PART F

ANNUAL REPORT

OF THE

MINISTER OF MINES

OF THE PROVINCE OF

BRITISH COLUMBIA

FOR THE

YEAR ENDED 31ST DECEMBER

1938

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BRITISH COLUMBIA DEPARTMENT OF MINES.

VICTORIA, B.C.

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JOHN F. WALKER, *Deputy Minister.*

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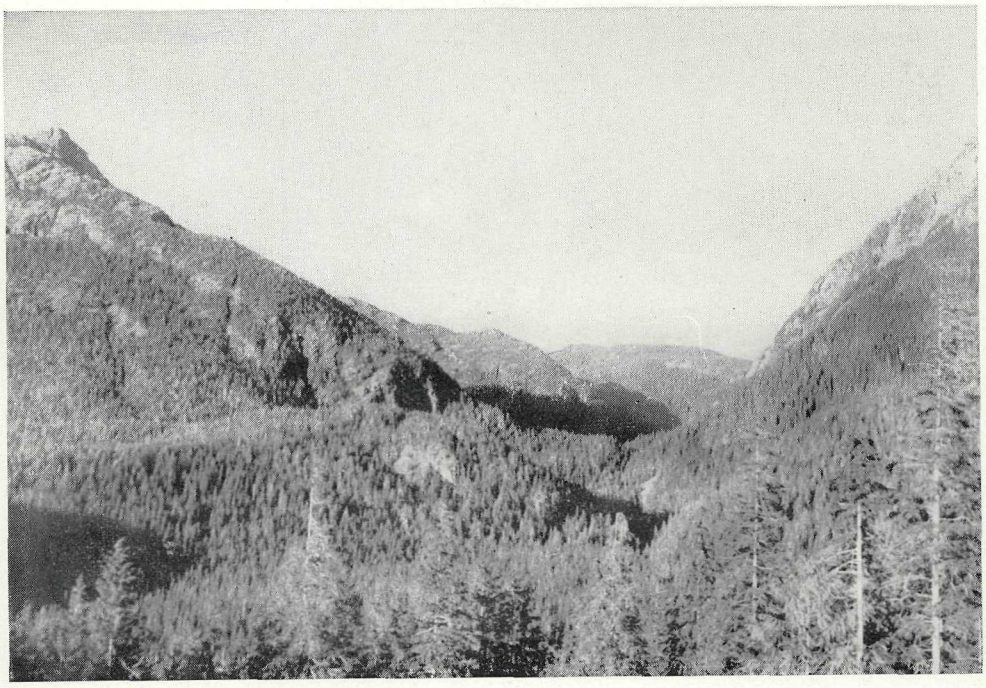
D. E. WHITTAKER, *Chief Analyst and Assayer.*

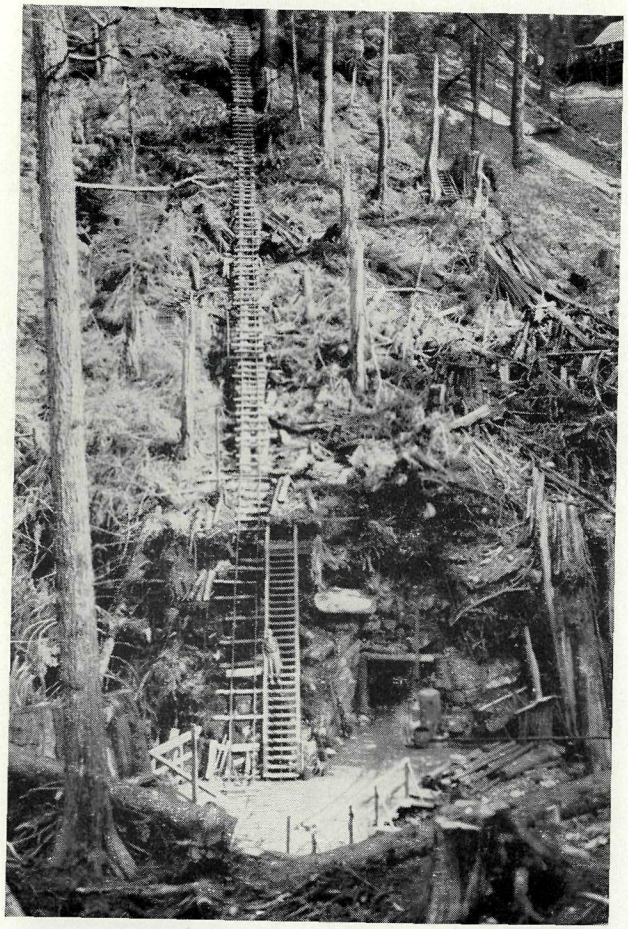
P. B. FREELAND, *Chief Mining Engineer.*

R. J. STEENSON, *Chief Gold Commissioner.*

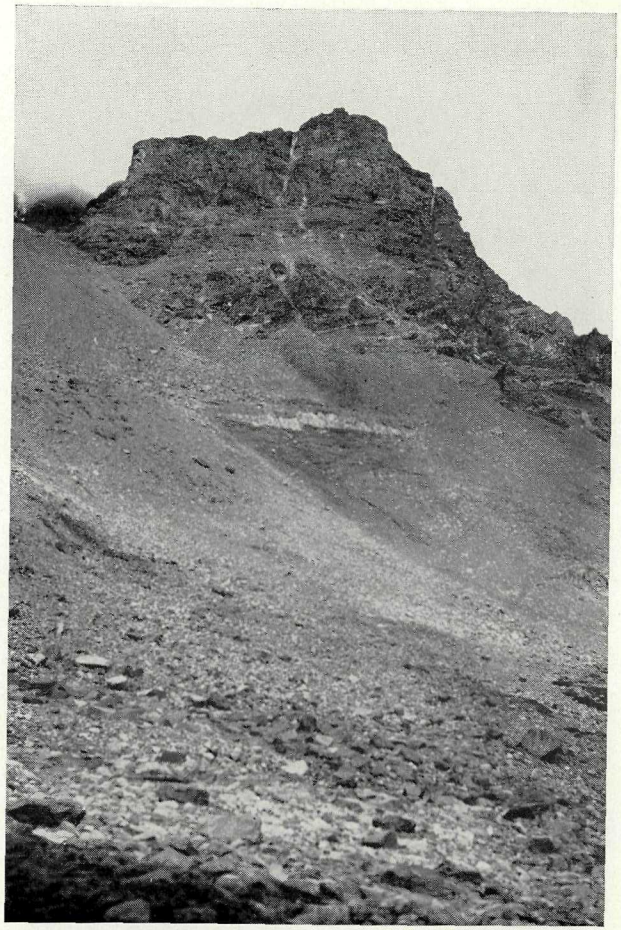
Blackhorn Mountain and glacier at head of Razor (Wolverine) Creek.



View north-east up Blind River, towards Zeballos Lake, from Central Zeballos property.



Surface incline from portal of 1,100-foot adit at Privateer Mine.



Dykes in bluff north-west of Homathko Gold Mines camp.

PART F.

SOUTH-WESTERN DISTRICT.

BY

H. SARGENT.

SUMMARY.

During 1938 prospectors and mining companies have paid a great deal of attention to gold-bearing veins on Vancouver Island, particularly in the Zeballos section and in some other localities tributary to the west coast. Production, which had been limited to shipping crude ore, was extended to milling when mills were provided during the latter part of the year for the *Privateer*, *Goldfield*, and *Rey Oro* properties. There was also activity elsewhere on Vancouver Island and at some points on the Mainland coast and adjacent islands. On the Mainland, producing mines were the *Ashloo*, *Britannia*, *Bralorne*, and *Pioneer* properties, with a new producer in the Empire Mercury Company. A small retorting plant was erected on the property of Empire Mercury Mines, Limited, and some mercury produced before the end of the year. Mercury production is a new departure in the Province. The scale of operations at the *Britannia* mine established a new record, and gold produced at the *Bralorne* mine exceeded the output of any previous year. Although the spectacular developments in the Zeballos area have attracted attention to that locality, prospectors were active in various other sections of the South-western District.

During the major part of the field season the writer was ably assisted by Edwin P. Williams. The co-operation of prospectors and mine officials and their numerous courtesies are gratefully acknowledged.

LODE DEPOSITS.

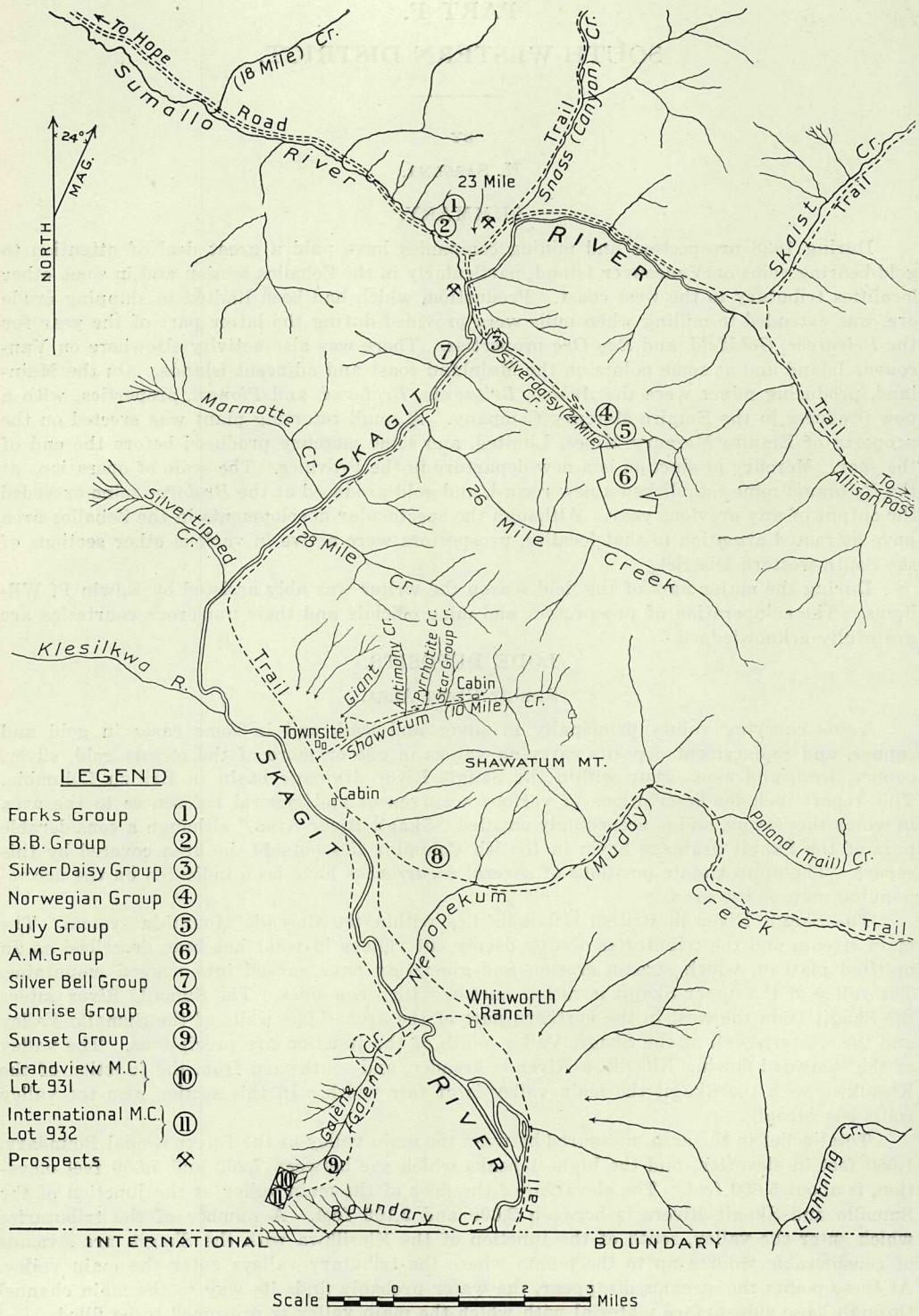
SKAGIT RIVER AREA.

Veins carrying values principally in silver and lead, and in some cases in gold and copper, and replacement deposits carrying values in one or more of the metals gold, silver, copper, lead, and zinc, occur within the Skagit River drainage basin in British Columbia. This report includes descriptions of various occurrences and general references to the area in which they occur, and is accordingly entitled " Skagit River Area," although a considerable part of the Skagit drainage basin in British Columbia lies outside the area covered by this report. The approximate positions of several occurrences have been indicated on the accompanying map of the area.

The Skagit River in British Columbia lies within the Cascade Mountain system. The main stream and the tributaries occupy deeply cut valleys in what has been described as an uplifted plateau, which stream erosion and glaciation have carved into rugged mountains. The valley of the upper Skagit is rather narrow with steep sides. The Sumallo River enters the Skagit from the west in the northern part of the area. The walls of the Sumallo Valley and the western wall of the Skagit Valley south of the junction are precipitous. The valley of the eastward-flowing Klesilkwa River is broader, and southward from the junction of the Klesilkwa with the Skagit the main valley is of fair width. In this section also the valley walls rise steeply.

Total relief in the area, measured between the main valley at the International Boundary, 1,650 feet in elevation, and the highest peaks which are between 7,200 and 7,300 feet elevation, is about 5,600 feet. The elevation of the floor of the main valley at the junction of the Sumallo and Skagit Rivers is between 2,000 and 2,100 feet. A number of the tributaries which enter the valley, south of the junction of the Klesilkwa with the Skagit, are streams of considerable volume up to the points where the tributary valleys enter the main valley. At these points the streams disappear, the water probably finds its way to the main channel through loose sub-surface material with which the main valley is presumed to be filled.

