence of replacement.

These properties are distant about four miles north-westerly from the town of Trout Lake, with which they are connected by an excellent trail.

At the head of Glacier creek, on the south-west side of Trout lake, at an elevation of 6,200 to 7,000 feet, is the *Ethel* mine, where there is a quartz vein from an inch to 18 inches wide, striking N. 45° W., with a dip of 60 degrees north-easterly, in a belt of lime-schist. The ore

occurs irregularly in the quartz as solid bunches and disseminated through the rock. The mineralization is galena, grey-copper, zinc-blende, and iron pyrites usually rich in silver. It has been developed by four adits, driven from the side of a steep draw, along its strike, the maximum difference of elevation between the highest and lowest drift being 200 feet. The property has been worked spasmodically for a number of years, and several shipments made at different times, the records of some of which only, are available. One lot of 5 tons shipped in the early part of 1900 assayed: Silver, 307.1 oz.; lead, 28.2 per cent.; zinc, 1.4 per cent.; a specially rich lot of 1,150 lb. assayed: Silver, 560 oz.; lead, 39.6 per cent.; zinc, 2.3 per cent.; and a third lot weighing 1,800 lb. assayed: Silver, 171.0 oz.; lead, 17.6 per cent.; zinc, 1.9 per cent. An assay of a selected sample of carbonate ore from close to the surface assayed: Gold, 0.5 oz.; silver, 1,110 oz.; lead, 39.3 per cent.

In sorting the ore which was shipped a considerable quantity of siliceous ore has been accumulated on the dump, the bulk of which assays: Silver, 40 oz.; lead, 4 per cent.; but, owing to the conditions of transportation, this is too low grade for shipment.

The property is connected with the town of Trout Lake by a trail having an average grade of approximately 1,500 feet to the mile, which is decidedly steep for packing over. There would be no difficulty, however, in building an aerial wire tram from the mine to the shore of the lake, and of carrying on operations during all times of the year.

While the vein is comparatively narrow, and the high-grade ore occurs in more or less scattered masses, the whole of the vein can be profitably mined if provided with a concentration plant.

On the south-east slope of Trout mountain, at the head of **Craig**. Three-mile creek, is the *Craig* property, where there are two veins in a calc-schist. Only a small amount of work has been done on these veins, which are of the same type as those on the *Ethel*, and occur in the same belt of rocks. The ore consists of iron pyrites and galena in a quartz gangue, samples of which assay: Gold, 0.2 oz.; silver, 11.5 to 30.3 oz.; lead, from 2 to 29.6 per cent.

There are other prospects located at different places along this belt, in the valleys of the creeks tributary to Trout lake, upon all of which more or less work has been done, and upon which there are said to be good "showings" of ore. They have, however, not been worked for a number of years, and were not visited by the writer.

On Mobbs (Canyon) creek, which flows into the Lardeau river **Senorita**. a short distance below the south end of Trout lake, several promising prospects exist, one of which, about two miles from the town of Gerrard, is the *Senorita* claim, where a quartz vein from 1 to 3 feet wide, with slickensided walls, has been discovered. The mineralization consists of galena and grey-copper, selected samples of the latter giving assays as high as 1,000 oz. in silver to the ton. The vein, however, is in a badly shattered zone, and is consequently much broken. Owing to lack of capital, only the necessary assessment-work has been done on this property.

In a basin at the head of the South fork of Mobbs (Canyon) **Linson's View**. creek a number of claims have been located on a series of veins traversing the phyllite close to its contact with the granite. The *Linson's View*, situated on the north-west side of the basin at an elevation of 6,000 feet, has three known veins traversing it, one of which is quartz mineralized with galena, zinc-blende, iron pyrites, and grey-copper, from 4 to 6 feet wide, occupying a fault-fissure in the granite. It has been developed by a crosscut and a shaft 35 feet deep, from the bottom of which a short level has been driven in a south-westerly direction along the strike of the vein. In doing this work some 900 lb. of ore was sorted out and shipped to the smelter, assaying: Silver, 261.2 oz.; lead, 12.3 per cent. This class of ore occurs as streaks and bunches in the quartz.

The second vein lies at the contact between the schist and lime, where it has been exposed by a few surface cuts. It is from 4 to 8 inches wide, containing

galena, iron pyrites, and grey-copper, assaying: Gold, 0.08 oz.; silver, 40.3 oz.

