

CANADA
DEPARTMENT OF MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

GEOLOGICAL SURVEY

PAPER 40-18

REPORT
AND
PRELIMINARY MAP

HOUSTON MAP-AREA, BRITISH COLUMBIA

BY
A. H. Lang



OTTAWA
EDMOND CLOUTIER
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1940

Price, 10 cents

ERRATA

The numbering of the mines and prospects on Preliminary Map 40-18A is incorrect. The legend should read as follows:

DRIFTWOOD DISTRICT

1. Debenture Group: lead-silver
2. Cronin Mine: lead-silver-zinc
3. Hyland Basin Group: silver-gold-lead
4. Lamarr: silver-gold-lead-zinc-copper
5. Reisetor Crook: copper-lead-silver
6. Rainbow: silver-gold-copper
7. Lorrain: silver-lead-zinc
8. Silver Pick Group: silver-gold-lead
9. Home Group: silver-lead-zinc-copper
10. Cimbric Group: low-grade copper

DOMO MOUNTAIN

11. Babine Gold Mines, Limited: gold-silver
12. Domo Mountain Mining Company, Limited: gold-silver

GROUSE MOUNTAIN AND VICINITY

13. Deep Creek Group: silver
14. Cassiar Crown and Last Chance: silver-gold-copper
15. Mineral Hill: silver
16. Lakeview: silver-copper

BABINE LAKE

17. Newman Peninsula: silver-copper-zinc
18. MacDonald Island: large, low-grade copper deposit

TOPLEY DISTRICT

19. Richfield-Topley Group: silver-gold-zinc-copper
20. Three-Star Group: silver-lead-zinc
21. Gold Group: silver-gold-lead-zinc-copper
22. Golden Eagle Group: silver-gold-lead-zinc
23. Evergreen Group: lead-copper
24. Jack-rabbit Group: silver-copper
25. Joker Group: copper

MORICE MOUNTAIN

26. Success Group: copper-silver-gold
27. Peacock Creek: silver-copper

BOB CREEK

28. Gold Brick Group: large, low-grade gold deposit

OWEN LAKE

29. Owen Lake Mine: silver-gold-copper-lead-zinc
30. Grubstake Group: silver-copper

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Illustration

Preliminary geological map—Houston Map-area, B.C.

Houston Map-Area, British Columbia

INTRODUCTION

Houston area is bounded by latitudes 54 degrees to 55 degrees and longitudes 126 degrees to 127 degrees, and forms a rectangle 40 miles by 70 miles. It is crossed by the Prince Rupert line of the Canadian National Railways and lies between Telkwa and Rose Lake stations; Smithers is 12 miles west of the area. Topley and Houston are the principal villages in the area. The writer mapped the Houston area geologically in 1938 and 1939 and examined the mineral deposits. This report describes the general geology briefly and deals particularly with the geological aspects of the mineral deposits.

The writer desires to express his appreciation to his field assistants and to the many residents of the district who extended courtesies to him.

GENERAL GEOLOGY

The predominant rocks of the Houston area are part of a great assemblage of volcanic and sedimentary rocks that is widespread in west-central British Columbia. In his early work in the Bulkley Valley, Leach found a volcanic series similar to what had been termed the "Porphyrite group" in the Nechako Basin; this series was overlain by coal-bearing sediments of Lower Cretaceous age, which he named the "Skeena series". In his later work he found that the volcanic series changed from porphyritic near Telkwa to tuffaceous near Hazelton, and also that the Skeena series, although perhaps unconformable near Telkwa, was conformable with the tuffaceous rocks near Hazelton. As the term "Porphyrite group" seemed inappropriate Leach proposed the name "Hazelton group"¹, which has been retained to the present time.

Fairly detailed geological mapping had been done previously in three districts within the Houston area, comprising a total of 350 square miles. These districts are Driftwood Creek area² in the northwest corner of the Houston area, Topley area³ in the east-central part, and Owen Lake area⁴ in the southwestern part. In the Driftwood Creek area the Hazelton group was divided into three divisions: a lower volcanic division composed mostly of andesitic lavas and tuffs; a sedimentary division consisting of argillite, quartzite, and tuff, containing fossils of lower Middle Jurassic age; an

¹ Leach, W. W.: The Telkwa River and Vicinity, British Columbia; Geol. Surv., Canada, Pub. No. 988 (1907). Skeena River District; Geol. Surv., Canada, Sum. Rept. 1909, p. 63.

² Hanson, G.: Driftwood Creek Map-area, Babine Mountains, B.C.; Geol. Surv., Canada, Sum. Rept. 1924, pt. A, p. 19.

³ Hanson, G., and Plemister, T. C.: Topley Map-area, B.C.; Geol. Surv., Canada, Sum. Rept. 1928, pt. A p. 50.

⁴ Lang, A. H.: Owen Lake Mining Camp, B.C.; Geol. Surv., Canada, Sum. Rept. 1929, pt. A, p. 62.

upper volcanic division composed of rhyolitic and andesitic lavas and tuffs; a group of sediments whose relationship was not established definitely was thought to be possibly a local development in the uppermost part of the upper volcanic division. At Topley, volcanic rocks were found to overlie a large body of granite. They resembled some units of the Hazelton group and were mapped as such, although it was recognized that they might be younger. At Owen Lake, volcanic rocks resembling the Hazelton group were found to be overlain unconformably by sediments of probable Upper Cretaceous age, which are cut by younger granite.

The field work on which this report is based consisted of reviewing the geology of the three previously mapped districts and of mapping in a less-detailed manner the large remaining part of the Houston area. This work showed that the most satisfactory section of the Hazelton group within Houston area is that of the Driftwood district, partly because the volcanic divisions are clearly divided by the middle, sedimentary division whose age is known precisely, and partly because this mountainous district affords excellent rock exposures whereas much of the remainder of Houston area is covered with overburden. Some additions were made to the geological knowledge of the Driftwood area: marine fossils of probable Jurassic age were found in tuffs near the upper part of the lower volcanic division; additional collections of marine fossils of lower Middle Jurassic age were made from the lower beds of the middle sedimentary division and the upper beds of this division were found to be of continental origin, containing coal and fossil plants too poorly preserved for determination; and the sedimentary strata that had been supposed to be developed locally in the upper volcanic member were correlated with the middle, sedimentary division.