The climate of the area is drier than that of the western slopes of the Cascade Mountains. Tree-growth is heavy; pines are more prevalent than on the western slopes, but



Skagit River Area.

a good deal of cedar grows in the main valley. So far as the writer knows no lumbering operations have been carried on in the area, though there appear to be considerable stands of timber. Fire and snowslides in parts of the area have destroyed a good deal of timber, some of which has found its way into the river and its tributaries and has accumulated as large jams.

South of the junction with the Klesilkwa the main valley, ranging from 1,650 to 1,900 feet in elevation, averages more than a mile in width. This includes low benches on which considerable areas are overgrown with rhododendrons; elsewhere the growth is principally of small pines. The benches are in part of gravel but seem to have a fair cover of light soil in other sections. Doubtless the valley-bottom and the low benches contain land which would be suitable for cultivation, though irrigation might be necessary. There have been several attempts at ranching which have been discontinued, probably largely owing to the lack of transportation, there being no local market. In the past few years part of the valley has been tested for placer by Keystone-drilling, the results of which are not known to the writer. Present activity in the area is related to prospecting and development of prospects, and to trapping.

Access is most convenient by way of the road from Hope, which follows up the valley of the Nicolum, over a divide and down the Sumallo River to a point 23 miles by road from Hope, near the junction of the Sumallo and Skagit Rivers. A number of prospects are in this vicinity, which has been called the 23-Mile Camp. From 23-Mile, the road continues about 4 miles to Skagit Bluffs. This has been designated as the western end of the Hope–Princeton Highway, of which the projected route continues to Allison Pass at the head of the Skagit River. It is understood that there remains about 12 miles of the projected highway, including Allison Pass and the approach from both sides, on which no work has been done. From 23-Mile a rough road, passable for trucks in dry weather, continues southward down the eastern side to Silver Daisy (24-Mile) Creek, about 1¼ miles from 23-Mile. From this point a trail continues down the east side to the International Boundary. From a crossing about 13 miles southward of Silver Daisy Creek there is also a trail (in poor repair) that runs southward along the west side to Galena Creek. Access to the area is also possible by several trails in use in former years. From the trunk road and trails, branch trails serve various mining properties. Limited accommodation is available for travellers at W. H. Robinson's cabin on the road, 22 miles from Hope. The camps at various mining properties and cabins in the main valley afford shelter at convenient points. C. J. Howlett has a cabin about at the site of the old Steamboat townsite, south of 10-Mile Creek, or 12½ miles by trail from the end of the road at Silver Daisy Creek.

It is perhaps well at this point to attempt to clear up confusion regarding certain stream names. The confusion is principally confined to a part of the area lying north-east and east of 23-Mile, and is due to differences between local and official names and to the fact that there have been some differences in the names which appear on various official maps. On the map accompanying this report the river flowing north-westward to the mouth of its tributary, the Snass, and thence south-westward, is called Skagit River, in accordance with Department of Lands Maps Nos. 6-C and 86.

Locally, the Skagit above the Skaist has been called Cedar Creek, and the Skaist, with the main stream as far as the junction with the Sumallo, has been called the Skaist; this usage reserved the name Skagit for the main stream below the mouth of the Sumallo. Unfortunately this confusion has found its way into some of the published reports.

The area covered by the accompanying map includes parts of two sections, mapped geologically by Cairnes in 1922 and 1923. An intervening north-westward-trending belt, averaging between 3 and 4 miles in width, was not mapped by Cairnes. This belt extends from one side of the area to the other, and crosses the Skagit River between points somewhat south of 24-Mile Creek and somewhat south of 28-Mile Creek. The geology of most of the area was mapped by Camsell, whose report and map appear in the Summary Report of the Geological Survey, Canada, for 1911. Cairnes' maps and reports appear in the Summary Reports of the Geological Survey, Canada, 1922, Part A, and 1923, Part A. Though on a smaller scale, the mapping by Cairnes was done in greater detail than that by Camsell. In the season of 1937 mapping was again undertaken in the area.

This work, by W. E. Snow, included the more detailed mapping of the belt not mapped by Cairnes. The results of Snow's work have not yet been published. Geological mapping of a narrow strip along the International Boundary is covered by sheets 14 and 15, respectively "Hozameen Range" and "Skagit Range," published in Memoir 38 of the Geological Survey, Canada, in 1912.

Based on Cairnes' mapping, supplemented by the mapping by Camsell, it may be said that the area included in the map accompanying this report is principally underlain by two series of rocks into which there are some later intrusives. These series are the Hozameen of Palæozoic age and the Dewdney of Jurassic and possibly Lower Cretaceous age. The north-east corner of the area is underlain by Cretaceous sediments, younger than and lying east of the Dewdney series. The contact which strikes somewhat west of north was stated by Cairnes to be probably a faulted one. In the south-west corner of the area the geological maps indicate Skagit volcanics of Oligocene age.

The boundary between the Hozameen series to the west and the Dewdney series to the east is shown in the northern and southern sections mapped by Cairnes in 1922 and 1923 respectively. In the northern section the boundary trends about south 30 degrees east to the point where it crosses the Skagit not far below the mouth of the Snass, from which point it continues roughly due south to the southern limit of mapping about 1½ miles south of 24-Mile Creek. In the area covered by the map herewith the northern limit of Cairnes' 1923 mapping crosses the Skagit about a mile below the mouth of 28-Mile Creek, from which point it runs roughly south 65 degrees east but does not follow a straight line. In this section the contact between the Hozameen and Dewdney series is shown extending about due south from the northern to the southern limit of mapping; that is, from a point roughly 6 miles east of the Skagit River, just east of a marked bend in Nepopekum Creek, to a point approximately 1½ miles from the International Boundary. It appears that the belt not mapped by Cairnes must be underlain principally by rocks of the Hozameen and Dewdney series.

The Hozameen series, referred to the Pennsylvanian subdivision of the Carboniferous period, is the oldest series mapped in this area. Including the part assumed to be underlain by Hozameen series in the belt not mapped by Cairnes, the Hozameen series must underlie considerably more than half the area and contains the host-rock of a great many mineral deposits.

The following passages, descriptive of this series, are quoted from the 1922 Summary Report, Part A, Geological Survey, Canada: "The Carboniferous rocks occur chiefly in the basin of Sumallo River. They are continuous into Coquihalla area where they were referred to the Pennsylvanian period and correlated both with the Cache Creek rocks of Thompson Valley and with the Hozameen series at the International Boundary. They are composed of volcanic and sedimentary rocks. The volcanic members are chiefly dark green andesitic rocks referred to in a general way as greenstones. They consist dominantly of flow types, but include some pyroclastic beds. In part these rocks are massive and of those some, probably, represent later intrusions. A large proportion, however, of these greenstones exhibit some degree of schistosity and, in part, have a very slaty structure. The more deformed members show much alteration to chlorite and, in some cases, to sericite. The sediments include chert, slate, and limestone. The limestone occurs in small proportion compared with either the chert or slate, but is of economic importance in that the ore-deposits of the section are commonly associated with it. The siliceous material composing the chert was, probably, derived from a magmatic source associated with the volcanic extrusions, but the slates are composed of normal sedimentary detritus.

"Near igneous intrusions these older rocks are all metamorphosed in varying degrees. The limestone suffers the most complete change, and its identity may be completely obscured in the process. The cherty and slaty rocks may also be greatly altered in composition and appearance. Near the junction of Sumallo and Skagit Rivers, and alongside the Dewdney trail, outcrops of a peculiar mottled rock may be seen. This rock was originally a chert interbedded with thin layers of slate or argillite. It has been irregularly bleached by the near-by intrusion of quartz diorite, and recrystallized to form a much coarser-grained rock than that from which it was derived.

"These Carboniferous (Cache Creek) rocks have a general trend of north 30 to 40 degrees west; and, north of Sumallo River, dip at an average angle of 50 to 60 degrees to

the south-west. South of the river several dips in the reverse direction were observed. The structure, however, includes probably more than one major fold and is complicated by faulting, thrusting, and overturning to the north-east."

It is worthy of note that in 1922 Cairnes attributed the deposits of mineralized, metamorphosed limestone in this series to intrusive members of the series. This hypothesis was set forth as follows: ". . . the more massive hornblende andesite and diorite porphyrite rocks included with the greenstones of the Carboniferous rocks are, in part, intrusive and have effected the metamorphism and mineralization . . ."

The following quotation from Summary Report, 1923, Part A, Geological Survey, Canada, gives further information concerning the Hozameen rocks in the southern part of the area: "Little information of value could be obtained relative to the thickness of the series, owing to its excessive deformation and to the faulted or intrusive character of its contacts with later formations. In the present area the series, as a whole, has a general trend of north 35 degrees west and dips at an average angle of 73 degrees to the north-east. This structure, however, is complicated by faulting and thrusting and by the development of slaty and schistose structures."

The Dewdney series is next to the Hozameen in areal extent and lies east or north-east of the Hozameen series, the contact being a faulted one. Cairnes referred the series tentatively to the Upper Jurassic but possibly Lower Cretaceous and stated that it might prove to include members belonging to both periods. The following descriptive material quoted from Summary Report, 1922, Part A, Geological Survey, Canada, refers to this series in the northern part of the area: "The rocks included with the Dewdney series . . . form a belt about 5 miles wide extending across Skagit and Skaist Rivers in a general north 15 degrees west direction above the mouth of Canon Creek. This trend corresponds closely with the average strike of the series. The structure is, apparently, synclinal, complicated by minor folding and by much faulting. A large part of the series is thinly bedded in shades of brown and black and some distinctly slaty strata are included. Massive beds are also abundant and from these in particular and at a number of localities poorly preserved fossils were discovered. . . . In a general way the members of the Dewdney series . . . are notable under the microscope for their tuffaceous appearance, a characteristic obtaining even in those members which in the outcrop and hand specimen strongly resemble normal sediments. The coarser rocks are all highly feldspathic. Their constituents under the microscope include plagioclase of intermediate composition, a minor proportion of quartz grains, and abundant fragments of lava, the whole in an almost isotropic ashy ground-mass. The proportion of crystal to lithic fragments varies greatly and the ground-mass usually constitutes a large proportion of the slide, differing in this respect from the feldspathic greywackes and arkoses of the Lower Cretaceous. Occasional sills of hornblende lamprophyre were observed in this section."

In the southern section Cairnes mapped the largest intrusive, a tongue from the Chilliwack batholith, consisting chiefly of granodiorite, assigned to the Miocene period. The tongue averages a mile or more in width and, from a mile or so east of Galena Creek, trends about north 70 degrees west beyond the western margin of the accompanying map. The northern boundary of the intrusive is indicated near the mouth of Galena Creek, and within the area covered by the accompanying map the intrusive is bordered by rocks of the Hozameen series. In the northern section Cairnes mapped two bodies of quartz diorite of Cretaceous age. One extends about 3 miles northward from the junction of the Skagit and Sumallo Rivers and crosses the contact from the Hozameen into the Dewdney series. The width is indicated as a little more than half a mile at the south end, diminishing to perhaps a tenth of a mile at the north end. The other body is about 2 miles in length and reaches a maximum width of about 1 mile near the northern end. This body is almost entirely north of Silver Daisy Creek, with its centre line about 1¾ miles east of the Skagit River at the mouth of Silver Daisy Creek, and is entirely surrounded by rocks of the Dewdney series. Smaller bodies of granitic intrusives, which do not show on Cairnes' maps, occur at various points in the area; for example, on the slope north of 10-Mile Creek and near the *Sunset* group on Galena Creek.

At three points in the area dark green or almost black rocks, usually containing conspicuous silvery white scales, are known to occur. Several specimens were submitted for

laboratory study. The white scales were found to consist of closely packed clusters of secondary sericite. The specimens were found to consist almost entirely of olivine, or of olivine with serpentine, presumed to be derived from the olivine, and occasional grains of pyroxene. The rocks are accordingly much altered, ultra-basic ones, probably representing peridotite with segregations of dunite. At one point similar rock, lacking the white scales, appeared as dykes in the rock with the white scales. It was found to be a completely reconstituted rock, containing patchy aggregates of pyroxene and lime feldspar, the pyroxene replaces the feldspar. Fine grains of sulphides, consisting principally of pyrrhotite, are disseminated through the rocks. Several samples of typical material were assayed and found to contain from 0.2 to 0.4 per cent. nickel. These were from exposures north of 23-Mile on the *Forks* group and on a prospect lying to the east, indicated on the map, but not named.

The third point at which the altered peridotite was found is on the south slope of the ridge between 10-Mile and 28-Mile Creeks, more precisely in the basin at the head of the small creek marked as Star Group Creek. This material was not sampled. The two exposures north of 23-Mile are close to the indicated position of the faulted contact between the Hozameen and Dewdney series, but lie to the east and west respectively of the intrusive quartz diorite previously mentioned, which crosses the contact in this vicinity. It may be significant that the occurrence north of 10-Mile Creek would be at no great distance from the assumed position of the contact in the unmapped belt. The writer did not attempt to outline the extent of the altered peridotite in either locality. It was reported locally that this rock occurs over a large area north of 23-Mile Creek.

At numerous points in the Skagit River area there are occurrences of sulphide minerals, as vein and as replacement deposits, with the latter quantitatively much the greater. More detailed discussion of the types of occurrence and descriptions of particular deposits will be found later in this report under the two headings, "Replacement Deposits" and "Vein Deposits."

It is reported that placer gold in small quantity was found in the Skagit River in 1858. No serious attempts have been made to mine placer gold, though, as mentioned previously, some ground has been tested by Keystone-drilling in the past few years. In 1860 the Dewdney trail was constructed by the Royal Engineers; it follows the route of the present road from Hope as far as Snass Creek. This trail and the branch trail from 23-Mile down the Skagit River furnished the most convenient route to Ruby Creek, a tributary of the Skagit, in the State of Washington, on which some fairly rich placer-ground was discovered in 1879.