The third vein outcrops 50 feet higher up the mountain, in a carbonaceous phyllite, and is shown by a surface cut to have a width of 10 feet, slightly mineralized with galena and iron pyrites. This vein has a south-easterly strike with a south-westerly dip at a high angle.

At the head of the basin, at an elevation of 4,800 feet, is the **Other Claims.** *Pedro* claim, where a quartz vein 2 to 3 feet wide, mineralized with galena, zinc-blende, iron pyrites, and a little grey-copper, has been developed by a short adit.

On the south-east side of the basin, at elevations ranging from 5,000 to 7,100 feet are the *Black Jack*, *Grand Solo*, and *Ruby Silver* groups on all of which quartz veins, having a south-easterly strike and south-westerly dip, occur in a phyllite formation, having a general north-westerly strike and north-easterly dip.

The veins are more or less mineralized with galena, zinc-blende, iron pyrites, and grey-copper, but, owing to their distance from transportation and high altitudes, can only be worked during the summer months, and only ore of a high grade will pay to mine.

On the *Grand Solo* claim is a quartz vein 2 to 4 feet wide, on the foot-wall side of which is a streak heavily mineralized with galena and grey-copper from 4 to 18 inches wide, a selected sample of which assayed: Silver, 555 oz.; lead, 17 per cent. This sample contained a large proportion of grey-copper. A second sample, taken from the same streak in a cut higher up the hill, assayed: Silver, 61.1 oz.; copper, 3.4 per cent.

Near the summit of the divide, at an elevation of 7,800 feet, close to the foot of a glacier, on the *Ruby Silver* claim, is the outcrop of a quartz vein 2 to 4 feet wide, with a streak of galena and grey-copper a few inches in width lying between it and the foot-wall phyllite. Selected samples from this streak assayed: Silver, 129 oz.; lead, 30 per cent.; copper, 4 per cent. The vein has been traced along its strike by a series of surface cuts, and has been proved to be the continuation of that on the *Grand Solo*.

These properties are distant about twelve miles from the town of Gerrard, and are connected therewith by a rough and steep trail which, at its upper end, crosses the path of several formidable snow-slides.

POPLAR CREEK SECTION.

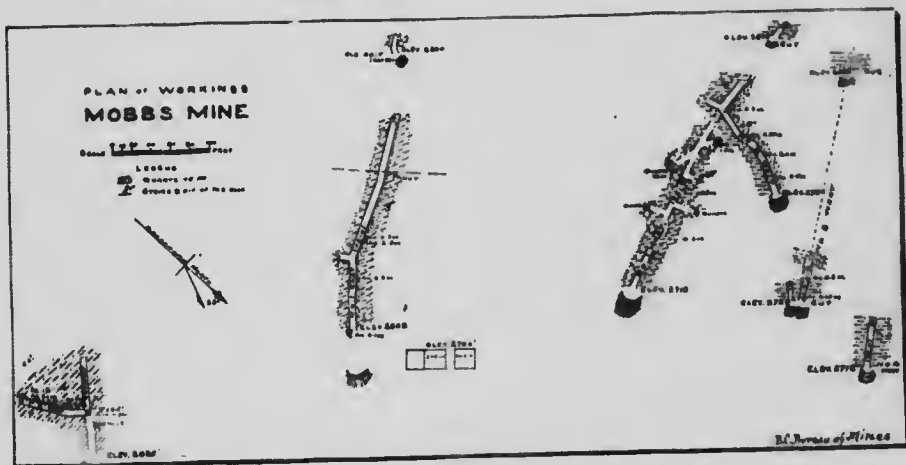
The formation on the south side of the Lardeau river at Poplar is considered to be the south-easterly extension of the Central Mineral Belt, and consists of green schists, slates, and phyllites, with which are associated broad bands of the yellow-weathering diabase-schist.

In the diabase-schists and phyllites quartz veins occur, varying in width from almost microscopic stringers to veins several feet wide. Of these veins there are two series, one of which conforms to the strike and dip of the enclosing rocks, and the other cutting them at varying angles, the greater number of the latter being nearly at right angles to the strike of the schists. In a number of places the diabase-schist and the veins associated with it are impregnated with iron pyrites and arsenopyrite, the latter sometimes occurring as solid streaks from a quarter to an inch wide, often very rich in gold. Some of the quartz veins also carry gold, but are "bunchy." The arsenopyrite is usually a heavy gold-carrier, weathering to iron oxide, in which the gold is sometimes found as wire, in plates, or as a spongy mass.