The sedimentary division was found on Dome Mountain and north of Fulton River, and a few small bodies of sediments in Bulkley Valley were mapped as part of this division on the basis of lithological resemblances and poorly preserved fossils. Elsewhere this division is lacking, apparently because it thins out to the east and to the south. Several occurrences of fossiliferous tuffs in the northwestern part of the area appear for lithological reasons to belong to the upper part of the lower volcanic division rather than to the sedimentary division. Relationship to the sedimentary division is the only certain criterion for distinguishing the upper and lower volcanic divisions, and, therefore, because of the limited extent of the sediments it is impossible to divide the bulk of the Hazelton volcanics of Houston area with any certainty, and they are mapped as "Hazelton group undivided". Most of the rocks so designated bear a lithological resemblance to the lower volcanic division, but certain rhyolites, particularly those forming the upper part of Morice Mountain, are more like the upper division. Included with this map-unit because of their small size are two occurrences of limestone and quartzite, one below the falls of Fulton River and the other at the north shore of Fulton Lake; these rocks contain poorly preserved fossils suggestive of Carboniferous or Triassic age.

A large body of granite outcrops sparingly across much of the low territory between Topley and Babine Lake and continues northeastward from that lake. Despite considerable field work devoted to the purpose, no contacts between this granite and any definite Hazelton rocks have been

found. The only rocks known definitely to be older than the granite are inclusions and an outcrop at the outlet of Fulton Lake, all of which are altered beyond recognition. The granite is thought to intrude the Hazelton group because practically all of the intrusives of British Columbia are Jurassic or younger, but the possibility that the granite is pre-Hazelton still remains.

The fact that the volcanic rocks of the Topley area overlie the granite with a basal conglomerate containing granite fragments was corroborated and a similar condition was found north of Babine Lake. Fossil plants were found in argillite immediately overlying the basal conglomerate in the Topley area and are of a type that may be either Jurassic or Cretaceous. The rocks that overlie the granite have been mapped separately from the Hazelton group, and are thought to be Cretaceous because they are post-granite and because they appear on the whole to have been less folded and altered than the Hazelton rocks. They bear some lithological resemblance to rocks of the Hazelton group, but in no way resemble the Tertiary rocks of Houston area.

Sediments of Leach's Skeena series outcrop immediately west of the Houston area, at Telkwa and south of that village, but these rocks have not been found within Houston area. A thick succession of argillite, sandstone, and greywacke occurs on Mount Nadina, and small remnants of similar rocks overlie unconformably volcanic rocks of the Hazelton group on the ridge west of Mount Nadina. Similar sediments occur on Houston Tommy Creek and on a creek 5 miles north, and on Tachek Creek. These occurrences contain fossil plants classed provisionally as Upper Cretaceous. These rocks bear considerable lithological resemblance to those classed as Skeena series. Somewhat similar sediments containing fossil plants classed as Upper Eocene or Oligocene outcrop on Nadina River, and an occurrence at the east boundary of the area, north of Rose Lake, is the continuation of a large body mapped as Upper Eocene or Oligocene in the adjoining Fort Fraser area.

In the Fort Fraser area the Upper Eocene or Oligocene sediments are interbedded with rhyolite flows, and for this reason lithologically similar flows and irregular, small intrusives in Houston area are also considered to be Upper Eocene or Oligocene. A large granite stock intrudes the sediments on Mount Nadina and is, therefore, very late Cretaceous or Tertiary in age, and several other stocks of granite, diorite, and related rocks, whose ages are unknown except for the fact that they cut the Hazelton group, are considered also to be early Tertiary, and it appears probable that the rhyolite is related genetically to the granite.

In much of the southeastern part of the area flat and gently dipping basaltic lava flows cover the older rocks. The total thickness of the lavas varies from less than 100 feet to about 1,500 feet, the thickest section being that of China Nose Mountain, southeast of Topley.

The area contains great expanses of glacial and fluvioglacial sand, gravel, and silt, which form serious obstacles to prospecting and to geological studies.

ECONOMIC GEOLOGY

With the exception of small placer gold deposits on Bob and Buck Creeks, the mineral deposits of Houston area are veins and replacements containing silver, gold, copper, lead, and zinc. In general, the silver content is unusually high. Except for a few deposits that may be classed as gold prospects, the gold content is too low to be of independent interest. Several properties have received substantial amounts of underground work and diamond drilling. Prospecting and development reached a peak in 1928 and 1929 and declined thereafter because of the lower prices of silver and base metals. Mineral production has consisted of the shipment of small lots of ore.

Veins are much more numerous than replacement deposits. Many veins are short, narrow, and lenticular, but others are of substantial size, and some deposits consist of zones of veins, lenses, and stringers that would be unimportant individually but whose aggregate is substantial. The most common metallic minerals are pyrite, sphalerite, galena, chalcopyrite, and tetrahedrite, which occur to some extent in practically all deposits. Pyrrhotite, alaskaite, bornite, malachite, specularite, and iron and manganese oxides occur in minor quantities in some deposits. The gold is usually associated with the pyrite and chalcopyrite and is rarely visible except microscopically. The silver is associated with tetrahedrite, alaskaite, and galena. Practically all the metals seem to be of primary origin, but the occurrence of a little native silver and copper indicates that some secondary metallization has probably occurred. Quartz is the common gangue mineral, rhodochrosite, barite, epidote, calcite, and ankerite occurring in a few places. Many deposits are characterized by alteration of the wall-rock to a soft, light grey rock, commonly containing disseminated pyrite, which is a useful guide in prospecting.

The deposits occur in the Hazelton group, in the volcanic rocks overlying the granite north of Topley, and in the small intrusive bodies. The intimate association in space between many deposits and the small intrusive bodies, leads to the conclusion that most or all of the deposits originated from the minor intrusives, either those now exposed or others not yet unroofed. They formed under fairly low temperature-pressure conditions. The minor intrusives and the rocks near them are, apparently, the most favourable for prospecting. The weaker rocks, such as argillite, contain many small fractures, and in consequence contain numerous small deposits.

Several regions within the map-area contain groups of deposits that have certain features in common. In the following pages the properties are classified according to these regions and the common features are outlined. Some properties have been described in earlier reports and have since been dormant; to avoid unnecessary repetition only the references to such properties are given.