Known discoveries in the area covered by this report are of a considerably later period. The oldest known is covered by the *International* and *Grandview* claims, which were staked in 1906 and are now Crown grants in good standing. In the fall of 1910 two prospectors reported that they had discovered rich gold ore on Steamboat Mountain south of 10-Mile Creek. In the following winter a good deal of interest was promoted in the alleged discovery and money was raised to carry on exploration. Attention was thereby attracted to the district, and when the season opened in 1911 a great deal of prospecting was undertaken. This resulted in a number of discoveries, notably in the 23-Mile Camp and on the north side of 10-Mile Creek.

The reported discovery of rich gold ore on Steamboat Mountain proved to be fraudulent and the boom collapsed, leaving three townsites which are now marked by a little weathered lumber remaining at the sites.

From time to time there has been a fair amount of activity in the area. In the past few years activity has been largely centred at two recent discoveries in the north-eastern part of the area. The *A.M.* copper property, discovered in 1930, has had a great deal of exploratory work done on it by the Consolidated Mining and Smelting Company of Canada, Limited. The *Norwegian* group, discovered in 1933, with adjoining claims, has been the site of a good deal of development-work by the Invermay Annex Mining Company. Small shipments to smelters have been made from the *Rainbow*, the *Silver Daisy*, and the *Invermay Annex* property. The shipments from the latter two consisted of silver-lead ore from narrow veins

The Annual Reports of the Minister of Mines, British Columbia, and the reports of the Geological Survey, Canada, previously mentioned, contain reports and progress notes con-

cerning various properties in the area. Specific references to some of these will be found in the descriptions of certain properties later in this report.

Many of the properties in the area have been restaked several times, and as a result are referred to in the previous reports under several different names.

Claims in the area in good standing, held by location, number 130 or more. The stakings date from 1921 onward, and more than 100 date from 1930 or later. Though discoveries were made in 1930 and in more recent years, many of the recent recordings cover discoveries of considerably earlier date.

The writer spent from July 9th to 17th in the northern part of the area, returned for a brief visit to the *Invermay Annex* property in October, and spent from September 25th to October 4th in the southern part of the area. Visits were paid to most of the known occurrences and detailed examinations were made where warranted. These, supplemented by information from reports which have been mentioned, form the basis of the two following sections of the report. Only properties visited by the writer are described in the following notes.

For information concerning properties not described in this report the reader is referred to Annual Reports of the Minister of Mines, British Columbia, and to Geological Survey, Canada, Summary Reports, 1911, Part A; 1920, Part A; 1922, Part A; 1923, Part A.

Replacement Deposits.

Deposits of this type, in rocks of the Dewdney and the Hozameen series, are the most important occurrences known in the area. On the *A.M.* property in the Dewdney series, pyrite and chalcopyrite with quartz and calcite replace the matrix in a breccia bed. The mineralogy is comparatively simple; values are in copper, gold, and silver. In the Hozameen series sulphide mineralization occurs with quartz and calcite in metamorphosed limestone, and to some extent in siliceous sediments and in volcanic rocks. A considerable number of lime silicates are developed in the metamorphic rocks and with the sulphide replacement deposits; the occurrence of scheelite at the *Mammoth* deposit in the 23-Mile camp is worthy of note. A variety of sulphide minerals occurs in the replacement deposits and in related veins. The sulphides include pyrrhotite, sphalerite, pyrite, chalcopyrite, arsenopyrite, galena, stibnite, jamesonite or boulangerite, and probably grey copper.

The deposits in the Hozameen series may be divided into two types. One, with sulphide mineralization, consisting principally of pyrite, chalcopyrite, and sphalerite, with some arsenopyrite and galena, carries values in copper and silver. This type is represented by the *Silver Bell* and *Sunset* properties described in the following notes. In the other division sulphide mineralization consists of pyrrhotite with more or less sphalerite, chalcopyrite, arsenopyrite, and pyrite, and occasional galena. This mineralization is represented by deposits occurring north of 10-Mile Creek and described under " 10-Mile Creek Section "; the silver content is very small; percentages of copper are lower, and gold values, though small, occur more consistently than in the first type.

In this area the average grade is low in all the replacement deposits on which work has been done. In the case of the *A.M.* group and of the first type of deposits in metamorphic limestone the grade is probably high enough to be attractive, provided sufficient tonnages can be proven to warrant large-scale operations. In the 23-Mile Camp, in addition to the *Silver Bell* group, which is described in the following notes, there are two other known occurrences, described in reports of the Minister of Mines, British Columbia, and in publications of the Geological Survey, Canada, under the names *Mammoth* and *Defiance*.

In the 10-Mile Creek section there are a great many known sulphide-replacement deposits carrying some values in gold in addition to copper and zinc. The close spacing of many exposures indicates that if some large replacement-bodies do not occur there must be a great many small bodies close together. These facts may be sufficient to warrant detailed geological mapping, and if the results were encouraging carefully directed exploration might be in order.

The limestone which is so important in connection with the replacement-bodies in the Hozameen series is very often so metamorphosed as to be difficult to recognize. The series has been greatly deformed and the limestone, probably originally present as more regular lenses, has been affected by the regional deformation, producing some very irregular bodies.

Daly refers to this feature of limestone in the Hozameen series observed near the boundary (Geological Survey, Canada, Memoir No. 38), as follows: ". . . Wherever seen, the beds are never continuous for more than a few hundred feet, but occur as pods or lenses from 30 to 40 feet thick in the middle and tapering off to nothing at each end. This form of limestone body is that often assumed when the rock-series in which it occurs has been subjected to powerful squeezing and rolling-out. The carbonate acted as if it were plastic, thinning here, thickening there, according as the lines of force were directed. The material pinched out at one point became accumulated in pods elsewhere . . ." This feature is obviously of importance in assessing the value of deposits in limestone in the Hozameen series, and in prospecting for such deposits.

A.M. The claims *A.M. Nos. 1, 2, 3, 4, 5, 12,* and *13, August Fraction, August Nos. 2, 3, 4, 6,* and *7,* located in 1932; *Rex,* located in 1936; *Fall Nos. 1* and *2, M.L.A. Fraction,* and *Snow Fraction,* located in 1937, are recorded in the name of the Consolidated Mining and Smelting Company of Canada, Limited. Five additional claims, recorded in the names of individuals, are understood to be controlled by the company. The claims are in and adjoining the basin at the head of a northward-flowing tributary which enters the Skagit River about 2 miles eastward from the mouth of the Skaist. The basin, which lies east of the head of Silver Daisy Creek, has an open and grassy floor with occasional patches of trees. The sides rise in steep rock bluffs. The camp is at about 5,425 feet elevation and the workings, which include open-cuts and six adits, lie south and south-east of the camp. The adits are at elevations from about 5,400 to 5,825 feet.

Supplies and equipment for the property are understood to have been brought up principally on a pack-trail which leaves the road at a point east of 23-Mile. The property is also readily accessible via the trail up Silver Daisy Creek, the divide at the head of the creek is crossed at about 5,850 feet elevation and the distance to 23-Mile by this route is approximately 7 miles.

The underlying rocks are mapped as Dewdney series by Cairnes, who states that the series forms a belt about 5 miles wide trending west of north, apparently in the form of a syncline complicated by minor folding and by much faulting. Cairnes also pointed out that the rocks are notable under the microscope for their tuffaceous appearance and that the coarser rocks are highly feldspathic. The workings are about 1½ miles from the western margin of the belt, and there the rocks strike west of north and the dips are from moderate to steep, north-eastward.

The mineralization occurs principally in a bed of breccia believed to be from 50 to 80 feet thick. The breccia is composed of fragments of other rocks in the series—namely, arkosic, tuffaceous, and argillaceous types—in a matrix composed almost entirely of introduced material. The matrix, composed of quartz, calcite, and sulphides, contains some corroded ferro-magnesian minerals, and has apparently replaced the original matrix of the breccia and to some extent has corroded the edges of the fragments. The sulphides, which make up a considerable proportion of the matrix, are principally pyrite and chalcopyrite, with some pyrrhotite. This mineralization carries some gold and silver values in addition to copper. Shears cut the wall-rock near the mineralized breccia, and on No. 6 level pyrite-chalcopyrite mineralization seems to be definitely related to a shear which strikes west of north and dips steeply to the west.

There are some narrow veins in which pyrite, chalcopyrite, sphalerite, and arsenopyrite are found. Selected arsenopyrite, from a shear cut in No. 5 adit, assayed: Gold, 1.86 oz. per ton; silver, 12.3 oz. per ton; copper, *nil.* Chalcopyrite and pyrite are developed with tourmaline in and along a 4-foot shear exposed on the surface north-west of the principal workings. This is similar to mineralization exposed in shallow workings on the *Invermay Annex* property, situated some distance to the north-west and described in another section of this report.

The No. 5 adit crosscuts a dyke similar to the quartz diorite or granodiorite on the properties at the head of Silver Daisy Creek. This dyke has been highly altered and contains a good deal of carbonate. It also contains some pyrrhotite and chalcopyrite.

The discovery was made in 1930 and the property was bonded to the Consolidated Mining and Smelting Company of Canada, Limited, in the same year. Underground development done by the company on six adit-levels consists of 2,478 feet of horizontal workings, all

driven by hand. When the property was visited in July, 1938, work had been suspended, and had not been resumed at the end of the year.

In the zone of mineralization the rocks have been very much altered, and it appeared probable that very close study and familiarity would be required before one could differentiate safely between various members of the series. The time devoted to the examination of this property did not permit detailed mapping of the workings. Brief references to the property appear in Annual Reports, Minister of Mines, British Columbia, 1930, 1931, and 1933. The writer is indebted to G. H. Kilburn, engineer for the company, who kindly supplied information concerning the extent of the workings.

The adits are all driven westward and, except No. 6, are all straight crosscuts. No. 6 level, driven 823 feet as a crosscut, encountered the mineralized zone at 723 feet from the portal. A drift was driven 85 feet northward from the adit-crosscut, and another 400 feet in length was driven southward. Crosscuts 130 and 80 feet in length respectively were driven westward from the drift at points 200 and 400 feet southward from the adit-crosscut. The sulphide mineralization appears to lie almost entirely to the west of a shear which is followed in the south drift. The crosscuts indicate that the mineralization is variable, and it appears to be richest close to the shear.

At 325 feet southward from the adit-crosscut, the writer took a sample across a width of 4 feet, measured westward from the shear. It assayed: Gold, 0.02 oz. per ton; silver, 2.4 oz. per ton; copper, 2 per cent. The average value on No. 6 level is understood to be lower than on the other levels and to consist chiefly in copper. The zone of disseminated sulphide mineralization was crosscut on Nos. 1, 4, 5, and 6 levels, on which the width exposed ranges from 65 to 80 feet. The range in elevation covered is approximately 380 feet. It is understood that although the average grade is low it would be attractive if sufficient tonnage could be blocked out to warrant a large-scale operation.

Silver Bell. The four claims, *Silver Bell* and *Silver Bell Nos. 3, 4,* and *5,* are recorded in the names of H. Thomson, T. Martin, F. Fritz, and H. L. Woods, all of Hope. The group composed of these claims is about 1 mile south of the junction of the Skagit and Sumallo Rivers, covering ground on the steep western side of the Skagit River Valley. Frank Fritz, who has long been connected with the property, has a cabin on the eastern side of the Skagit about three-eighths of a mile southward from the end of the road at Silver Daisy Creek. The river is crossed near the cabin by means of a boat and cable, and a trail climbs to the principal workings, situated on a narrow bench at the tops of bluffs. An adit, driven north-westward from the face of the bluff, is at approximately 2,300 feet elevation, about 360 feet above the river.

The *Silver Bell* group was known for some time as the *Diamond* group and reported upon in Annual Reports of the Minister of Mines, British Columbia, from 1913 to 1923, and by Camsell, Geological Survey, Canada, Summary Report, 1911, and Cairnes, Geological Survey, Canada, Summary Report, 1920, Part A. More recently the property was reported upon under the name *Bell* group in Annual Reports of the Minister of Mines, British Columbia, 1925 and 1927, and in Geological Survey, Canada, Summary Report, 1922, Part A.

The claim *Silver Bell No. 3* of the present group was recorded in 1921, the other claims were recorded in 1935 and 1938. However, ground covered by these claims had been staked before and allowed to lapse.

The geological mapping shows the property to be underlain by rocks of the Hozameen series, which include limestone of varying purity interbedded with massive cherty rock, and volcanic rocks, some of which are intrusive. Contact metamorphic effects, including the development of sulphide mineralization, have been attributed to the intrusive greenstones included in the Hozameen series. At the principal showing the enclosing rock has been brecciated in part and in part disturbed by squeezing. The original minerals, apparently, have been selectively replaced by silicates. The result is a complex, composed largely of lime silicates, bearing little resemblance to the limestone from which it is presumed to have been derived. Locally it has been aptly called "curly rock"; some of this, however, may have been produced by the squeezing of rock originally composed of laminæ of siliceous, argillaceous, and possibly calcareous material. Pyrrhotite, arsenopyrite, and chalcopyrite form the bulk of the material in certain bands, and occur as grains or small masses disseminated through the metamorphic rock, which also contains garnets, epidote, and actinolite. Arseno-

pyrite also occurs in some narrow, vein-like masses. Cairnes reported some sphalerite and galena in narrow stringers on the borders of the main showing. The writer was shown a specimen containing grey copper, said to have come from such a vein. An 8-inch vein of almost solid chalcopyrite in a cut 1,100 feet above the river has been mentioned in earlier reports, but was not visited by the writer. Values are principally in copper, with some silver; a little gold has been reported from some samples; in general the grade is low.

The writer visited the principal and lowest showing, also an adit and a group of open-cuts, lying west of the principal showing. Previous reports refer to some surface cuts situated at considerably higher elevations. It is understood that recent work has been concentrated on the principal showing. This has been explored by stripping a considerable area, and making a crosscutting trench in rock on a narrow bench just above a steep bluff, and by driving a short adit from the face of the bluff a few feet below the bench. A short distance farther north a surface cut has been made on the bench.