In 1903 much excitement was caused in the Poplar Creek district by the discovery of a rich pocket of gold in a quartz vein on the *Lucky Jack* claim, within a hundred yards of the railroad, resulting in quite a rush, and the whole country being staked for miles. Development proved disappointing, however, and a few shots blew out the rich pocket. Subsequent work failed to find any more of this specimen ore, the balance of the

The "G" vein belongs to the first series, and is an irregular deposit formed by replacement along a fracture-zone in the phyllite. It has been developed by surface cuts and a crosscut which taps the vein 30 feet vertically below its outcrop. From the crosscut drifts were driven 20 feet in an easterly direction and 15 feet in a westerly direction along the strike of the vein. A pocket of galena was found in the vein where cut by the crosscut, and a winze was sunk on it to a depth of 80 feet, in the hope that it was the apex of an ore-shoot. The galena gave out a few feet below the crosscut level, and 30 feet below the collar of the winze the ore-bearing fissure was cut off by a fault which had a north-easterly dip at an angle of 73 degrees, a width of 3 feet, and was filled with crushed and broken rock. From the 50-foot level in the winze, and again from the bottom, crosscuts were driven north-easterly beyond the fault, hoping to find the downward continuation of the galena ore, but without result.

The "G" vein consists of quartz, mineralized with iron pyrites and galena, from a few inches to 3 feet wide, a sample of which, taken from the east drift a few feet east of the crosscut, assayed: Silver, 7 oz.; lead, 4.2 per cent.; and a sample across the face of the drift assayed: Silver, 2.1 oz.; lead, 1 per cent. A sample from the ore showing in the face of the west drift assayed: Silver, 0.9 oz.; lead, 0.5 per cent. From the pocket of galena ore found by the crosscut several tons were sorted out, a sample of which assayed: Silver, 95 oz.; lead, 77.5 per cent. All the above samples gave negative results for gold.



Of the cross series of veins, the No. 1 east and Nos. 1 and 2 west have received the most development. The No. 1 east is from 2 to 4 feet wide, occupying a well-defined fissure separated from both walls by a gouge, and showing slickensides in several places. Its mineralization consists of iron pyrites, galena, and a little free gold, in a quartz gangue. It has been developed by a number of surface cuts, a shaft 23 feet deep, and an adit on its course 220 feet long. Samples taken at various places along this vein show it to contain: Gold, from 0.05 to 0.3 oz.; silver, 2.5 oz.

Two hundred and ninety feet west of this No. 1 east is the No. 1 west vein, which occupies a similar fault having a strike of S. 57° W., with an almost vertical dip. The vein is from 18 inches to 5 feet wide, mineralized with iron pyrites, occasional patches of galena, and some free gold, in a gangue of quartz having a banded structure. It has been developed by several surface cuts and an adit 200 feet long. Samples taken at various places along this adit assayed: Gold, from 0.3 to 0.35 oz.

At 89 feet in from the portal a small quartz vein conforming to the strike of the formation was passed through. At 140 feet in a second small quartz vein was

found on the west side of the drift, the eastern extension of which was cut 10 feet farther on. A sample taken from the western limb of this vein assayed: Gold, 1.5 oz.; and panned quite well.

The No. 2 west vein has an average strike of S. 45° E., with a dip to the south-west at an angle of 37 degrees. Commencing at a place 40 feet vertically above and 180 feet north-west of the portal of the No. 1 west adit, an adit has been driven along the No. 2 west vein for a distance of 128 feet, where it makes junction with the No. 1 west vein, and is apparently cut off by it. A crosscut driven through this latter and a drift along it to the south-west fails to find any continuation of the No. 2 west vein.

This No. 2 west vein is from 15 to 20 inches wide, and gave the following assays from samples taken across it at different places in the adit: At 20 feet in from the portal the sample assayed: Gold, 0.5 oz. At 38 feet the sample assayed: Gold, 2 oz. At this place a few specimens showing visible gold were obtained, but no pieces in which gold could be seen were included in the sample assayed. Sixty feet in the sample assayed: Gold, 0.25 oz.; and at the junction of this vein with the No. 1 west the sample assayed: Gold, 0.3 oz.