MINERAL DEPOSITS

DRIFTWOOD REGION

The Driftwood region is a rugged part of Babine Mountains in the northwest corner of the map-area, bounded by Carr and McKendrick Creeks. The mountains are composed mostly of the sedimentary division and the overlying volcanic division of the Hazelton group. These rocks are folded into two rather flat synclines, the structure being such that the volcanic division forms most of the summits and the sedimentary division is exposed mainly on the valley slopes. With one exception, the mineral deposits occur in the uppermost beds of the sedimentary division or in the base of the volcanic division. Most of the deposits are in or near small intrusive bodies of rhyolite, quartz porphyry, and diorite. The most favourable places to prospect for additional deposits in the Driftwood region are, therefore, close to the contact between the above-mentioned divisions, particularly where the rocks are cut by minor intrusives. The contact between the two divisions is shown in detail on the Driftwood Creek sheet, Geological Survey Publication No. 2048, division 4 of that map being now considered equivalent to division 2.

1. *Cimbria Group*

References: Geol. Surv., Canada, Sum. Rept. 1924, pt. A, p. 33. Ann. Repts., Minister of Mines, B.C.: 1927, p. 138; 1932, p. 85.

2. *Cronin Mine*

References: Geol. Surv., Canada, Sum. Rept. 1924, pt. A, pp. 29-32. Ann. Repts., Minister of Mines, B.C.: 1925, p. 137; 1928, p. 167; 1929, p. 168; 1930, p. 141; 1931, p. 73.

3. *Debenture Group*

References: Geol. Surv., Canada, Sum. Rept. 1924, pt. A, p. 32. Ann. Repts., Minister of Mines, B.C.: 1913, p. 108; 1915, p. 77; 1916, p. 130.

4. *Hyland Basin Group*

References: Geol. Surv., Canada, Sum. Rept. 1924, pt. A, p. 32. Ann. Repts., Minister of Mines, B.C.: 1924, p. 97; 1925, p. 137; 1926, p. 133; 1935, p. 39C.

This property is at an elevation of 5,200 feet, at the south side of a large cirque near the head of Cronin Creek. Trucks can be driven up the Driftwood road to Engineers Camp, about 16 miles from Smithers, thence pack-horses are taken to the head of Driftwood Creek and over a 6,000-foot pass to Hyland Basin, a distance of about 6 miles from Engineers Camp. The claims are optioned to R. W. Wilson, of Vancouver.

The deposits are in sheared and fractured argillite, which forms the top of the sedimentary division of the Hazelton group. These rocks are intruded by several rhyolite dykes, some of which follow the shearing of the country rock.

The main showing is at the surface, exposed by a series of open-cuts for 250 feet, and consists of lenticular quartz veins following both walls of a rhyolite dyke that strikes north 70 to 80 degrees east, parallel to the shearing of the argillite. The dip, as well as can be determined, is steeply southeast. The dyke has an average width of 4 feet and the width of

quartz varies from a thin streak to 5 feet. The quartz is barren in places and elsewhere is well mineralized with galena and tetrahedrite, and a little sphalerite and chalcopyrite. The metal content is erratic but averages well, the results of channel sampling furnished by Mr. Wilson ranging to a maximum of: gold 1.20 ounces a ton; silver 595.0 ounces a ton. Seven tons of picked ore were shipped in 1937 from a cut near the southwest end of the zone, the content being: gold 0.98 ounce a ton; silver 273.0 ounces a ton; lead 32 per cent.

A crosscut was driven for 35 feet immediately below the surface showing, exposing the dyke and 1 to 2½ feet of well-mineralized quartz. The vein appears to be displaced 9 feet by a fault whose plane dips 20 degrees to the south.

An adit with backs of from 50 to 100 feet has been driven for 200 feet along the projected strike of the deposit, and from this working four short crosscuts have been driven in an attempt to locate the zone. Rhyolite that appears to be the downward continuation of the dyke was encountered at several places, but the only quartz exposed is at the end of the farthest crosscut, where up to one foot of quartz containing a little galena and tetrahedrite follows a contact between argillite and rhyolite.

The underground work is disappointing, as it suggests that the surface showing has been bottomed. There are other alternatives, however: quartz lenses may lie at irregular intervals down the dip of the rhyolite or they may rake into the hillside along the contact of the rhyolite; or the quartz may follow fractures dipping away from the dyke, in which case the short crosscuts would be inadequate to expose the downward continuation of the zone. These possibilities could be tested by diamond drilling or additional underground work.

5. *LaMarr Gold Mines, Limited*

References: Geol. Surv., Canada, Sum. Rept. 1924, pt. A, p. 35. Ann. Repts., Minister of Mines, B.C.: 1925, p. 137; 1926, p. 132; 1927, p. 119; 1928, p. 167; 1929, p. 165; 1930, p. 141; 1931, p. 73; 1937, pp. 16-19C.

This company controls claims described in earlier reports as the Silver King group and as the Skookum and Elk groups. These claims cover a basin at the head of Driftwood Creek and are reached by the Driftwood road, on which trucks can be taken to Engineers Camp, a distance of about 16 miles from Smithers, the remaining 3½ miles being suitable only for sleighs and pack-horses.

The country rocks on these claims are sheared, rhyolitic tuffs and flows belonging to the upper volcanic division of the Hazelton group. The lower workings of this property are close to the base of the division. The deposit consists of a shear zone containing quartz veins striking east, dipping 45 to 70 degrees north, and exposed for a total length of about 1,500 feet. The individual quartz veins are discontinuous and lenticular, ranging in width from 1 inch to 6 feet. The longest exposure is about 240 feet. The quartz contains variable amounts of galena, tetrahedrite, chalcopyrite, pyrite, and sphalerite, and a little native copper and native silver. High gold assays have been reported, but the gold content appears to be erratic.

The main working is an adit at elevation 4,950 feet, in the bottom of the basin and close to the east bank of Driftwood Creek. The adit runs north 20 degrees east for 197 feet, at which point it intersects the shear zone, following it 110 feet to the west and 130 feet to the east. In these drifts, which are about 50 feet below the surface, quartz is exposed for a continuous distance of 35 feet at and near the intersection of the adit, and it also occurs in different places along the two drifts. Seven tons of hand-sorted ore are reported to have been shipped in 1927 from the above-mentioned, 35-foot exposure, the metal content being as follows: gold 2 ounces; silver 627 ounces; copper 200 pounds; lead 642 pounds; zinc 653 pounds. A detailed account of these workings, with a plan, is contained in the Annual Report, Minister of Mines, B.C., 1937, pages 16-19C, and these details are not repeated in the present report. Since that plan was made a winze was sunk at the point shown on the plan as the end of the east drift. This was flooded, but it is stated to have been sunk for 12 feet, the zone being 8 feet wide at the bottom. The east drift has also been continued on a bearing of south 65 degrees east for 50 feet, at which distance the quartz pinches out and a crosscut was driven south 40 degrees east for 25 feet.