Recent work at the south end of the showing has exposed disseminated sulphide mineralization in metamorphic rock cut by joints which strike east of north and dip from 35 to 45 degrees westward. The jointed rock contains disseminated mineralization for a thickness of 5 feet normal to the jointing, below which the rock is more siliceous and the sulphides are less abundant. A sample across 3 feet of the better mineralized material assayed: Gold, *nil;* silver, 2 oz. per ton; copper, 2.3 per cent.

Old stripping continues northward, and at about 60 feet from the most southerly stripping a trench has been driven in rock due west for about 25 feet from the face of the bluff, and thence for 26 feet at south 65 degrees west. The inner 28 feet of the trench crosscuts sulphide mineralization which is massive in two bands and in the remainder of the section is disseminated and variable.

The most easterly mineralization is along a fracture striking north 10 degrees west and dipping 75 degrees to the east; along it heavy sulphide mineralization, about 18 inches wide, is developed. This can be traced southward for about 35 feet as a very rusty band up to 4 feet wide. About 5 feet to the west another rusty band on the surface contains a good deal of sulphides and quartz. To the west again the rock is less well-mineralized, but the section sampled at the most southerly stripping lies west of the southerly projection of this second well-mineralized band. At the face of the trench the rock is sparingly mineralized with sulphides, but for the few feet east of the face on the north side of the cut the rock is very rusty and shows more evidence of sulphides.

From a point about 20 feet north-west of the bend in this trench stripping trends north-eastward for 28 feet. It exposed what are doubtless the northerly continuations of the fractures along which the most massive sulphide mineralization is developed south of the trench. Here the more easterly fracture seems to stand almost vertically, and the rock on the sides of the fracture is heavily impregnated with sulphides for a total width of 2 or 3 feet.

Disseminated sulphides, extending outward from the more massive mineralization, give a total width of 7 or 8 feet which is well-mineralized. Farther away the sulphides fade out and the rock becomes noticeably impregnated with epidote. To the west, beyond 5 feet of barren or very low-grade material, the second well-mineralized band is 18 inches in width. The mineralization does not terminate at the north-western boundary of the stripping, but the distance to which it extends northward along the projected strike of the fractures has not been indicated.

A cut has been made at a point near the edge of the bluff, 50 feet east of north from the end of the stripping just described, and about 80 feet due north from the outer end of the long crosscutting trench. In this open-cut shearing striking north 35 degrees west and dipping 45 to 65 degrees south-westward is exposed for a length of 12 feet. Toward the outer end of the cut there is moderate sulphide mineralization for a width of 18 inches.

In the workings which have been described the sulphides have been in part affected by weathering, and possibly some of the copper has been leached. Dense, hard seams or lenses of limonite have been formed at some points where sulphide mineralization was presumably concentrated; elsewhere, unless freshly broken, the rock has a rusty coating which obscures any unaltered sulphides.

An adit has been driven 80 feet north-westward from the face of the bluff at a point about due east of the most southerly stripping, and about 30 feet below the highest rock

exposed in the surface workings. The adit slopes downward for the inner 25 feet, that is from the point where it is vertically below the long trench. There is probably 10 or 12 feet of rock between the floor of the trench and the roof of the adit. For 15 feet toward the portal from this point a steeply-dipping fracture is exposed in the adit and along it there is a good deal of copper carbonate, but the wall-rock, which is siliceous, contains little sulphide mineralization. From this point north-westward to the end of the adit the wall-rock is cut by parallel joints which strike about north 70 degrees east and stand about vertically; though siliceous, the rock contains a moderate proportion of disseminated sulphides.

The more easterly and wider of the two well-mineralized bands exposed in the stripping above the adit would fall at or outside the portal if projected to that point, and must have been weathered off if it continued that far. The western band was not recognized in the adit and may not continue that far south or to that depth. It seems probable that the siliceous rock in which the adit was driven represents material less favourable for sulphide mineralization than the more limy rock exposed on the surface. Joints or sheeting of moderate westerly or north-westerly dip, exposed at the south end of the stripping, suggest the possibility that only the inner end of the adit is in the favourable zone; the disseminated mineralization there lends support to this supposition.

From a point in a draw about 250 feet westward from the stripping, and at approximately 2,425 feet elevation, an adit has been driven about 100 feet at north 80 degrees west, following a slip which dips 75 degrees to the north. Just outside the portal a fault is exposed, striking north 30 degrees west and dipping steeply to the north-east. Thin-bedded limestone is bent at the fault in such a manner as to indicate that the north-east side had moved downward relative to the south-west side. Chert at the north-east side is faulted against limestone on the south-west side.

From a point 8 feet inside the portal a short drift runs north 30 degrees west for a few feet. The floor is 2 or 3 feet below that of the adit, and the drift was filled with water to the level of the adit floor. The south wall of the adit is siliceous, but the roof and north wall are of bedded limestone which strikes east and dips 40 degrees north. At 80 feet from the portal the adit is timbered where it cut through fracturing which strikes north. A little disseminated sulphide mineralization is exposed in the siliceous south wall at the portal, and some rusty arsenopyrite is exposed at the portal of the short drift. On the dump there is some silicified limestone containing pyrite and chalcopyrite.

About 25 feet higher than the adit there is an outcrop of fine-grained andesitic greenstone. Farther up the hill, at approximately 2,550 feet elevation, silicified limestone has been exposed in an open-cut, and followed up the slope to about 40 feet higher elevation in a series of cuts or benches. The limestone strikes northward and dips about 65 degrees eastward, but at the highest working it is practically vertical and to the west the rock is very siliceous. On the east side of the lowest face the limestone contains garnets of moderate size.

The cut exposes evidence of mineralization over 7 feet from east to west. Limestone east of the cut shows little evidence of mineralization. Most of the mineralized section is rusty and leached. From 15 to 33 inches from the eastern side a fair quantity of sulphide mineralization, chiefly pyrrhotite and chalcopyrite, is to be seen. A sample across this section, 18 inches wide, assayed: Gold, *nil;* silver, 0.4 oz. per ton; copper, 0.3 per cent. Lime is exposed for 10 feet north-east of the lowest bench, and at 40 feet there is an exposure of fine-grained greenstone. Rusty rock, 5 to 7 feet wide, is exposed in the benches above.

Sunrise.

A claim known as the *Sunrise*, near the bottom of the south-westerly slope of Shawatum (Steamboat) Mountain, was recorded in 1933 in the name of C. J. Howlett, of Hope. In 1937 the *Dorothy* claim was recorded in the name of J. S. Day, who is associated with Howlett, and in 1938 the claims *Sunrise Nos. 2, 3,* and *4,* said to extend in a line southward to Nepopekum (Muddy) Creek, were recorded in the names of Howlett, Day, and W. Jamieson. The *Good Luck* claim, recorded in the name of H. C. Cooke, and the *Red Cross* claim, recorded in the name of H. H. Stevens, staked in 1937, are understood to be contiguous to those held by Howlett, Day, and Jamieson. It is reported that there was some further staking in 1938.

The workings, consisting of four open-cuts, at elevations from 2,400 to 2,500 feet, are understood to be on the *Sunrise* claim. They are situated on a moderately steep, wooded slope overlooking and about 400 feet above a fairly level area, which extends south-eastward

from the main Skagit Valley, between Steamboat and Little Steamboat Mountains. The workings are reached by a trail which leaves the main Skagit trail about three-quarters of a mile south of Howlett's cabin, which is south of 10-Mile Creek. The branch trail, at easy grade, is followed somewhat south of east for approximately a mile, and from this point a new trail is followed north and east to the workings about half a mile distant.

Overburden is generally not heavy on the steep slope but, with the tree-cover, is sufficient to mask the bed-rock in most places. The section is mapped as underlain by the Hozameen series. In 1911 Camsell mentioned that the Hozameen series some 3,000 feet higher on the mountain was "folded, fractured, and metamorphosed, and . . . traversed by dykes of diorite porphyry, diabase, and lamprophyre."

A fine-grained diorite dyke was observed at the most westerly cut. The other exposures are of white, soft, decomposed rock, cut by irregular quartz lenses and stringers, and, at the second cut, apparently overlain by a fine-grained siliceous layer. The dyke, siliceous layer, and white, decomposed rock contain disseminated sulphides, principally pyrite. Stains suggest the presence of some copper sulphide, and some galena and sphalerite were observed. Microscopic study indicated that the siliceous layer was a dense breccia with small angular quartz fragments, and that the white decomposed rock was probably a silicified limestone.

The first cut is at approximately 2,400 feet elevation; the second, about 150 feet south 80 degrees east from the first, is at approximately 2,430 feet elevation; the third, about 100 feet from the second, at north 80 degrees east, is roughly at 2,490 feet elevation; and the fourth, 235 feet south 45 degrees east from the second, is at approximately 2,500 feet elevation. Pyrite is exposed in the dyke at the first cut, in the silicified limestone and the breccia at the second, and in the silicified limestone at the third and fourth cuts. At the fourth, a considerable amount of chlorite was noticed and a little sphalerite and galena were to be seen, particularly in the north-west corner of the cut at the floor. Samples of the pyrite-bearing breccia, and the silicified limestone impregnated with pyrite from the second and third cuts, assayed *nil* in gold and silver. In the fourth cut a vertical channel, representing 5 feet, assayed: Gold, 0.02 oz. per ton; silver, 0.4 oz. per ton. A sample across 15 inches in the north-west corner at the floor assayed: Gold, 0.02 oz. per ton; silver, 0.2 oz. per ton; lead, *nil;* zinc, 3.8 per cent.

Sunset. Four claims recorded in 1936 in the names of J. S. Day and C. J. Howlett, and four claims recorded in 1938 in the names of W. A. Jamieson, J. D. Mowat, H. Castillou, and M. M. Castillou, are included in this group. The claims are near the head of Galena Creek in the south-west corner of the area and are served by a branch trail up Galena Creek, which also serves the *International* and *Grandview* Crown-granted claims lying a short distance to the south. The branch trail leaves the main Skagit trail on the east side of the river at the Whitworth Ranch, crosses the river on a foot-log and, on the west side of the river, crosses ground which is flooded during high water. The crossing is about 5 miles from Howlett's cabin south of 10-Mile Creek, which makes the distance, to the end of the road at Silver Daisy Creek, roughly 17 miles. There is also a route down the west side of the Skagit from a crossing not far from Howlett's cabin. This trail has several stream crossings where the bridges would need to be rebuilt or repaired. From the junction of these two routes, about a quarter of a mile west of the Skagit River, at about 1,700 feet elevation, the trail up Galena Creek climbs steadily by a series of switchbacks for approximately 4½ miles to a junction at approximately 4,800 feet elevation.

From this point the trail to the *International* and *Grandview* claims continues south-westward, and the trail to the *Sunset* camp runs westward about 1,500 feet to the camp at 4,700 feet elevation. The trail traverses a considerable section, sloping toward the Skagit, in which the timber has been killed by fire.

The property was known formerly as the *Silent Friend* group, which was reported upon in Annual Reports of the Minister of Mines, British Columbia, for 1929 and 1930. At that time surface work was done on contact metamorphic-type mineralization, and an adit 320 feet long was driven below the outcrop. Work by the present operators has consisted in cleaning out and extending the surface cuts and driving a short branch drift following shearing on the adit-level.

The camp and workings are in a northward-facing basin tributary to Galena Creek. A log cabin, built by the former operators, was without a roof last September, but was serving

temporarily as a shelter in which a tent was erected. The adit-portal, at approximately 4,860 feet elevation, is about 950 feet westward from the camp on the north-easterly side of a small spur extending northward into the basin. A dry gulch, trending about north 30 degrees east, runs into the basin on the other side of the spur. The surface workings and exposures are principally on the western side of the spur, which slopes steeply in a north-westerly direction, and toward the foot the slope is heavily covered with debris. These workings are from 80 to 130 feet higher than the adit. The slopes in the basin are steep, as are those in the country traversed by the trail up Galena Creek. Overburden is heavy and, within a short distance of the camp and workings, there is a moderately heavy stand of timber, consisting of hemlock and balsam fir from 10 to 18 inches in diameter.

This section was mapped by Cairnes as underlain by the Hozameen series intruded by an elongated mass of granodiorite, referred to the Chilliwack batholith of Miocene age, which crosses Galena Creek trending somewhat north of west. Just north of the camp and about 1,100 feet north-eastward from the workings there are outcrops of similar rock in a small area, assumed to be a smaller intrusive related to the larger one. The surface showings consist of limestone more or less altered by contact metamorphism. The limestone is squeezed and contorted but appears to strike about north 30 degrees east and to dip 35 degrees westward, and has an indicated thickness of 60 or 70 feet. It is cut by joints and some shears which are roughly parallel to the bedding. The limestone is overlain by greenstone and underlain by black, cherty rock and green, siliceous breccia. The adit driven south-westward by former operators, from a point 60 feet below the foot-wall of the limestone, is in chert and breccia for its length of 320 feet.

From the dip of the limestone-beds exposed in the surface it might have been expected that the adit would have intersected limestone about 250 feet from the portal. Since the adit did not enter limestone it is apparent that the dip of the contact must be flatter than the dip of the bedding observed on the surface, or that the contact must be either a faulted or an unconformable one.

Metamorphism of the limestone varies from recrystallization to complete replacement by sulphides, or almost complete replacement by lime silicates and magnetite or specular hematite. Actinolite, garnet, calcite, quartz, some epidote, magnetite, specular hematite, pyrite, sphalerite, chalcopyrite, and a minor amount of galena are the principal minerals developed in the metamorphosed rock. At some points these contact minerals, lacking the sulphides, make up the rock which then appears in dyke relationship to the rest of the mass. It is possible that such occurrences represent silicification of basic dykes which previously had been almost completely altered to carbonate, though they may represent complete reorganization of the limestone, with the introduction of basic elements along fracturing or other favourable structural features. The alteration of the limestone is by no means uniform, some sections have escaped with inconspicuous recrystallization, whereas the near-by rock is composed of contact silicates or of sulphides. Except for jointing and minor shearing along the bedding, the structural features which have controlled the alteration are not marked.