The Nos. 3 and 4 west veins lie still farther to the west of the No. 2, and have been prospected to a limited extent by surface cuts and a short adit. In width these veins vary from 2 to 4 feet, and samples assay: Gold, from 0.1 to 0.25 oz. to the ton. A number of panning tests of ore from the surface cuts showed small quantities of free gold.

The accompanying map of the workings (Fig. 4) shows the relative positions of the several veins, adits, and cuts, their altitudes and places from which samples were taken, with the assay results.

South-east of the *Mobbs* mine, on Rapid creek, is the *North Star* group, where a similar vein system occurs. On this property some stringers of arsenopyrite in a diabase-schist have been found, which are rich in gold. The development on this property consists of surface cuts and an adit, but, as it has been idle for a number of years and no information was to be obtained which would be of material assistance in forming an opinion as to the mineral resources of the district, and also owing to lack of time, the property was not visited.

At the *Calumet and Hecla*, a property half a mile north-west of the town of Poplar, within a few hundred yards of the railway-track, development-work was in progress this summer. On this property there is a mass of quartz, having a strike of N. 45° W. and a slight north-easterly dip, some 20 feet wide, occupying a zone of crushing in the diabase-schist, which here forms the country-rock. Several open-cuts have been made along its outcrop, and a shaft (elevation 3,000 feet) sunk thereon to a depth of 34 feet. From the bottom of the shaft crosscuts were driven 5 feet to the north-east and 10 feet to the south-west through the quartz. At the bottom of the shaft the ore-body consists of a mass of crushed schist and quartz mineralized sparingly with iron pyrites, on the hanging-wall side of which there is 8 feet of solid quartz, and on the foot-wall side 4.5 feet. In order to determine the value of this material, samples were taken at intervals across the bottom of the shaft, commencing from the hanging-wall side, as follows: Sample No. 1—5 feet of quartz assayed: Gold, 0.1 oz.; silver, 0.8 oz. Sample No. 2—3 feet of quartz assayed: Gold and silver, traces. Sample No. 3—4 feet mixture schist and quartz assayed: Gold, 0.15 oz. Sample No. 4—2 feet crushed quartz and schist assayed: Gold and silver, nil. Sample No. 5—4.5 feet quartz assayed: Gold and silver, traces.

From the collar of the shaft three samples were taken, commencing from the hanging-wall side, as follows: Sample No. 6—4 feet quartz assayed: Gold and silver, traces. Sample No. 7—12 feet schist assayed: Gold, 0.1 oz. Sample No. 8—8 feet quartz on the foot-wall side assayed: Gold, 0.15 oz.

A sample taken across 4 feet of quartz, 7 feet below the collar of the shaft, where it was a little more highly mineralized, assayed: Gold, 0.1 oz.

Two hundred and seventy feet down the hill north-easterly from the shaft, and some 40 feet below it, a crosscut was driven to tap the vein. The total length of this crosscut is 269 feet, and it has passed through the place where the vein should have been, without discovering it. The diabase-schist was cut at 225 feet in from the portal of the crosscut, and at 240 feet a fracture-plane was passed through, containing some quartz stringers having a north-westerly strike. A drift was made along this for a distance of 68 feet in the hope that it would lead to the vein, but with negative results. Some samples were taken along this drift, and from some mineralized streaks in the diabase passed through by the crosscut, which were assayed for gold and silver, but were not found to contain any of these metals.

There are on this property other vein-outcrops, one of which, along a fault, contains some copper in addition to gold. At the time of my visit to the property this summer development was in progress, which consisted of driving exploratory crosscuts through the diabase-schist towards the copper-bearing vein above mentioned, and the gold-bearing quartz vein. These were being driven from an approximate elevation of 2,400 feet, but, aside from cutting a few stringers of quartz containing iron pyrites, nothing of importance had been discovered, but these crosscuts had to be driven some distance farther before they could be expected to cut the downward continuation of any of the known ore-bearing fissures.

Close to one of these new crosscuts there was found, a few years ago, a stringer containing galena rich in gold. This stringer was only a few inches in width, and the rich galena only occurred for a short distance in it, but was exceedingly rich, some specimens containing as much as 25 per cent. gold, which occurred native in the galena. It was rather hoped that the work going on this summer would discover another one of these rich stringers.