From the east bank of Driftwood Creek, 30 feet above the main adit, a drift has been driven along the shear zone for a distance of 97 feet. As this is only about 20 feet below the surface, the zone is much oxidized. A raise connects this drift with the drift from the main adit. About 10 tons of sorted ore, partly from this raise, was shipped in 1937 and assayed: gold 0.31 ounce a ton; silver 70.5 ounces a ton; copper 1.2 per cent; lead 3.6 per cent; zinc 2.7 per cent.

The probable continuation of the zone is exposed at an elevation of about 5,400 feet on the steep wall of the basin, distant about 1,200 feet east of the main adit. Here the surface showing consists of a lens of quartz up to 4 feet wide. The "Foley" adit was driven for 185 feet in an easterly direction, 70 feet below the lowest part of the surface exposure. The main part of this adit did not encounter quartz, but a short branch drift follows for 15 feet a vein from 6 inches to 2½ feet wide, striking south 70 degrees east and dipping 70 degrees north, containing banded sulphide minerals along the foot-wall.

At an elevation of 6,700 feet on a flat-topped ridge extending southward from Cronin Mountain, and about 3,000 feet east of the main adit, is a surface showing that may be related to the main shear zone. This vein strikes south 75 degrees east, the width and dip being uncertain. The quartz contains variable amounts of sulphide minerals and a picked sample is reported to have assayed: gold 0.24 ounce a ton; silver 92 ounces a ton; copper 2.5 per cent.

6. Lorrain Copper-Silver Mines, Limited

References: Geol. Surv., Canada, Sum. Rept. 1924, pt. A, p. 32. Ann. Repts., Minister of Mines, B.C.: 1921, p. 103; 1922, p. 105; 1924, p. 97; 1926, p. 134; 1928, p. 167; 1929, p. 166; 1930, p. 141; 1931, p. 73.

7. Rainbow Group

References: Geol. Surv., Canada, Sum. Rept. 1924, pt. A, p. 34. Ann. Repts., Minister of Mines, B.C.: 1925, p. 138; 1929, p. 165; 1930, p. 140; 1931, p. 73.

The Rainbow group is owned by Mrs. J. Wright and Angus McLean, of Smithers. It is situated at elevations of 3,500 to 4,100 feet on a ridge a quarter of a mile east of Sunnypoint cabin on the Driftwood road, about 15 miles from Smithers. Immediately southeast of the Rainbow group are the Driftwood, Harvey, and Judges groups; these are described in earlier reports, but are dormant at present.

The veins on the Rainbow claims occur in altered volcanic rocks at the base of the upper division of the Hazelton group. Four short adits and several open-cuts display quartz showings that are not exposed sufficiently along their strikes to permit one to determine whether all are separate veins or lenses, or whether some are connected.

The Taylor showing is in a 6-foot pit that was filled with water when visited. Specimens of quartz on the dump contain about 10 per cent chalcopyrite and tetrahedrite. Sixty feet below this showing an adit has been driven 136 feet, without disclosing the continuation of the vein.

Forty feet above the Taylor showing a pit exposes a zone striking north 25 degrees west and dipping 60 degrees northeast. It consists of altered volcanic rock containing small nests of quartz, chalcopyrite, and tetrahedrite. Mr. McLean stated that eight sacks of higher grade material were mined from this exposure and shipped, together with five sacks from another part of the property, to the sampling plant at Prince Rupert, the whole shipment assaying: gold 0.57 ounce a ton; silver 40.2 ounces a ton; copper 12.0 per cent; lead, trace; zinc 0.9 per cent; arsenic 0.55 per cent; antimony 1.65 per cent.

About 100 feet east of the last-mentioned open-cut an adit 75 feet long follows an irregular, lenticular quartz vein up to 6 inches wide that strikes north 85 degrees east, the dip varying from 50 degrees south to vertical. The vein consists of quartz and fairly massive tetrahedrite, chalcopyrite, and pyrite. Ore is said to have been shipped from this adit several years ago.

Fifty feet above the last-named adit another, 15 feet long, exposes two intersecting quartz veins containing considerable tetrahedrite. One vein, 3 inches wide, striking north 5 degrees east and dipping 40 degrees east, is terminated by a fault that strikes north 40 degrees west and dips 55 degrees southwest. The other vein is 4 inches wide, strikes north 65 degrees west, and dips 67 degrees south. The intersection is too disturbed to indicate the relative ages of the veins.

About 300 feet east of the Taylor adit an adit 50 feet long follows a vein up to 6 inches wide, striking north 70 degrees west and dipping 55 degrees southwest. The quartz contains streaks of tetrahedrite up to one-eighth inch wide, parallel to the walls.

Mr. McLean furnished the writer with the results of ten samples taken by Mr. J. T. Mandy from different exposures and dumps on this property. In these the gold content ranges from 0.01 to 1.00 ounce a ton, and the silver from 2.0 to 106.0 ounces a ton.

8. Reiseter Creek Group

Reference: Geol. Surv., Canada, Sum. Rept. 1924, pt. A, p. 35.

9. Silver Pick Group

References: Geol. Surv., Canada, Sum. Rept. 1924, pt. A, p. 33. Ann. Repts., Minister of Mines, B.C.: 1922, p. 106; 1923, p. 111; 1924, p. 97; 1925, p. 138; 1926, p. 134; 1927, p. 119; 1929, p. 168.

This property, known formerly as the Little Joe, is owned by A. Elmstead, the T. King Estate, and M. Kean Estate. It is at an elevation of 5,500 feet near the head of Little Joe Creek and is reached by a good trail from Engineers Camp on the Driftwood road, a distance of about 9 miles, or by the continuation of the Hyland Basin trail. The latter route is longer and crosses three high passes, but is convenient for engineers who may be visiting other properties.

The country rocks are sheared and altered rhyolite tuffs and flows at the base of the upper volcanic division of the Hazelton group.

The main showing is exposed in an adit driven in a northerly direction for 172 feet. A flat-lying zone of quartz lenses and stringers, with a total width up to 4 feet, is exposed for a length of about 130 feet. The quartz contains tetrahedrite and some galena, sphalerite, and chalcopyrite. A winze has been sunk for 30 feet and 11 tons of ore have been mined from an overhand stope. The zone strikes north 65 degrees west and dips 15 to 20 degrees north; the quartz lenses range from 1 to 16 inches wide. Samples and shipments are reported to have indicated a very high silver content and a moderate gold content.