Limestone is exposed on the rocky spur 60 feet higher than and about 75 feet south-westward from the adit-portal. To that point the rock exposed on the spur is chert or cherty breccia. Typical contact minerals are observed in breccia at approximately the elevation of the adit, 30 to 50 feet westward from the portal. On the easterly side of the spur, 95 feet above the level and 110 feet south-west of the portal, a shear is exposed striking north 35 degrees east and dipping 30 degrees north-westward, following the bedding in the limestone. It is marked by a rusty streak, 6 to 12 inches wide, containing garnets, specular hematite, and some pyrite, and is traceable for 40 feet south-westward. The overlying rock is green and fine-grained and appears to be composed of lime silicates and carbonate. Contorted limestone, 7 or 8 feet below the shear, contains some copper carbonate. The rocks exposed to the south and south-east are fine-grained greenstones. To the west overburden conceals the rock for 25 to 40 feet, beyond which mineralized showings are exposed on the westerly slope. The exposures are in an area of irregular shape, which has a maximum length from north-east to south-west of about 80 feet and a maximum width of about 60 feet, measured north-westward down the slope.

Near the bottom fresh stripping extends horizontally for about 70 feet from a cut in rock at the south-west end to the north-east end of the exposure. There is another cut at the south-west end about 15 feet lower than the first. The cuts expose sulphide mineralization, including a lens of dark brown sphalerite containing small masses of chalcopyrite. There is a good deal of quartz, and apparently calcite has been leached. Pyrite, chalcopyrite, and a little galena were also observed. The sulphides are considerably more abundant in the upper than in the lower cut. In the upper cut sphalerite, as free as possible from inclusions of chalcopyrite, was selected. Quartz with pyrite and chalcopyrite was also selected. Samples of these materials gave the following assays:—

Description.	Gold.	Silver.	Copper.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
Selected sphalerite	Trace	0.2	*Nil*	60.6
Selected quartz with pyrite and chalcopyrite	0.02	4.2	5.2	7.4

Twenty-two feet north-eastward across the exposure from the south-west side of the upper cut a band of contact silicates, 2 to 4 feet wide, is exposed. This band trends south-eastward and dips steeply. Beyond it, flat-lying gossan is exposed just below the stripping and extends north-eastward for about 25 feet, then turns downward and is covered by debris.

Just above the gossan the stripping exposes disseminated sulphides, of which a chip sample, taken from 15 feet along the stripping, assayed: Gold, 0.01 oz. per ton; silver, 2.6 oz. per ton; copper, 1.1 per cent.; zinc, 13.1 per cent. The disseminated sulphides extend to about 2 feet above the bottom of the stripping, then give way to limestone which is probably recrystallized, but otherwise shows little evidence of metamorphism. This extends for about 15 feet up the slope to a second irregular seam of gossan, up to 5 feet thick, exposed for a horizontal distance of about 25 feet. A third similar seam of gossan is exposed 20 feet or so above the second. Between 50 and 52 feet from the south-west end the stripping crosses another band, composed of contact silicates, containing pyrite and magnetite. This stands steeply and trends south-eastward up the slope. The three flat-lying seams of gossan thus extend between two steep bands of contact minerals containing little sulphide, and are separated by horizontal layers of limestone not markedly affected by metamorphism. North of the second steep band of contact silicates recrystallized limestone extends for 20 feet horizontally, which contains garnets, magnetite, and other contact minerals, but very little sulphide mineralization. Beyond this the rock contains specular hematite to the end of the exposure.

The adit was driven 146 feet at south 27 degrees west; thence 61 feet at south 71 degrees west; thence 112 feet at north 66 degrees west to the face. In this distance it passed from east to west under the principal showing. Shearing, crosscut from 52 to 58 feet on the last course, had been followed 10 feet south-westward by a drift. The shearing dips steeply to the south-east. Some calcite and hematite, filling narrow cracks, are exposed in the drift. The adit is in chert or cherty breccia, cut by several joints and fractures, but containing little mineralization. If the adit were continued on its last course it would probably pass the bottom of the dry gulch under shallow cover. Whether it would encounter limestone or not is uncertain, and the extension in this direction could probably be determined more cheaply by surface work, even in the heavy overburden below the surface workings. An alternative method of locating the base of the limestone would be to raise from the adit, and it might be in order to raise on the shearing exposed in the drift. This would probably be more expensive than stripping on the surface but should leave a more permanent working.

The extent of the body containing ore-minerals has not been delimited by the existing workings, and extensive sampling would be necessary in order to determine the grade of the deposit. It is likely that further stripping would expose more sulphide mineralization and, as the mineralization is irregular, changes would probably be observed if cuts were extended into the deposit.

10-Mile Creek Section.

A great many occurrences of sulphide mineralization have been prospected by surface workings in a section of country lying north of 10-Mile (Shawatum) Creek, which enters the Skagit Valley from the east just south of the old townsite. The mineralized section extends

from the tributary, shown on the map as Giant Creek, eastward for about 1¾ miles as far as bluffs above the cabin, and northward to the summit of the ridge between 10-Mile and 28-Mile Creeks. Some thirty mineral claims are understood to be in good standing in this section. All are held by location and are unsurveyed. These claims were recorded in various years from 1924 to 1938. A number of them cover discoveries made prior to 1924, which formerly were known by other names. A prospect named *Clear* group is shown on the map accompanying Camsell's report (Geological Survey, Canada, Summary Report, 1911), though the group was not described in the report, and the *Billican, North Star,* and *Skagit Giant* groups were described by Cairnes (Geological Survey, Canada, Summary Report, 1923, Part A). Of these names, *Skagit Giant* alone is now in use and applies to a claim staked recently. References to this section were made in the Annual Reports, Minister of Mines, British Columbia, for 1923 and 1929.

The old townsite is approximately 11 miles southward by pack-trail from the end of the road at Silver Daisy Creek. The trail up 10-Mile Creek leaves the Skagit River trail at the townsite and, after making its way across the flat, climbs to the north side of 10-Mile Creek Valley and continues on that side to a cabin at about 3,750 feet elevation, just north of the creek, about 2½ miles eastward from the townsite. In its length of about 3½ miles the trail climbs approximately 2,000 feet; for most of the distance the grade is fair, but in two sections the trail climbs steeply. The north side of the valley rises to a ridge of which the summit ranges in elevation from 5,900 to 6,600 feet. In the section with which this report is concerned there are four tributaries which head in fair-sized basins, and in their lower courses occupy deep draws cutting through the steep lower slopes of the 10-Mile Creek Valley. Moderate-sized timber extends to elevations of 5,000 to 5,500 feet, above which the slopes are more open. Overburden is deep in the basins and of moderate depth on the steep lower slopes. Rock-exposures are numerous as much of the country is steep and bluffy.

The four tributaries are shown on the map, named from west to east Giant, Antimony, Pyrrhotite, and Star Group Creeks; of these, the first and last are called Dry Gulch and Mineral Creek respectively in the report by Cairnes.

The writer spent four days in the fall of 1938 examining occurrences in the 10-Mile Creek section. C. J. Howlett, who has been familiar with the section since shortly after the first discoveries were made, and who owns a considerable number of the claims, very generously acted as guide. It is believed that the most promising occurrences were examined in this period, but a number were not visited, including some of the higher showings described by Cairnes. Those visited range in elevation from 2,750 feet west of Giant Creek to 5,600 feet in the basin at the head of Star Group Creek. As the claims are unsurveyed and many of the location-posts are old, it is impossible for the writer to be entirely certain on which claims some important showings are situated. Accordingly where particular occurrences are described in the following notes they will be located with reference to the cabin or the tributary creeks. So many showings have been discovered and have been prospected in shallow workings, that to describe even the more important ones in detail would require more space than it seems desirable to devote to this report, which, accordingly, has been generalized as much as possible.

Geological mapping by Cairnes shows this section to be underlain by rocks of the Hozameen series. These include andesitic greenstone, chert, cherty argillaceous sediments, and limestone. The series has been subjected to regional deformation, and in this locality a strong system of jointing, striking about north 31 degrees west and dipping steeply to the south-east, is characteristic. There has also been more local deformation resulting in fracturing and shearing of rather diverse attitudes. Small intrusives of quartz diorite and hornblende diorite were observed by the writer, and Cairnes mentions other diorite intrusives.

Although irregular replacement deposits containing massive and disseminated sulphides are numerous, and have been incompletely explored by many surface workings, their structural relationships and certain other important features have not been clearly indicated. This is due to a number of factors—the margins of these bodies tend to be gradational and are rarely completely exposed by the workings; the rocks have been very much deformed and have been greatly metamorphosed; the rugged terrain, timber, overburden, and rusty coating on much of the weathered rock surface combine to obscure the rocks and make it difficult to trace their relationships. However, certain features are apparent—a consider-

able number of the deposits are developed in a metamorphic rock which apparently is derived from an original limestone; the regional jointing with shears, which have variable attitudes, appears to have furnished channels through which the mineralizing solutions gained access to the rocks in which the deposits are developed. It is also worthy of mention that intrusive dioritic rocks have been found or indicated close to most of the important centres of mineralization.

The most promising replacement mineralization seen by the writer lies in the small area extending from the east side of Pyrrhotite Creek to just east of Star Group Creek, between about 4,500 and 5,000 feet elevation, and not far east of Antimony Creek, at about 3,400 to 3,450 feet elevation. At these showings massive and disseminated sulphide mineralization is developed, generally in a fine-grained mottled rock from buff to pale purple colour and of cherty appearance.

Some of it is siliceous but much of it contains carbonate. At some points the rock has obviously been brecciated. It probably represents irregular masses or pods of impure limestone, which generally has been completely metamorphosed. Some cherty beds may be included and there may have been nodular cherty inclusions in some of the limestone. The extent of the bodies of the metamorphic rock has not been indicated. It is found in contact with or close to andesitic greenstone, which forms an important part of the series. Some of the limestone adjoining diorite intrusives is now represented by a highly epidotized rock from which practically all the carbonate has been eliminated. At other points rock, composed almost entirely of moderately fine-grained carbonate, is to be seen.

Quartz diorite outcrops on the ridge between two branches of Star Group Creek and just east of the east fork of the creek. Hornblende diorite outcrops on the ridge less than a quarter of a mile eastward from Pyrrhotite Creek at approximately 4,575 feet elevation. Float, or a doubtful outcrop, just above the main trail, a short distance east of Antimony Creek, indicates the probability that diorite intrudes that locality also.

Sulphide mineralization varies from networks of narrow joints or fractures filled with sphalerite and pyrrhotite to disseminated sulphides and massive fine-grained sulphides composed principally of pyrrhotite. Pyrrhotite is present in the greatest quantity, and sphalerite second quantitatively, but at some points is almost entirely absent. Chalcopyrite is very commonly present and almost always in small quantity. Pyrite and arsenopyrite are present locally and galena was observed at one or two points. Calcite or ankeritic carbonate is often present, and may be coarsely crystalline. At some points carbonate crystals are intergrown with well-crystallized quartz. Quartz, usually heavily mineralized with sulphides, occurs in lenses or vein-like masses in some of the larger, irregular sulphide deposits. This quartz is often the focus for the development of pyrite and arsenopyrite.

The ridge between the two forks of Star Group Creek has been called Gold Pan Point. It is composed largely of quartz diorite for some distance north of the junction of the two forks of the creek. A good deal of mineralization has been exposed east of the east branch and west of the west branch for some distance north of the junction.

Vein-filling in east-west fracturing in the diorite, and some disseminated mineralization in greenstone, have been prospected by extensive workings on Gold Pan Point. East of the east fork on the steep south-westerly slope between 4,650 and 4,720 feet elevation, there are four cuts and a 25-foot adit, exposing mineralization varying from massive to sparsely disseminated sulphides. Massive sulphides, occurring over widths of 5 or 6 feet, grade into sparsely disseminated mineralization. At two of the cuts lenses of quartz, heavily mineralized with sulphides, are exposed; they strike north-westward and dip from 30 to 45 degrees to the south-west and are underlain by disseminated mineralization. These workings constitute what has been called the "glory-hole," and a great deal of work has been done in an area roughly 125 feet from north to south and a maximum of 50 feet from east to west. However, the variable nature of the mineralization and the depth of overburden leave room for doubt concerning the size and grade of the deposit. A sample across 5 feet of massive sulphides assayed: Gold, 0.10 oz. per ton; silver, 0.3 oz. per ton; copper, 0.1 per cent.; lead, *nil;* zinc, 10.8 per cent.

Possibly 600 feet farther north, also east of the creek, at about 4,750 feet elevation, a recent cut exposes massive and disseminated mineralization, adjoining and just south of a

small outcrop of quartz diorite. Due west on Gold Pan Point there is disseminated mineralization in greenstone very close to quartz diorite and the cuts exploring the veins lie to the south. In the west fork, about 150 feet west of the mineralized greenstone, sulphide mineralization of a disseminated character is exposed in the bed of the creek. A sample across 45 inches assayed: Gold, 0.02 oz. per ton; silver, 0.8 oz. per ton; copper, *nil;* zinc, 2.2 per cent. Just west of the creek, at elevations from 4,875 to 4,850 feet, there are three cuts or strippings in a distance of about 275 feet from north to south. A sample of selected fracture-filling, largely sphalerite, from the most northerly, assayed: Gold, 0.20 oz. per ton; silver, 1.2 oz. per ton; copper, 0.2 per cent.; lead, *nil;* zinc, 22.9 per cent.