The results of this exploratory work will be watched with interest, as, if it be found that the mineralized fissures contain ore of a commercial value at the depth at which these crosscuts will intersect them (some 600 feet below their outcrops), it will go a long way towards restoring confidence in the camp, and will stimulate development of other properties.

In the immediate vicinity of the town of Poplar are located the *Lucky Jack*, *Suede*, and *Gold Park* (Martin & Gilbert) properties, in which occur quartz veins and stringers both parallel to and crossing the diabase-schist and phyllite formations. The veins are of quartz, mineralized with iron pyrites, galena, arsenopyrite, and native gold, varying in width from a fraction of an inch to as much as 6 feet.

On the *Gold Park* several veins occur at close intervals, and at surface the decomposing diabase-schist lying between them yields gold by panning. An attempt was made to sluice some of this decomposing surface material, but it did not pay. In a few places, both on the *Gold Park* and *Suede* properties, stringers of arsenopyrite traverse the formation in all directions, forming a stockwork. Some of this mineral is very rich in gold, assays of selected specimens showing it to contain as much as 325 oz. of that metal to the ton. A mill test of 8 tons of ore taken from the *Suede* group some years ago yielded gold to the value of \$246 gross, a trifle over \$30.81 a ton. It is obvious, however, that there was not much of this material available, or the property would not now be idle.

In 1910 a considerable amount of prospecting was done along that part of the diabase-schist on the *Suede* property containing arsenopyrite stringers. The work consisted of sinking a number of test-pits and driving an adit on some of the quartz veins. While this exploration-work did not reach any great depth, it was on the whole disappointing, many of the pyrite stringers proving to be gash-veins, and playing out a few feet below the surface of the ground. The quartz veins also were found to be spotty and to be low grade between the richer spots. Sufficient work has not yet been done, however, to finally decide the value of this property, one way or the other.

About five miles up Poplar creek from the railroad a belt of serpentine crosses the creek, having a north-westerly strike and of much the same appearance as

that noted on Brown creek. This serpentine contains asbestos in the seams which traverse the rock and along the slips.

Along the path of a snowslide on the steep mountain-side, 200 or 300 feet above the level of the creek, the rock is exposed over a considerable area, showing seams and masses of asbestos in a number of places. The asbestos at surface has a short fibre and is quite brittle, but probably could be utilized in the manufacture of insulating material for boiler and steam-pipe coverings, etc. No work has been done on this property to ascertain its commercial value.

On the north-east side of Poplar creek, on Mount Johnson, between Lake and Hope creeks, is situated the *Star* group of claims, at an altitude of 7,300 feet. The formation consists of carbonaceous calc-schist, phyllite, and limestone, very similar to the rocks noted on Surprise creek and in Gold gulch, lying between the Central and Lime Dyke Mineral Belts.

On the property are two veins, one of which consists of quartz mineralized with galena and iron pyrites, having an average width of 6 feet, with a strike of N. 63° W., cutting the formation at an angle of between 20 and 25 degrees, with a steep dip to the north-east. The second vein consists of quartz carrying iron pyrites and galena in a dark, banded limestone of a schistose structure. The quartz does not occur as a well-defined vein, but is a series of stringers between the laminae of the limestone, and conforming to both their strike and dip.

These quartz stringers vary in width from a few inches to several feet. It is rather a band of mineralized limestone than a vein proper. The strike of this rock is N. 40° to 45° W., with a slight dip to the north-east. Development-work consists of surface cuts and shallow adits a few feet long. The quartz vein has been proved for a distance along its outcrop, of several hundred feet on the north slope of the divide, where, in an ancient glacial basin, a short adit has been driven, showing it to be well mineralized with galena and iron pyrites. A sample containing galena from this place assayed: Gold, 0.2 oz.; silver, 30.3 oz.; lead, 29.6 per cent. A sample of quartz containing iron pyrites from which the galena had been removed assayed: Gold, 0.2 oz.; silver, 11.5 oz. In a cut 300 feet below this adit is an outcrop of galena, from which a sample taken assayed: Silver, 34.16 oz.; lead, 44.44 per cent.

Down the creek which flows from the basin into Hope creek a large amount of float has been found, which presumably comes from this vein.