A crosscut adit has been driven for 96 feet at a point about 100 feet below and 400 feet southwest of the main showing. In the roof, near the face, a shear zone 1 foot wide strikes north 32 degrees east and dips 20 degrees west. This zone contains masses of quartz up to 2 inches wide, containing rust and disseminated tetrahedrite. It is not clear whether this is the same zone as the main showing.

On the surface, about 200 feet above the main showing, a picked sample from a vein a few inches wide is reported to have assayed: gold 2.3 ounces a ton; silver 94 ounces a ton; copper 3 per cent.

On the trail, about a quarter of a mile east of the main showing, a vein up to 1 foot wide strikes north 50 degrees east and dips about 20 degrees northwest. The quartz contains limonite, tetrahedrite, chalcopyrite, and a little galena. A picked sample is reported to have assayed: gold 1 ounce a ton; silver 42.0 ounces a ton.

DOME MOUNTAIN

10. Babine Gold Mines, Limited

Reference: Ann. Rept., Minister of Mines, B.C., 1938, pp. 15-20B.

Babine Gold Mines, Limited, is a private company controlled by R. W. Wilson, of Vancouver, holding sixteen claims on the southeastern slope of Dome Mountain, adjoining the northeastern claims of the Dome Mountain Gold Mining Company. The property is about 25 miles from the highway, the last 19 miles being by a new road of good grade that is not yet gravelled but is used for sleighs in winter and pack-horses in summer.

The claims are much covered by overburden and observation of the rocks is confined largely to surface and underground workings. The rocks are interbedded andesite, tuff, and breccia, presumably belonging to the lower volcanic division of the Hazelton group; they have a northwesterly strike and are sheared in directions roughly parallel to the strike. These rocks are intruded by irregular, dyke-like bodies of quartz porphyry, the largest exposure being 15 feet wide. In general, the volcanic rocks are silicified near the porphyry contacts.

A zone about 300 feet wide, consisting of several approximately parallel veins and lenses dipping steeply northeast and striking at an average of north 45 degrees west, is exposed by strippings and open-cuts on the Free Gold and Iron Mask claims. The most important veins in this zone are a pair from 15 to 45 feet apart, which vary in width up to 3 feet but average 6 to 8 inches. In places the wall-rock contains disseminated sulphides for distances up to 1 foot from the veins. The more northerly vein of the pair (No. 2 vein) has been traced for 750 feet, and the southern one (No. 3 vein) has been traced for 400 feet. A small outcrop of quartz porphyry lies 150 feet north of the west end of the zone. What is called the No. 1 vein is a series of irregular lenses of quartz containing a little pyrite, lying 50 feet north of, and parallel to, the east end of the No. 2 vein. The No. 4 vein is about 80 feet south of, and parallel to, the east end of the No. 3 vein; it is up to 8 inches wide, is exposed for a length of about 200 feet, and consists of quartz with some pyrite. Several smaller lenses and stringers of quartz complete the zone as exposed at the surface.

An adit bearing south 40 degrees west has been driven for 343 feet, crosscutting the zone at depths up to 90 feet. Several flat veins, lenses, and stringers that may be related to the No. 1 surface exposure were intersected in this drive, but the continuations of the No. 2 and No. 3 veins were not found in this part of the workings. Two steep veins that are probably the continuations of the 3A and 4 surface exposures were struck 320 feet from the portal; these intersections form part of a zone of quartz lenses up to 10 inches wide that was followed by drifting in an irregular northwesterly direction for about 280 feet. At the face of the drift a crosscut was driven to the northeast for 75 feet, at which point it intersected a quartz vein up to 28 inches wide occurring partly in altered volcanic rock and partly in fractured rhyolite. This vein appears to be the continuation of the No. 3 vein, as a 70-foot raise inclined 80 degrees north connects with the surface exposure of the No. 3 vein; this raise was not examined.

The steep veins contain up to about 20 per cent pyrite, in the form of fine disseminations and banded masses. With this mineral are minor quantities of sphalerite, galena, tetrahedrite, and chalcopyrite. Mr. Wilson stated that he had found some visible gold. A microscopic study made in connection with a test shipment to the Bureau of Mines, Ottawa, is reported to indicate that 36.6 per cent of the gold is plus 200 mesh and 16.5 per cent is minus 800 mesh, and that the gold occurs as grains in galena and chalcopyrite that occur as minute veinlets in the fractured pyrite. This shipment consisted of 680 pounds taken from the underground exposure of the No. 3 vein, and it is reported to have assayed: gold 1.78 ounces a

ton; silver 2.18 ounces a ton; lead 1.54 per cent; zinc 5.87 per cent; copper 0.15 per cent; arsenic 0.02 per cent; sulphur 10.38 per cent. Assays of up to 8.3 ounces a ton of gold have been reported from dump samples.

The flat veins encountered in the adit are up to 30 inches wide and dip less than 20 degrees, except where rolls occur. They contain less sulphides than the steep veins, and the owner stated that although fair gold assays had been obtained in places, the average was low. These veins show only a slight tendency to penetrate the porphyry, suggesting that they were formed before the porphyry was fractured; some may even antedate the intrusion of the porphyry. The probable relationship between the steep veins and the porphyry makes that rock a guide for further prospecting, and it would appear that the most immediate objective for any further work would be to determine the position and extent of the porphyry masses.

11. Dome Mountain Gold Mining Company, Limited

References: Ann. Repts., Minister of Mines, B.C.: 1922, p. 100; 1923, p. 111; 1924, p. 96.

GROUSE MOUNTAIN AND VICINITY

References: Geol. Surv., Canada, Sum. Rept. 1915, p. 65. Ann. Repts., Minister of Mines, B.C.: 1916, p. 126; 1917, p. 111; 1920, p. 90; 1923, p. 113; 1924, p. 98; 1925, p. 140; 1926, p. 135; 1927, p. 138; 1928, p. 169; 1929, p. 169.

Grouse Mountain is a prominent ridge averaging 4,500 feet in elevation and situated 6 miles southeast of Walcott. The summit is reached by a steep go-devil road from Low's ranch. The mountain is composed of altered, contorted, and sheared lavas and water-lain tuffs of the Hazelton group. These rocks are intruded by numerous dykes and less regular bodies of diorite and coarse-grained feldspar porphyry, the diorite cutting the porphyry in places.