Several cuts expose sulphide mineralization at various points between Star Group Creek and Pyrrhotite Creek. The draw occupied by Pyrrhotite Creek trends about south 10 degrees west and a long surface cut is on the eastern side at approximately 4,500 feet elevation. The cut is about 110 feet in length and runs at about north 20 degrees west to a point approximately 60 feet from the creek. From 8 to 28 feet and 33 to 54 feet from the south end the cut exposes massive sulphides, consisting principally of pyrrhotite with some chalcopyrite. The mineralization seems to trend about north 30 degrees east and to dip 40 to 55 degrees south-eastward. There is disseminated mineralization with occasional bands of massive sulphides to the north end of the cut. A chip sample, taken carefully between 37 and 49 feet from the south end, excluding decomposed material from 41 to 42 feet, assayed: Gold, 0.02 oz. per ton; silver, trace; copper, 0.5 per cent.; zinc, *nil.* At the cut, overburden is 5 to 8 feet thick. For 800 or 900 feet up the hill, north-eastward from the long cut, variable mineralization is exposed at intervals in several cuts and outcrops. Rock, well-exposed for some distance above the creek on the west side, appears to consist largely of siliceous breccia and to contain little mineralization.

Two cuts, about 100 feet apart, on the steep slope east of Antimony Creek, at approximately 3,400 and 3,450 feet elevation, expose sulphide mineralization of good width. These cuts are understood to be on the *Ruby* and *Vancouver* claims. In the more northerly cut massive mineralization is developed under shearing striking east and dipping 25 degrees to the south; the mineralization also cuts through the hanging-wall of the shearing in small chimney-like masses. A sample representing 8 feet normal to, and lying immediately below, the shearing, assayed: Gold, 0.10 oz. per ton; silver, trace; copper, 0.35 per cent.; zinc, *nil.*

Massive mixed sulphide mineralization apparently occupies most of a vertical section of about 25 feet, exposed in two cuts in the basin at the head of Star Group Creek at about 5,600 feet elevation. Typical material, selected from the dump of the lower cut, assayed: Gold, 0.02 oz. per ton; silver, 0.3 oz. per ton; copper, *nil;* zinc, 0.4 per cent.

Mineralization, consisting largely of pyrite, is developed in epidotized greenstone exposed in cuts at about 2,700 feet elevation on the trail a short distance east of Giant Creek and on the ridge just west of Giant Creek between 2,750 and 3,200 feet elevation. Some magnetite occurs at the latter location. Selected heavily mineralized material returned assays of a trace in gold and silver. One sample assayed 0.3 per cent. copper. Showings of massive pyrrhotite mineralization are understood to occur east of the creek at higher elevations.

Vein-mineralization does not appear to be apt to yield commercial ore-bodies, but it doubtless has a relationship to the replacement deposit and gives some indication of the association of values. Typical occurrences are described in the remainder of this report on the 10-Mile Creek section.

Numerous parallel veins are exposed in bluffs just north of the cabin, and these have been prospected between elevations of 4,175 and 4,500 feet by strippings, surface cuts, and two or three short adits. The bluffs are predominantly of fine-grained andesitic greenstone cut by a great many parallel joints striking about north 35 degrees west and dipping 75 to 80 degrees eastward. There are also flatter-lying shears. Many of the joints are filled with mixed sulphides, in which the writer recognized sphalerite, arsenopyrite, chalcopyrite, galena, and a fine-grained grey sulph-antimonide of lead which is probably jamesonite, and Cairnes reported the presence of stibnite. Pyrrhotite is the most abundant and is followed by sphalerite. Galena appears to occur locally. Most of these veins are less than an inch wide, though some are 2 or 3 inches in width. The vein-fillings consist almost entirely of sulphides,

of which many crystals appear to have grown inward from the walls. Samples taken by the writer gave the following assays:—

Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
2- to 3-inch vein in 10-foot adit	0.10	6.6	*Nil*	2.7	4.4
½- to ¾-inch vein	0.06	0.4	*Nil*	—	7.9

Some assays quoted in the Annual Report, Minister of Mines, British Columbia, 1929, from the *Gold Coin* group, doubtless from this same series of veins, gave materially higher assays in silver. Although these veins are numerous they do not appear to be sufficiently closely spaced, and are too narrow individually to be of commercial importance. Irregular lenses of similar sulphides are developed in flat-lying shears from 2 to 15 inches thick and were observed intersecting the joints. Disseminated sulphides were observed in the walls of the steep fractures and the flatter-lying lenses.

Quartz or quartz and carbonate, usually abundantly mineralized with sulphides, occurs as veins or lenses within or on the margins of several of the irregular replacement-bodies. This mineralization is apparently developed along shearing and is usually of low or moderate dip.

The ridge, called Gold Pan Point, is composed largely of quartz diorite for some distance northward from the junction of the two forks of Star Group Creek. Several fractures of east strike and steep north dip cut the quartz diorite. These fractures are generally from 6 inches to 1 foot wide, and contain crushed wall-rock, some quartz, and mixed sulphides, including notable proportions of arsenopyrite. From one of these, at approximately 4,650 feet elevation, the writer took two samples, which returned the following assays:—

Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
Principally sulphides, representing about 6-inch width of vein	0.08	0.3	0.6	*Nil*	9.8
Selected arsenopyrite from vein	0.40	0.6	—	—	23.6

Veins striking about south 70 degrees east and dipping 45 degrees or less steeply to the south were observed on the ridge just east of Pyrrhotite Creek, in workings at elevations from 4,350 to 4,400 feet. The rock is the fine-grained metamorphic rock, probably originally limestone. Most of the veins, which are from 2 to 10 inches wide, contain mixed sulphides which are also disseminated in the wall-rocks. Arsenopyrite is an important constituent of the veins and occurs intergrown with large well-formed quartz crystals. Selected arsenopyrite assayed: Gold, 0.36 oz. per ton; silver, 0.8 oz. per ton; arsenic, 27.0 per cent. About 500 feet a little east of north from these workings an open-cut, at about 4,650 feet elevation, exposes an irregular vein from 1 foot to 2½ feet wide, striking north-westward and dipping steeply to the south-west. This vein is filled largely with sulphides but also contains some quartz; the sulphides consist of solid, well-crystallized pyrite, with some pyrrhotite and arsenopyrite. A sample of selected pyrite assayed: Gold, 0.14 oz. per ton; silver, 0.1 oz. per ton; copper, *nil*.

A quartz vein outcrops in Pyrrhotite Creek at approximately 4,500 feet elevation. The vein is not well exposed, but appears to strike about north 30 degrees east and to dip steeply to the south-east. It is 4 to 5 feet in width and is composed largely of quartz, but contains pyrite, chalcopyrite, and some stibnite.

Vein Deposits.

Vein deposits in the Skagit River area, described in the following notes, occur in andesitic and cherty rocks of the Hozameen series, in the Skagit volcanic series, and in granitic rocks. Most of the veins on which work has been done average less than 2 feet in width. The veins contain a variety of sulphide minerals, and quite commonly sulphides form the greater part of the mineralization. Values are principally in silver and lead, copper and gold contained in the veins or in parts of the veins depend usually on the presence of chalcopyrite or arsenopyrite and pyrite. Work on the veins has been done principally in the 23-Mile Camp and in the granitic intrusive just east of that camp. Small shipments of ore carrying good values in silver have been made from the *Invermay Annex* and *Silver Daisy* properties in this part

of the area. On the *International* and *Grandview* claims, in the Skagit volcanics, the vein contains segregations of almost pure galena carrying moderate values in silver and comparatively little gold. Pyrite-chalcopyrite mineralization in the same vein carries moderate values in gold, silver, and copper, and is essentially free from lead. Veins are found in and at the margins of sulphide replacement deposits and are referred to in the part of the report dealing with replacement deposits.

B.B. The claims *Big Ben* and *Big Ben No. 2*, which form this group, are recorded in the names of W. H. Robinson and V. Lunde, and cover ground north of the Sumallo River just east of the 23-Mile junction. The workings are on bluffs north of the road and lie east of a rock-slide which is half a mile or so westward from the junction. Several of the workings were made years ago, but the claims now covering them were staked recently. The country-rock is fine-grained andesite and granular quartzite, some of which has been brecciated. A quartz diorite intrusive, mapped by Cairnes, is near-by, and dykes, probably related to the larger intrusive, are found close to the workings. A short adit and several rock-cuts on the bluffs explore quartz-sulphide mineralization in joints or fractures, which strike north-eastward and are vertical or dip very steeply, and in shattered wall-rock adjoining these fractures. The sulphides observed include pyrrhotite, chalcopyrite, arsenopyrite, pyrite, galena, and needle-like crystals of a lead sulph-antimonide which, after microscopic study, were reported to be boulangerite or jamesonite.

Numerous fractures of the same general attitude are to be seen in the bluffs south of the Sumallo, in the same vicinity, and some of these show as conspicuously rusty streaks. The more easterly and higher workings were made some years ago and are reached by a switchback trail which crosses the rock-slide.

The highest working is a cut at about 2,475 feet elevation and, about 12 feet lower, there is an adit from which a short raise connects with the middle of the cut. The face of the cut is about 15 feet high and is divided midway by a flat-lying, rusty band a few inches thick. Above this, a fracture containing 1 inch to 1½ inches of sulphides is separated from a parallel fracture containing 2 to 4 inches of sulphides by 18 inches of light quartzite. Mineralized material 3½ feet wide, immediately below the flat-lying band, narrows going down. It includes 9 inches of massive sulphides, consisting chiefly of pyrrhotite and chalcopyrite, with some galena, pyrite, and arsenopyrite. A sample across the solid sulphides, 8 inches wide at the floor, assayed: Gold, 0.20 oz. per ton; silver, 24.0 oz. per ton; copper, 0.4 per cent.; lead, 3.5 per cent.; zinc, *nil.*

The adit is driven north-eastward from a 15-foot rock-cut which starts at the edge of the bluff. The connection with the cut above is 18 feet from the portal, and from this point the adit turns to a course of north 70 degrees east and continues 21 feet to the face. A fracture, containing sulphides, usually a few inches wide, is followed for the length of the adit. At the turn the sulphides form an irregular mass 15 inches wide which narrows ahead, the width in the face is about 2 inches. About 10 feet back from the face a fracture striking north 20 degrees west and dipping 50 degrees westward crosses the adit. It is 3 inches wide and contains sulphides; several narrow parallel joints also contain sulphides. South-westward from this adit and 125 to 150 feet lower there are two rock-cuts exposing narrow fractures or joints, of north-easterly strike and steep north-westerly dip, which contain some small lenses of sulphides.

A recent working on the property, consisting of stripping on a bluff, is possibly 150 feet above the road and is reached by climbing the steep slope from the road east of the rock-slide. A little sulphide mineralization is developed in irregular fracturing over a width of 5 or 6 feet, but the sulphides are concentrated principally in one or two narrow fractures. Radiating aggregates of fine needles of the antimony-bearing sulphide are conspicuous along with arsenopyrite. The sulphides from a fracture 2 to 4 inches wide, and the adjoining material to the slides, were sampled, giving the following assays:—

Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
Sulphides from fracture 2 to 4 inches wide	0.02	19.8	*Nil*	1.8	Trace
Twenty-one inches west of fracture, containing a good deal of sulphide	0.02	3.4	*Nil*	1.1	Trace
Twenty-one inches east of fracture, containing little sulphide	Trace	0.8	*Nil*	Trace	Trace

Talus obscures the downward continuation, but the mineralization can be traced for 20 feet upward, in which distance it pinches to a narrow width, and above is obscured by overburden.

International and Grandview.

The Crown-granted claims *International*, Lot 932, owned by R. E. Hemphill, of Glendale, California, and *Grandview*, Lot 931, owned by Joseph Gibson, Sardis, B.C., are at the head of Galena Creek, in the position indicated on the map. They are the oldest locations in the area, having been staked in 1906 and brought to Crown grant in 1915. They were described by Camsell (Geological Survey, Canada, Summary Report, 1911), and by W. M. Brewer, Annual Report, Minister of Mines, British Columbia, 1915, under the name *International* group, and were referred to in the Annual Report, Minister of Mines, British Columbia, 1929, under the name *Grandview*. It is understood that the claims were bonded to interests, represented by Alex. Robinson, operating under the name of Morning Star Mines, Limited (N.P.L.), which company, now defunct, was registered in August, 1927, and was removed from the register in November, 1932. At the same time Robinson was responsible for work on the *Silent Friend* group, which is now known as the *Sunset* group, and is described in this report under the latter name. When the writer visited the property in September, 1938, he was not accompanied by a guide well acquainted with the property. Evidence of a tent-camp was found, but no recent working was observed in the part of the property visited.

From the junction, about 1,500 feet eastward from the camp on the *Sunset* group, the Galena Creek trail continues south-westward on the ridge east of Galena Creek. For half a mile it climbs by a series of switchbacks, then follows the crest of a rather sharp ridge which forms the divide between Boundary Creek to the south-east and Galena Creek to the north-west. At a point a little less than 1½ miles by trail from the junction the route turns north-westward for about 200 yards, reaching a small lake, at the eastern end of which a temporary camp was evidently set up some years ago. The lake is roughly 350 yards long and is the highest of several in the upper basin of Galena Creek. From the western end of the lake workings in a dry gully are reached by climbing north-westward up a talus-slope for about 200 yards. The workings extend into a gully or draw which runs about 25 degrees east of north from steep bluffs which form the rim of the basin. The bluffs are of andesitic tuff and andesitic breccia. The area was mapped as underlain by Skagit volcanics of Oligocene age. The north-easterly boundary of the formation would be no very great distance from these workings.