The lime vein has been opened on the south side of the divide by a series of surface cuts and short crosscuts. The mineralization consists of galena, iron pyrites, and a little zinc-blende, and has an average width of 4 feet. Samples taken from several of the cuts, combined, quartered down, and assayed, show it to contain: Silver, 2.64 oz.; lead, 23.23 per cent. At this altitude timber is not plentiful, the trees being stunted and not well suited for mine purposes. There is, however, plenty of suitable timber available down the creek which heads on this side of the divide and flows into Lake creek.

It is probable that prospecting will show this mineralized lime-belt to outcrop farther down the Lake Creek slope, where an adit could be driven on it and thus develop it at depth. In this event it could be easily and cheaply mined, there being ample facilities for economic mining, and the ore could be taken to the railroad by way of Lake creek. The quartz veins could be similarly developed from the Hope Creek side, and its ore taken out by way of that stream to the railroad.

There are several other prospects tributary to the town of Poplar upon which more or less work has been done at various times, but which have lain idle now for a number of years. Particulars of these, as well as additional information with regard to some of those already mentioned, will be found in a report by R. W. Brock, contained in the Summary Report of the Geological Survey of Canada for the year 1903, on pages 72 to 77, and in the report for the year 1904, on pages 89 and 90; also in the report of W. Fleck Robertson, which appeared in the Annual Report of the Minister of Mines of British Columbia for the year 1903, on pages 112 to 116.



Plate 16. Mohican Mountain



Plate 18. Hydraulic Mining at Tenmile



PLACER GOLD.

The existence of placer in Lardeau creek and the Lardeau river, in the Trout Lake Mining Division, has been known for a number of years, but, so far, all attempts at saving the gold have proved failures, partly owing to the difficulty in diverting the water, and partly to the presence of large boulders in the stream-beds where the gold occurs.

Near the town of Trout Lake, at the mouth of a small canyon, during a period of extra low water, a pocket of gold was found a good many years ago in the gravel of the present stream-bed, and the gravel-banks a little farther down the stream contain gold, as can be proved by panning. In order to work this placer, a Spokane company built a dam at the mouth of the canyon, from which a flume was constructed to carry the water of the creek and expose the gravel of the creek-bed, so that it could be mined. The experiment was unsuccessful, however, on account of the heavy flow of water that season, and the following spring's high water took out a part of the flume, which was never rebuilt.

At Ten-mile, a short distance below the mouth of Garner creek, a placer-miner by the name of Peter Culkeen has done much exploration-work endeavouring to locate pay-gravel in an ancient lake-basin. Lardeau creek at this place is crossed by a rim of hard rock, through which it has only recently (geologically speaking) cut, and which it has not yet worn down to grade, but flows over in a low fall.

Placer gold has been found on both sides of this rim, and the supposition is that on bed-rock in the basin above gold in paying quantities exists. Mr. Culkeen has been acting on this theory for the past few years, and during his leisure-time has done a considerable amount of trenching, sluicing, and hydraulicking with home-made apparatus. Plate 18 shows one of the trenches with his hydraulicking apparatus. It is his intention, during the low-water period this fall and winter, to drive a crosscut through the rock-rim of the basin and explore the gravel along bed-rock above it. There is too much water in the gravel to permit of its being explored by shafts, which Mr. Culkeen attempted to do, but only succeeded in sinking a few feet before the water drove him out.

He has found gold in several places in the gravel; some pieces shown to the writer were a good size, but considerably flattened and worn smooth, showing that they have been transported some distance. In the Lardeau river below Poplar gold has been found in the present bed of that stream as far south as Gold Hill, in the Ainsworth Mining Division. The river, however, is full of boulders, some of which are quite large, and contains such a heavy flow of water that it would only be possible to work it by means of a dredge.

An attempt is being made to do this by an American company, the dredge being located in the river a short distance above the railroad bridge at Gold Hill, in the Ainsworth Division. What the results are is not yet known. Owing to lack of time, and the dredge being outside the district under examination, it was not visited by the writer, nor did inquiry elicit any definite information. The problem of successfully dredging the Lardeau river is a difficult one, on account of the swiftness of the stream and the presence of boulders, which add materially to the cost of operations.

ACKNOWLEDGMENTS.