The deposits on the main part of the mountain are chiefly sheeted zones of sphalerite and chalcopyrite in the tuffs. They occur near the intrusives mentioned above and are probably related to them. High silver assays have been reported from certain shoots. Considerable underground work was done between 1916 and 1927 on the claims of the Cassiar Crown Copper Company, which are still kept in good standing. The adits on these claims were blocked by ice and could not be examined. Other nearby claims on which discoveries have been reported are the Lakeview, Cornu Copia, Black Fox, Hidden Treasure, Rainstorm, and Solo. These properties are not discussed because they are described adequately in the references listed, no evidence of recent work being found.

13. Last Chance Group

Reference: Ann. Rept., Minister of Mines, B.C., 1937, p. 11C.

In 1935 a discovery was made on the Last Chance claims, at the northwest end of Grouse Mountain. This prospect is reached by a sleigh road from Farewell (Deep) Creek. It consists of quartz veins in andesitic rock, the veins being mineralized with tetrahedrite and minor amounts of pyrite. A long description is contained in the reference given above,

where the best assay is recorded as: gold, 0.33 ounce a ton; silver, 312.0 ounces a ton; copper, 4.0 per cent; from a width of 3 inches. A grab sample from about 1 ton of ore is reported to have assayed: gold, 0.10 ounce a ton; silver, 119.0 ounces a ton; copper, 3.5 per cent.

14. Mineral Hill

References: Ann. Repts., Minister of Mines, B.C.: 1914, p. 226; 1925, p. 141; 1926, p. 137.

15. Deep Creek Group

Reference: Ann. Rept., Minister of Mines, B.C., 1928, p. 169.

16. Ivanhoe Group

Reference: Ann. Rept., Minister of Mines, B.C., 1928, p. 169.

17. Lakeview Group

Reference: Ann. Rept., Minister of Mines, B.C., 1926, p. 144.

BABINE LAKE

18. Newman Peninsula

Reference: Ann. Rept., Minister of Mines, B.C., 1927, p. 150.

19. MacDonald Island

References: Ann. Repts., Minister of Mines, B.C.: 1927, p. 149; 1929, p. 180. Ann. Rept., Consolidated Mining and Smelting Co., 1929.

MacDonald Island is about 1 mile in diameter and is situated in Hagan Arm of Babine Lake, 9 miles north of Topley Landing. Altered, basic, volcanic rocks of the Hazelton group outcrop intermittently around the shore, and near the centre of the island an intrusive body of monzonite porphyry forms a small knoll rising about 200 feet above the lake level. The boundaries of the intrusive are not exposed.

The porphyry is broken by a multitude of minute fractures, which are occupied by quartz stringers containing chalcopyrite, and malachite and a little bornite, pyrite, galena, and sphalerite. The rock between the stringers contains very fine disseminations of the above-named minerals. At one point, an adit has been driven for 60 feet in a direction north 20 degrees east along a zone containing more stringers than elsewhere. Other short adits and open-cuts indicate that the entire body of porphyry is probably mineralized to some extent. In 1929, the property was optioned to the Consolidated Mining and Smelting Company who did considerable diamond drilling, following which they reported that approximately 8,000,000 tons were indicated in one body assaying approximately 0.01 ounce a ton in gold, 0.15 ounce a ton in silver, and 0.8 per cent copper.

At the southwest corner of the island, at the water's edge, a 60-foot adit with backs of about 8 feet has been driven by E. Campbell. Here the rock is much-altered lava, the adit following the hanging-wall of a stringer of massive sphalerite and galena striking northeast and dipping 60 to 70 degrees southeast. At the portal the stringer is about 2 inches wide and the remainder was obscured by lagging and muck, but specimens

on the dump indicate a width of about 1 foot in places. A grab sample from the dump, taken in 1927 by Douglas Lay, is reported to have assayed: gold, 0.10 ounce a ton; silver, 12 ounces a ton; lead, 13 per cent; zinc, 19 per cent.

TOPLEY AREA

Several mining properties are grouped in an area northeast of Topley, which is underlain principally by the older granite and by volcanic rocks overlying the granite unconformably. The deposits occur in the volcanic rocks and are of three types. (1) Veins and replacements containing pyrite, chalcopyrite, sphalerite, galena, and tetrahedrite in a gangue of quartz and calcite. These deposits contain gold and silver in varying quantities and are the most important type. (2) Veins containing specularite and some pyrite and chalcopyrite in a gangue of quartz and epidote. (3) Veins containing galena and chalcopyrite in a gangue of carbonate and barite.

Although a little quartz and pyrite have been found in the granite, the fact that the volcanic rocks overlie the granite indicates that the mineral deposits must be related to a younger source. The veins of type (2) are plainly associated with bodies of rhyolite that are probably late Cretaceous or early Tertiary in age, and it is probable that the other veins are related to rhyolite or plutonic rocks of similar age not yet exposed by erosion.

20. Richfield-Topley Group

References: Geol. Surv., Canada, Sum. Rept. 1928, pt. A, pp. 71-74. Ann. Repts., Minister of Mines, B.C.: 1927, pp. 140-148; 1928, pp. 173-174; 1929, p. 179; 1937, pp. 26-27C.

The Richfield-Topley claims are now held by A. Chisholm, W. Innes, and L. B. Warner. Much underground development and diamond drilling was done on this property by the Topley-Richfield Mining Company, Limited, from 1927 to 1929. This work indicated two main bodies with high silver and moderate gold content, but work at depth was reported to be discouraging and the mine was closed in October 1929. Part of the machinery and equipment has been removed, but the buildings are in good condition. This part of the property is described very fully in the reports cited above and was not studied in detail by the writer.