The lowest workings, at approximately 5,850 feet elevation, are almost completely filled with talus. About 150 feet southward from this point the draw is reduced to a narrow steep gutter cut through bluffs which rise for 50 or 60 feet. The principal showing lies on the eastern side of the draw, at the foot of bluffs 100 feet south 20 degrees west from the talus-filled cut first visited. Mineralization is well exposed there and for perhaps 30 feet to the north. The volcanics are cut by a series of joints which strike from 5 to 30 degrees west of south and stand vertically or dip steeply to the east. Such a joint forms the eastern wall of the draw and of the mineralization, and cuts through the flat-lying contact between underlying andesitic tuff and overlying andesitic breccia. The joint can be distinguished for 40 or 50 feet above the contact in the face of the bluff, but the mineralization, which is 4 to 5 feet wide in the underlying andesitic tuff, dies out abruptly at a flat-lying irregular surface of low dip to the north, about 4 feet above the contact. This surface is not noticeable in the bluff to the east, but can be followed as an irregular break for 10 feet west of the mineralization and is then obscured by talus.

The contact, at approximately 5,900 feet elevation, is marked by a fairly strong joint in the bluff to the east. The western wall apparently dies out a few feet above the top of the mineralization; it is a joint less regular than the eastern wall. The mineralized exposure consists of rusty decomposed material, white earthy matter, some quartz, and lumps of sulphides, and one considerable mass of sulphides from 18 inches to 2 feet wide and 2 feet in vertical extent. Except for a shell around the outside this consists of coarse, cubic galena, containing a little pyrite and chalcopyrite. The shell, and a seam immediately below it, consists of quartz, pyrite, and chalcopyrite. Lumps of fine-grained calcite are also to be seen

and this mineral accounts for the white earthy material in the outcrop. Two samples of selected material returned the following assays:—

Description.	Gold.	Silver.	Copper.	Lead.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
Cubic galena	0.06	23.0	----	76.8
Selected quartz and pyrite	0.30	5.2	1.2	0.1

It would probably be feasible to test the continuity of this occurrence by surface workings for 100 feet or so to the north, beyond which the debris is probably too deep for such work. It could be followed southward into the bluffs by a drift.

Invermay Annex Mining Company, Ltd. (N.P.L.).

The *Norwegian* group of eight claims, with twenty-one other claims, situated near the head of Silver Daisy Creek, and the *Home* claim, situated east of the Skagit River about opposite the mouth of the Sumallo, were recorded in 1933 and subsequent years. The claims are now in the name of the Invermay Annex Mining Company, Limited, which was incorporated in 1934.

The discovery was made in 1933 on claims of the *Norwegian* group, on which the principal workings are situated. The accompanying plan shows the five adits and a number of open-cuts, as at October 21st, 1938. An aerial tramway was built from a point below the workings to a lower terminal on the *Home* claim, near the Skagit River, in 1935. This lower terminal was constructed in 1938 after having been destroyed by a snowslide. In 1936 a shipment of ore was made to the smelter at Trail. Work on No. 3 level was commenced in 1937, and after a considerable shut-down was resumed early in the fall of 1938 near the inner end of the level.

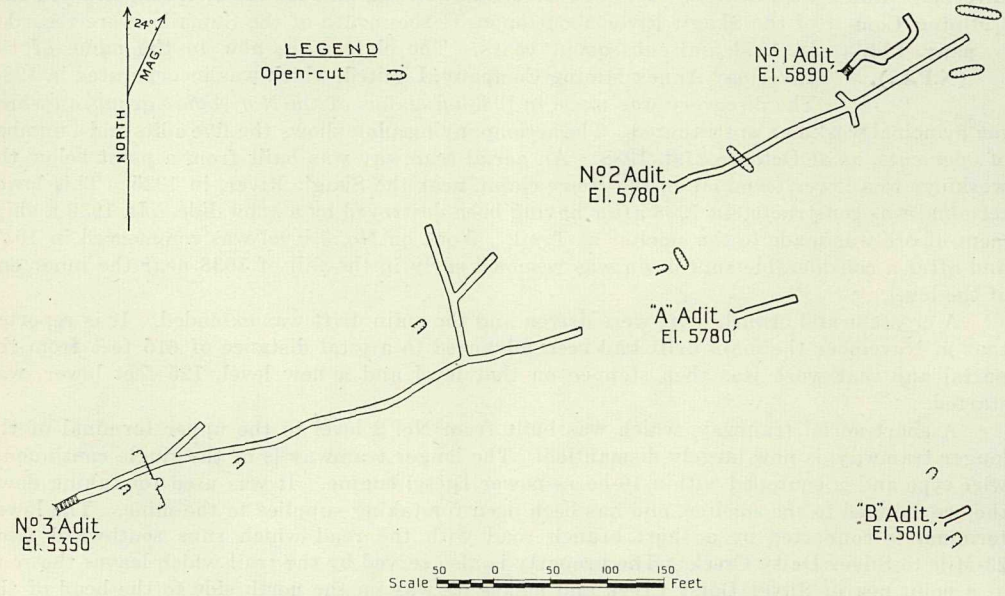
A crosscut and branch drift were driven and the main drift was extended. It is reported that in November the main drift had been advanced to a total distance of 615 feet from the portal and that work was then stopped on that level and a new level, 125 feet lower, was started.

A short aerial tramway, which was built from No. 2 level to the upper terminal of the longer tramway, is now largely dismantled. The longer tramway is of the single continuous-wire type and is equipped with a 10-horse-power Diesel engine. It was used for taking down the ore shipped to the smelter, and has been used for taking supplies to the mine. The lower terminal is connected by a short branch road with the road which runs southward from 23-Mile to Silver Daisy Creek. The property is also served by the trail which leaves the road at a point nearer Silver Daisy Creek and makes its way on the north side to the head of the creek. The lower section of the trail climbs steep bluffy slopes and crosses rock-slides in a series of switchbacks. The upper section is at an easier grade on more gentle, timbered slopes, but traverses considerable stretches of boggy ground. The camp, with accommodation for about fifteen men, and the upper terminal of the tramway near the camp are at approximately 5,100 feet elevation, about 3,100 feet higher than the road and 3¾ miles by trail from it. They are on a moderate south-westerly slope not far north of the creek and just below the steep slope on which the workings are situated. This slope is timbered to about the elevation of No. 2 level, 5,780 feet elevation, above which it is more open and grassy. Overburden is generally several feet deep.

Geological mapping by Cairnes shows the area in which the property is situated to be underlain by rocks of the Dewdney series, intruded by a considerable mass of quartz diorite. The rocks exposed in the surface and underground workings on this property, and on the *July* group, are granitic, as is an outcrop farther south-east on the divide at the head of the creek. Specimens submitted for microscopic study were reported to be hydrothermally altered, apparently most of them were originally granodiorite or quartz diorite. However, some of the specimens are of altered biotite granite, and at the *Invermay Annex* property some very much altered material of more basic composition appears as dykes in the more acid rocks. The altered rocks contain sericite, calcite, and more or less chlorite, actinolite, diopside, and touramaline, and disseminated sulphides. There is commonly enough carbonate present to cause specimens to react noticeably with acid.

Surface cuts and underground workings on the property have indicated and partly explored a shear-zone for a length of approximately 1,000 feet. Shearing between walls

which are usually from 1 foot to 2½ feet apart has been followed for the lengths of No. 2 and No. 3 levels. The general strike is north of east, but considerable changes in strike occur. The dips are generally steep to the south, though northerly dips are also observed. Shear-strands, generally from 1 inch to 1 foot in width and striking north-east, join the wider shearing on both sides. Some gouge seams of similar strike cross the wider shearing. The crosscut near the inner end of No. 3 level cuts seven or eight shears in 100 feet lying north of the main drift. Various surface cuts expose shear-strands occurring in widths of 30 or 40 feet. Thus branching and sub-parallel shear-strands cut a zone which, at least locally, is of considerable width; the actual width has not been indicated. No. 1 level, which follows an irregular course, is doubtless in part on the shearing followed on No. 2 level; and probably the shearing followed in No. 2 and No. 3 levels is the same, and is the principal shear of the zone. However, this is not proven, the levels are not connected, and the attitude of the shearing varies considerably at different points.



Invermay Annex property. Plan of workings from compass survey; elevations are approximate.

The material between the walls of the shearing is crushed and altered wall-rock with which there may be one or more lenses of quartz and sulphides paralleling the walls. The lenses are usually less than 8 inches thick and commonly are from 1 inch to 6 inches thick. The combined width of such lenses in any section of the wider shearing rarely amounts to 1 foot. The vein-mineralization was apparently largely concentrated in the wider shearing, though narrow lenses of quartz and sulphides are also found in branching or parallel shear-strands and, at some points, the walls of such strands have been impregnated with sulphides. Much of the better mineralized material is frozen to the walls, though some more sparingly mineralized lenses are comparatively free from the walls. It seems probable that the banded nature common to much of the vein-filling is in part inherited from gouge which it has replaced and in part is due to successive movement along the shear between periods of mineralization. At some points, as for example the inner end of No. 2 level, there has been a good deal of movement since the vein-minerals were introduced.

A varied suite of sulphide minerals is to be found on the *Invermay Annex* property and there is a good deal of difference in the modes of occurrence of some of these minerals. Galena and sphalerite are important constituents of vein-filling. Lumps of coarse cube galena were found on the surface, and some parts of the vein are composed largely of sphalerite. Some of the vein-matter has a dark, banded appearance, and is composed chiefly of finely crystalline quartz, galena, and sphalerite, with the sulphides tending to be segregated in separate bands. A fine-grained grey mineral, identified as jamesonite, was observed in

banded ore in which pyrite, arsenopyrite, and chalcopyrite, may also be found. It is possible that grey copper also occurs in ore of this type, though the mineral has not been identified. Some vein material of this type is banded with white quartz which is moderately coarsely crystalline and contains disseminated crystals of arsenopyrite and chalcopyrite, and more rarely of pyrite. Similar moderately coarsely crystalline quartz with an open, vuggy structure is also found, forming narrow lenses, and this material, though having a little sphalerite along the walls, appears to be mineralized principally with arsenopyrite in thin, elongated prisms. Locally, the wall-rocks along fractures contain disseminated sulphides; they consist principally of pyrite and arsenopyrite, but also include chalcopyrite and sphalerite, and carry non-commercial values in gold. There is still another type of mineralization on the property—namely, the occurrence of small and variable amounts of pyrite and chalcopyrite in a heavily tourmalinized gneissic rock which weathers to a very rusty colour. This material has been incompletely explored in " A " and " B " adits and in surface cuts lying southward from No. 2 adit-portal. A sample taken in the cut 45 feet north from " B " adit-portal, across 18 inches normal to the foliation, assayed: Gold, 0.02 oz. per ton; silver, 1 oz. per ton; copper, 0.25 per cent.

The vein-mineralization so far exposed has been valuable principally for its silver and lead content. The ore shipped to the smelter in 1936 had a dry weight of 21.227 tons and the smelter assay was: Gold, 0.01 oz. per ton; silver, 175.3 oz. per ton; lead, 13.6 per cent.; zinc, 19.8 per cent. Vein material, sampled by the writer, assayed from a trace to 0.14 oz. per ton in gold. The gold appears to be associated with pyrite and arsenopyrite, and as these are sparingly developed or absent in the more heavily mineralized parts of the vein the gold values are apt to be negligible in material carrying good values in silver and lead.

The following table of assays of samples taken by the writer will give some notion of the range in values. The shipment is evidence that material of higher grade has been obtained on the property:—

Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
No. 2 level—	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
6 inches at west side of vein, approximately 270 feet from portal	Trace	92.4	Trace	15.6	14.9
4 inches at east side of vein, approximately 270 feet from portal	Trace	31.6	*Nil*	2.6	16.1
No. 3 level—					
6 inches across sulphide lens, main drift, approximately 330 feet from portal	0.04	22.0	*Nil*	.....	17.8
2 inches quartz and sulphides, main drift, approximately 485 feet from portal	0.14	22.0	*Nil*	*Nil*	6.6
3-inch zincky vein in north crosscut, 30 feet from main drift, inner end No. 3 level	0.08	8.0	0.4	.....	24.0
7 inches altered wall-rock with sulphides at tight shear in north crosscut, 100 feet from main drift	0.08	1.2	0.2	.....	0.5
20 inches altered wall-rock with disseminated sulphides from face of branch drift from north crosscut	0.04	1.4	Trace	.....	0.8

There are caved cuts in the direction of the main shearing for 200 feet east of north, up the slope from No. 1 adit-portal. No. 1 adit, following an irregular course, crosses several rusty shears. Down the slope 125 feet towards No. 2 portal a cut exposes shearing across a width of about 4 feet. The portal is approximately 110 feet vertically below No. 1 level and 185 feet west of south from No. 1 portal. In its length of 290 feet, No. 2 level followed shearing between walls generally from 2 to 2½ feet apart. The roof is lagged from the portal to 22 feet, from 75 to 110 feet, and from 154 to 248 feet from the portal, obscuring the nature of the vein-filling. In the lagged sections there are two small stopes, from which it is understood that the ore shipped from the property was mined. From the portal there is little vein material to be seen in the roof until just before the lagged section at 75 feet is reached, where there is 1 foot of vein-matter. The centre line of the manway serving the first stope is approximately 95 feet from the portal. The roof of the stope, 28 feet above the floor

of the drift, extended 8 feet westward and 20 feet eastward from the centre line of the manway. Shearing, 6 to 10 inches wide in the roof, contained streaks of zincky vein material. Eastward from the end of this lagged section there is little but gouge until a point a few feet from the next lagged section is reached; there, vein-mineralization, about 7 inches wide, is developed and continues to the lagging. The second stope is in this lagged section, the manway approximately 210 feet from the portal was inaccessible. From the end of the lagging to the face, a distance of 42 feet, the shear is loose and apparently there has been post-mineral movement. Streaks or lenses of vein-matter occur in the shear, and about 25 feet from the face two such lenses, with a combined width of 10 inches, are separated by about 18 inches of altered wall-rock. The results of sampling these lenses appear in the table earlier in the report.