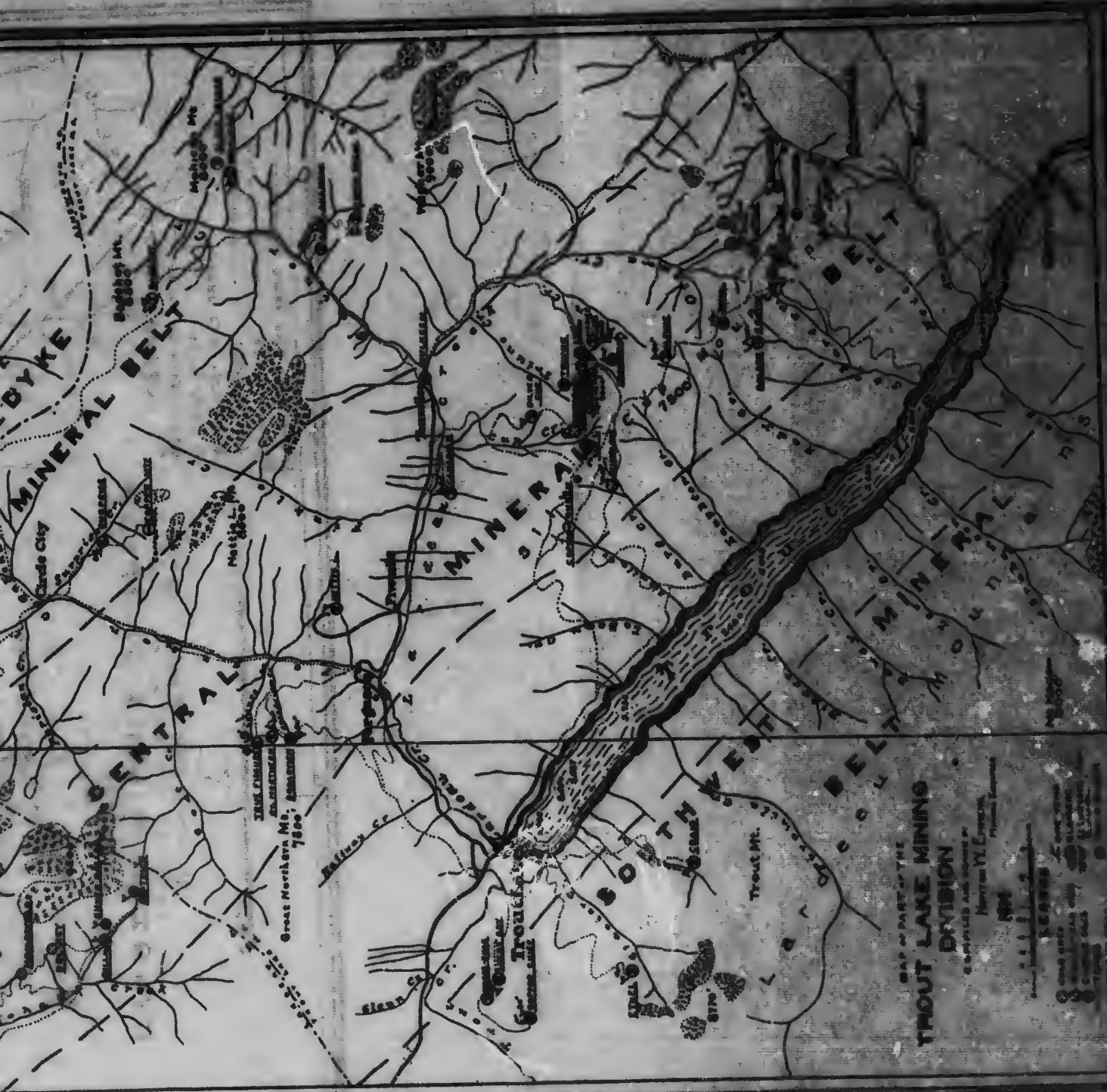
In making the examination of the Trout Lake Mining District the writer is particularly indebted to the following gentlemen for assistance and information: Mr. J. T. Lanthers, Mr. J. C. Kirkpatrick, Mr. Alex. McLean, Mr. P. Culkeen, Mr. H. Rogers, Mr. Dave Morgan, Mr. Wilson, manager at the Calumet and Hecla, and others.

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MAP OF PART OF THE
TROUT LAKE MINING
DIVISION
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