In 1934 a discovery was made by the present owners about 900 feet northeast of the old workings. This consists of a shear zone about 5 feet wide striking north to north 45 degrees east and dipping 45 degrees south-east. This zone contains a lenticular quartz vein up to 2 feet wide, well mineralized with pyrite, chalcopyrite, sphalerite, and galena. An inclined shaft follows the vein for about 35 feet, and from the bottom of the shaft about 60 feet of drifting has been done to the south. The drift is winding because it follows a westerly striking fault for part of its length. At the face of the drift a quartz vein strikes north 10 degrees west and dips 60 degrees east, the width being indeterminate; what appears to be the same vein outcrops at the surface with a width of 1 foot and is stated by the owner to have assayed about \$30 a ton in gold, silver, and copper. A shear zone discovered about 300 feet south of the shaft may be the con-

tinuation of the zone exposed in the shaft, but this has not been proved because of deep overburden between the two occurrences. The following assays are reported in the Annual Report, Minister of Mines, B.C., page 27C:

No.	Gold Oz. a ton	Silver Oz. a ton	Copper Per cent	Lead Per cent	Zinc Per cent
1.....	0.46	10.0	1.0	nil	2.8
2.....	0.10	6.4	0.8	trace	3.9
3.....	0.16	16.0	1.8	nil	5.2
4.....	0.46	28.0	3.0	3.1	10.7
5.....	0.22	9.0	1.5	nil	3.6
6.....	0.26	9.0	4.8	nil	11.2

1. Taken in drift, from vein 15 inches wide, immediately beyond fault.
2. Taken in drift, across 21 inches, 12 feet south of shaft.
3. Grab sample from better part of dump.
4. Selected material from better part of dump.
5. Grab sample from remainder of dump.
6. Selected material from remainder of dump.

21. Gold Group

References: Geol. Surv., Canada, Sum. Rept. 1928, pt. A, p. 74. Ann. Rept., Minister of Mines, B.C., 1937, p. 27.

This property, called the Cup group in earlier reports, consists of sixteen claims held by L. H. Kenny, D. E. Hagberg, F. L. Simonds, and Matthew Sam. It is immediately south of Richfield (Finlay) Creek and is reached by a motor road 3 miles long that branches from the Topley-Babine road, the total distance from Topley being about 7 miles.

The claims are underlain by andesite breccia and andesite porphyry, these rocks outcropping prominently in the valley of Richfield Creek, which is entrenched about 150 feet, the lower 50 feet being a rock canyon. South of this gorge the property is largely drift covered. The showings are at the south wall of the gorge and are exposed by several open-cuts and seven adits, the longest of which is 80 feet.

The principal showings are two rather flat, parallel quartz veins about 700 feet apart horizontally and 125 feet apart vertically. They strike southeast and dip from a few degrees to 30 degrees northeast. The western, or lower, vein has been traced at intervals for about 300 feet, and the eastern vein has been traced for about 350 feet. The veins vary in width from a few inches to 6 feet, most exposures being over 3 feet wide. They consist of quartz with varying amounts of pyrite, sphalerite, chalcopyrite, tetrahedrite, and galena. The walls are altered to light-coloured rock and are impregnated with pyrite. High silver returns have been obtained from shipments of hand-sorted ore, and it is probable that most of the silver is associated with the tetrahedrite. The gold content of the shipments is up to 0.18 ounce a ton, but higher gold assays are stated to have been obtained from samples of pyritiferous ore from the eastern vein. The greatest concentration of sulphide minerals was observed in exposures up to 4½ feet wide in a recently mined drift at the

end of the longest adit on the western vein. In addition to the two flat veins described above, four steeper veins are exposed by open-cuts.

The individual workings and vein exposures at this property are described in great detail in the Annual Report of the Minister of Mines cited above. The following table gives the returns from recent shipments of sorted ore, furnished by the owners:

No.	Weight Lbs.	Gold Oz. a ton	Silver Oz. a ton	Copper Per cent	Lead Per cent	Zinc Per cent
1.....	90	0.065	460.0	3.0	0.3	0.4
2.....	186	0.18	211.2	1.9	trace	1.1
3.....	89	0.06	31.0	2.3	51.7	5.6
4.....	36	0.04	14.2	2.4	31.9	15.6

Nos. 1 and 2 from No. 4 adit, east vein.

Nos. 3 and 4 from adit about 150 feet above No. 4 adit.

22. Golden Eagle Group

References: Geol. Surv., Canada, Sum. Rept. 1928, pt. A, p. 74. Ann. Rept., Minister of Mines, B.C., 1937, p. 24C.

The Golden Eagle group, owned by D. Heenan of Topley and by the estate of C. Matheson, is immediately south of the Gold group and is reached by a branch from the Topley-Babine road. The claims are underlain by andesite breccia traversed by shear zones from 2 to 5 feet wide. In these shear zones are lenses of quartz up to 18 feet long and 16 inches wide, containing sphalerite, pyrite, chalcopyrite, galena, and tetrahedrite. The two principal zones are about 70 feet apart, striking north 30 degrees west and dipping variably to the northeast. They have been traced for about 350 feet and a shaft that may be on the continuation of one of the zones has been sunk on a showing about 325 feet farther to the northwest. The property is described in more detail in the reports cited above, subsequent activity consisting of shipments of ore by Mr. Heenan, who furnished the following returns:

No.	Weight Lbs.	Gold Oz. a ton	Silver Oz. a ton	Copper Per cent	Lead Per cent	Zinc Per cent
1.....	1,016	0.20	253.0	0.9	11.1	11.4
2.....	595	0.16	248.6	1.0	17.4	12.4
3.....	4,747	0.08	125.0	—	5.75	8.6
4.....	33,037	0.135	199.2	—	17.7	11.0

Nos. 1 and 2 from most southerly cut on No. 2 vein; shipped in 1938.

No. 3 from most northerly showing on No. 1 vein; shipped in 1928.

No. 4, composite sample from several showings; shipped in 1934.

23. Three Star Group

This group, held by L. Kylling of Topley, is on the north side of Richfield Creek about 1 mile southeast of the Richfield-Topley claims. The principal showing occurs in altered andesite breccia, strikes north

85 degrees west, dips 25 to 30 degrees north, and has been traced for about 60 feet. It consists of a zone with well-defined walls about 3 feet apart, made up of 4 inches of banded quartz, pyrite, and galena along the foot-wall, up to 1 foot of disseminated pyrite along the hanging-wall, and a central part composed of hydrothermally altered rock with little sulphide mineralization. The owner stated that a sample from the dump gave a total assay value of about \$11 a ton. Two samples sent to the sampling plant at Prince Rupert are reported to have assayed 0.23 and 0.12 ounce of gold a ton and 27.60 and 1.80 ounces of silver a ton.

24. Jack-rabbit Group

References: Geol. Surv., Canada, Sum. Rept. 1928, pt. A, p. 76. Ann. Repts., Minister of Mines, B.C.: 1928, p. 177; 1930, p. 144.

25. Joker Group

References: Geol. Surv., Canada, Sum. Rept. 1928, pt. A, p. 76. Ann. Rept., Minister of Mines, B.C., 1930, p. 145.

MORICE MOUNTAIN

Morice Mountain is a large massif with several summits about 6,000 feet in elevation, lying between Morice River and Buck Creek. The mountain consists chiefly of rhyolite and related volcanic rocks of the Hazelton group, intruded by small stocks of granite and diorite. Several mineral showings have been found on the mountain, but little work has been done on them and most of the claims have been allowed to lapse. The only ones on which recent work was observed were the Success and Peacock groups.

26. Success Group

These claims are on the west slope of Morice Mountain at an elevation of about 4,000 feet, and are reached by a trail that leaves the Morice River road about 1 mile north of Houston Tommy Creek. Surface work has been done in recent years by E. G. Bellicini of Houston. The deposit occurs in fractured rhyolite and consists of stringers and disseminations of chalcopyrite, pyrite, and secondary copper minerals. The showings outcrop for about 400 feet along the north bank of a small stream, and of this distance a 100-foot section is more mineralized than the rest. Mr. Bellicini states that a sample taken at intervals from this 100-foot section had a total assay value of about \$7 in copper, silver, and gold (gold at \$20.67). The zone is cut by a 3-foot dyke of fine-grained, dioritic rock, which is displaced 10 feet by a fault that strikes north 35 degrees east. At the west end of the zone granite is exposed along the banks of the creek for about 100 feet, the contacts being unexposed. The granite contains a little disseminated chalcopyrite and pyrite and a sample is said to have assayed \$1.80 in gold (gold at \$20.67).

Other showings of a somewhat similar nature occur on the north-western slope of the mountain, on the old Sholto and Croesus claims, which have been inactive for some time. These are described briefly in the Annual Report, Minister of Mines, B.C., 1930, page 142.

BOB CREEK

28. Gold Brick Group

References: Geol. Surv., Canada, Sum. Rept. 1929, pt. A, pp. 92-93. Preliminary Paper 36-20, pp. 121-125. Ann. Repts., Minister of Mines, B.C.: 1905, p. 113; 1914, p. 234; 1916, p. 127; 1927, p. 140; 1928, p. 172; 1929, p. 204; 1933, pp. 98-99; 1936, p. 37C.

Bob Creek is a tributary of Buck Creek, 7 miles south of Houston, and is reached by a passable motor road. In this locality the Gold Brick group of eight claims is held by G. W. Smith of Houston, and associates.

A canyon about 400 feet deep begins about half a mile above the mouth of the creek. The lower half-mile of the canyon is cut in much-altered, sparsely mineralized, volcanic rocks of the Hazelton group, beyond which the canyon is cut in Tertiary basalt. The older volcanic rocks were originally breccia and andesite and are now almost completely altered to a light grey, earthy mixture of sericite, kaolin, and probably other minerals. The rock contains much yellow iron stain. Away from the altered zone, the volcanics are intruded by small dykes of syenite porphyry and diabase, but within the altered zone the rocks are so changed that it is impossible to determine whether intrusives are present.

For about 1,500 feet along the canyon, the rock contains sparse disseminations of pyrite, sphalerite, and galena. Where the rock is breccia, in some places the fragments are replaced and in others the matrix. Greater amounts of sulphides occur in stringers that traverse the rocks in all directions; most of these are very narrow, but one 8-inch stringer was observed.

Lay¹ states that of seven samples taken along the canyon, four assayed a trace of gold and three assayed 0.04, 0.20, and 0.10 ounce of gold a ton. Mr. Smith stated that twenty-eight samples taken by an examining engineer assayed from 0.01 to 0.25 ounce in gold and 0.10 to 0.90 ounce in silver a ton, and that picked samples from the stringers gave high assays in gold and silver. Kerr² states that four hundred samples taken by a private engineer ranged up to 0.1 ounce of gold a ton, but averaged less than a quarter of that figure; Mr. Smith disputes this statement, saying that he is not aware of such samples having been taken.

It is evident that a large tonnage of low-grade, metallized rock is present, but although several attempts have been made to develop the property, it would appear that the average gold content has not been determined conclusively. It would be fairly simple and inexpensive to bulk-sample the section provided by the canyon, in view of the accessibility and of the recently established sampling plant at Prince Rupert. The extent of the mineralization north and south of the canyon is imperfectly known and should be explored if a favourable average grade is indicated by sampling. It seems unlikely that the higher grade shoots could be developed independently of the main mass, except on a small scale, but this could be determined by selective sampling.

¹ Ann. Rept., Minister of Mines, B.C., 1933, p. 98.

² Geol. Surv., Canada, Paper 36-20, p. 124.

Placer Deposits

Below the canyon described above, Bob Creek flows through an alluvial flat where placer mining was done many years ago, but no records of this early work are available. Two placer leases are held by Messrs. MacDonald and Silverthorne, and these have been optioned to G. W. Smith, who mined several ounces of coarse, angular gold near the foot of the canyon. Mr. Smith states that five churn-drill holes were sunk in 1937, one reaching rock at a depth of 40 feet and averaging 50 cents a yard from the surface, and the remaining holes being stopped at 50 feet without striking bedrock. It is unlikely that any large placer deposit occurs, but there appears to be some unworked ground immediately below the canyon and there may be concentrations in old channels under the flat that lies between the canyon and the mouth of the creek.

OWEN LAKE

The Owen Lake camp, in the southwestern part of the area, received considerable development from 1928 to 1930, when detailed reports were published. As there has been no subsequent activity the deposits are discussed only in general terms in the present report.

This part of Smithers area is underlain mostly by andesitic and rhyolitic flows, with related tuffs and breccias, belonging to the Hazelton group, and overlain in the western part by sedimentary rocks of probable Upper Cretaceous age. These rocks are intruded by stocks of granite and diorite with which the mineral deposits are associated. Interesting features of the deposits are the presence of several well-defined criteria of low-temperature mineralization, and the occurrence of alaskaite, a sulphide of silver, lead, and bismuth not known to occur elsewhere in Canada.

29. Owen Lake Mine

References: Geol. Surv., Canada, Sum. Rept. 1929, pt. A, pp. 62-91. Ann. Repts., Minister of Mines, B.C.: 1915, p. 78; 1916, p. 92; 1923, p. 113; 1924, p. 99; 1928, p. 170; 1929, p. 171; 1930, p. 141.

30. Grubstake Group

Reference: Geol. Surv., Canada, Sum. Rept. 1929, pt. A, p. 91.