In the distance of about 620 feet from No. 2 portal to No. 3 portal there are several caved cuts and pits. About 90 feet from the lower portal, a wide crosscutting surface working exposes shearing and some vein-mineralization, and 25 feet nearer the portal a smaller cut exposes 7 or 8 inches of banded vein in which arsenopyrite, chalcopyrite, and pyrite occur in crystalline quartz with galena and sphalerite and some jamesonite in bands on the walls of the quartz.

In No. 3 adit, which is approximately 430 feet lower than No. 2, there is fairly continuous vein-mineralization from the end of the timbering at 40 to 70 feet from the portal. The shearing, which is from 1½ to 2½ feet wide, contains 10 to 12 inches of vein-matter, consisting of quartz heavily mineralized with sphalerite but containing some galena, notably between 50 and 60 feet from the portal. Between 80 and 100 feet from the portal there is mineralization, irregular in width and in proportion of sulphides. In this section, branch shears diverge north-eastward and one, containing gouge only, is followed in a drift for 48 feet from a point 100 feet from the portal. From the branch drift onward the main drift contains less sulphide mineralization. Irregular lenses carrying a good deal of sulphides over widths from 2 to 12 inches, and lengths up to 15 feet, are found to about 350 feet from the portal. These lenses appear to be controlled in part by branch or cross-shears which strike east of north and dip generally steeply to the north-west. From this point to the face of the main drift (at October 21st) vein material is usually less than 2 inches in width. This material is light in colour, moderately coarsely crystalline, and is vuggy and sparingly mineralized with sulphides.

A branch crosscut, driven northward from a point about 385 feet from the portal, crosscut several shear-strands; one of these about 30 feet from the main drift contains a zincky lens 3 inches wide. The others contain little or no quartz, but the brecciated material in some of the shears and the material along the walls contain disseminated sulphides, largely pyrite, with some chalcopyrite, arsenopyrite, and sphalerite; this material gave low assays in gold. In this section a good deal of the rock is basic, very much altered, and cut by numerous shears. At the west side of the drift running north-east from this crosscut, there is an irregular lens of quartz cut by stringers filled with chlorite. Tourmaline, and some ankeritic carbonate, a small quantity of feldspar, and some pyrite and chalcopyrite, are contained in the quartz. Similar material, 1 foot wide, was also observed at the wall of the vein near the face of the main drift.

July. The claims *July* and *July No. 1*, located in 1935, are recorded in the names of G. M. Allison, T. Smitheram, and V. Lunde, of Hope. Situated near the head of Silver Daisy Creek the claims lie east of the *Invermay Annex* property. The workings on the *July* group consist of two short adits and some surface cuts, on ground which slopes steeply to the creek to the south, about half a mile by trail from the *Invermay Annex* camp and approximately 4½ miles by trail from the end of the road near the mouth of Silver Daisy Creek. Both adits start about at the edge of a talus-slope on which some of the surface cuts have been made.

The rock exposed in the workings is quartz diorite, similar to that at the adjoining *Invermay Annex* property, and the geological setting is essentially the same at both properties. Sulphide mineralization occurs with fine-grained quartz in narrow widths, generally following the walls of a zone of shearing or fracturing, of which the average strike in the workings is east of north and the dip is usually steep to the east. However, the fracturing is not simple, a number of splits run off into the walls and there are changes of strike at short intervals. There are also some changes in dip.

The two adits, which are both drifts, expose walls from 3 to 4 feet apart, along which there are lenses of quartz and sulphides or gouge seams, from 1 inch to 1 foot thick. The central part of the vein is occupied by altered wall-rock which usually represents two-thirds or more of the volume between the walls. The sulphide minerals are principally sphalerite, arsenopyrite, and chalcopyrite. The assays of samples listed below give an indication of the grade of the mineralization.

Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
Mixed sulphides selected from upper adit dump	0.15	30.2	2.1	*Nil*	13.8
4 to 5 inches rusty quartz at face, upper adit	0.02	2.4	0.5	*Nil*	1.0
6 inches zincky material at hanging-wall lower adit, 80 feet inside portal	0.06	4.7	0.6	*Nil*	18.1
3 inches fine-grained quartz with arsenopyrite at hanging-wall, about 65 feet from portal	0.04	11.6	1.4	*Nil*	4.9
2½ inches oxidized vein-matter at foot-wall, about 65 feet from portal	0.04	5.4	0.7	*Nil*	4.8

The upper adit is at approximately 5,675 feet elevation and is 32 feet long, driven at north 15 degrees east. The walls are 3½ to 4 feet apart and dip 75 degrees eastward. In the face there are several narrow, rusty streaks, of which the best is 4 to 5 inches wide.

The lower adit, at approximately 5,660 feet elevation, starts from a point about 175 feet south 18 degrees west from the upper portal. The first 80 feet of this adit is on a bearing of about north 25 degrees east. The working is timbered for 12 feet and from the timber to 80 feet from the portal there is vein-matter, 2 to 7 inches wide, along the east wall. At the end of the course the vein-matter, which is 7 inches wide and zincky, appears to be cut off by a gouge band which follows the east wall of the next course. For most of the distance from 35 to 80 feet from the portal there is from 1 inch to 3 inches of oxidized vein-matter along the west wall. The roof is lagged in this section. In the next course, 21 feet at north 8 degrees east, there is principally gouge along both walls. This is followed by 41 feet at north 25 degrees east with a scantily-mineralized quartz-lens, up to 12 inches wide, along the east wall for the first 15 feet or so, followed by gouge which continues along the next course 19 feet at north 45 degrees east. The working then turns to a bearing of north 8 degrees west for 8 feet to the face, though the gouge band along the east wall of the previous course appears to continue its north-easterly strike. The gouge band along the west wall in the course, 41 feet at north 25 degrees east, appears to continue on that bearing and was therefore left in the wall when the drift turned to the bearing of north 45 degrees east. The last course of the working, following a shear crossing the general strike, was probably started with a view to crosscutting to the fracture wall marked by the gouge band, left behind 19 feet to the south-west. The projection of the gouge band on its observed bearing would be 8 or 10 feet ahead of the end of the working.

Silver Daisy. The claims—*Silver Daisy, Silver Stem, Silver Leaf,* and *Black Jack*—which form this group are held by location in the name of Mae Matheson, of Vancouver. The group is on the east side of the Skagit River near the mouth of Silver Daisy Creek, 1¼ miles by road southward from 23-Mile. The claims were recorded in the years 1925, 1937, and 1938, but cover a discovery made some years earlier. The property has been mentioned in various Annual Reports of the Minister of Mines, British Columbia, from 1913 to 1929, and in Geological Survey, Canada, Summary Report, 1920, Part A. Small shipments of ore, understood to amount to about 30 tons in all, were made to the smelters at Trail and Tacoma in various years from 1916 to 1929. No work was being done when the writer examined the property in July, 1938.

There are 4 adits which, for convenience, will be referred to as "A," "B," "C," and "D" adits. "A," "B," and "C" are close together, and are driven on the vein from the steep walls of the gorge through which Silver Daisy Creek flows. "A" and "B" adits are on the north side and "C" is on the south side of the creek about at the same elevation as "B." "D" adit is a long crosscut, driven from a point on the north side of the creek about where the gorge joins the Skagit Valley. The portal is approximately 285 feet down-stream from "B" and "C" portals and 175 feet lower. It is about 250 feet east of the road.

The rock is a massive, black, cherty member of the Hozameen series. The vein, usually marked by shearing from 8 inches to 2 feet wide, contains lenses of quartz and sulphides from 2 to 8 inches, and usually between 2 and 4 inches, in width. Splits leave the main shearing at several points. The strike of the shearing changes from north 65 degrees east at the south-west end of " C " adit to north 20 degrees east at the north end of " B " adit. The dips of the shearing and the flat-lying splits range from 80 degrees to about 30 degrees north-westward. One flat-lying split, containing about 2 inches of quartz, is to be seen in the bluff between "A" and " B " adits. The sulphides, which include pyrrhotite, sphalerite, chalcopyrite, and galena, and probably tetrahedrite, are largely confined to the quartz-sulphide lenses. The following table of samples and assays will give an idea of the range in values in the better mineralized material now exposed.

Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
Quartz and sulphides, average width 3 inches at hanging-wall "A" adit, 20 feet from north face	0.04	23.8	Trace	1.7	5.6
Quartz and sulphides, average width 3 inches at hanging-wall, south end of drift, "A" adit	0.10	170.7	0.7	15.7	2.0
" C " adit; quartz and sulphides, average width 6 inches; inner 20 feet	0.04	41.6	Trace	2.5	10.2

"A" adit is driven north-westward from the foot-wall, reaching the vein in a few feet. The vein has been drifted upon south-westward for 12 feet and north-eastward for about 48 feet. In the south face, which is just a few feet from the wall of the gorge, there is shearing 6 to 12 inches wide which, at the hanging-wall, contains quartz and sulphides from 2 to 4 inches wide. For just over 30 feet north-eastward from this face the floor has been stoped and the roof is high. Beyond that point to the north-east face the shearing is from 10 inches to 2 feet wide and contains sulphide-bearing quartz which reaches a maximum width of about 4 inches.

" B " adit, about 15 feet lower than "A," had the floor flooded by water from the creek when the property was examined. It is driven 64 feet at north 37 degrees east, thence 50 feet at north 22 degrees east to the face. From 20 to 64 feet from the portal the ground is stoped above the level, excepting for a 5-foot pillar in the middle of the stope. At the inner end of the stope quartz, containing some sulphides, is 3 to 6 inches thick; the dip there is 35 degrees westward. The dip steepens progressively to 80 degrees westward at the end of the drift beyond the stope, and the vein-filling gives way to rusty gouge.

" C " adit is driven south-westward for 60 feet. Quartz, 3 to 6 inches wide, containing some sulphides, is followed for 27 feet at about south 40 degrees west until it comes to a strong slip striking south 65 degrees west and dipping 60 degrees north-westward. This slip forms the foot-wall from the junction south-westward to the face. Though the slip continues north-eastward toward the wall of the gorge there is little mineralization along it. For the inner 20 feet of the adit there is quartz, fairly well mineralized with sulphides, from 6 to 8 inches wide. Pyrrhotite is the predominant sulphide; there is a less quantity of sphalerite and some chalcopyrite and galena.

In its length of 503 feet " D " adit curves from an easterly to a south-easterly course, crosses beneath the creek, and, near the inner end, curves to the east again. At 362 feet from the portal it cut a 1½- to 3-inch fracture containing gouge and quartz with sulphides and abundant sphalerite. The fracture strikes north 65 degrees east and dips 75 degrees north-westward. There is a second fracture containing iron sulphides 8 inches in the foot-wall of the first, and some thin veins of quartz farther in the foot-wall. This mineralization has been followed 6 feet westward in a drift. At this point the working is about 70 feet westward from the inner end of " C " adit and the strike of the fracturing is parallel with that in " C " adit. However, the dip observed in " C " adit is 60 degrees, and the position of this fracture on " D " level is such that an average dip slightly steeper than 80 degrees would be required to connect with " C " adit. For 28 feet beyond the short drift on " D " level a fracture striking north and dipping 25 degrees to the west is exposed in the western

wall of the working. This fracture, ½ inch to 2 inches thick, containing gouge and quartz, does not intersect the previously mentioned fracture in the working.

Tatla Lake Area.

In the past three or four seasons there has been a good deal of prospecting in certain sections of the area tributary to Tatla Lake Post-office. Situated about 2 miles west of the south-west end of Tatla Lake, Tatla Lake Post-office is approximately 215 miles due north of Vancouver and is about 105 miles westward from Williams Lake, on the Pacific Great Eastern Railway. This report deals with lode-gold prospects in the Blackhorn Mountain section, approximately 24 miles south 20 degrees west, and in the Perkins Peak section, approximately 21 miles south 75 degrees west from Tatla Lake Post-office. Prospects on Tatlayoko Lake, also tributary to Tatla Lake Post-office, have been described in recent reports.

Blackhorn Mountain, in the Clinton Mining Division, and Perkins Peak, in the Quesnel Mining Division, lie within the "Tatla-Bella Coola Area," mapped geologically by Dolmage (Geological Survey, Canada, Summary Report, 1925, Part A). A hematite deposit and a prospect carrying low values in gold, both on Perkins Peak, were described by Dolmage. Of these, the hematite deposit has been described in several Annual Reports of the Minister of Mines of British Columbia. So far as the present writer knows, O'Grady's description of the property of the Homathko Gold Mines, Limited, on Blackhorn Mountain, published in the Annual Report of the Minister of Mines, British Columbia, 1937, Part F, is the only publication dealing with prospects in that section, where the activity dates from discoveries made in 1936. Current interest in the Blackhorn Mountain and the Perkins Peak sections is in gold-bearing quartz. Both sections lie comparatively short distances east of the eastern contact of the Coast Range batholith, which is composed essentially of granodiorite and quartz diorite. The general trend of the contact is west of north but the actual outline of the batholith is very irregular. Dykes, doubtless related to the batholith, are conspicuous in both sections and are very numerous in the Blackhorn Mountain section.

The settlement of Tatla Lake is near the western margin of the Interior Plateaux system. A few miles to the west the rolling plateau gives way to more rugged topography, merging, in turn, into the Coast Mountains, which cut off direct access to the sea and necessitate a trip of about 150 miles by road eastward to Williams Lake; thence 315 miles by railway and steamer, or about 365 miles by highway, in order to reach Vancouver.

The area tributary to Tatla Lake has a moderate precipitation, has generally a dry summer and a rather cold winter. Settlers have lived in this area for many years, driving their cash product—beef cattle—to the railway at Ashcroft in the early days and now to Williams Lake. A motor-truck makes the return trip between Williams Lake and Tatla Lake weekly, carrying mail, passengers, and freight. Accommodation for travellers is available at various points along the route, also at the ranch of Robert Graham, site of the Tatla Lake Post-office and store, and of a very comfortable dwelling, where excellent accommodation is afforded travellers. At Kleena Kleene, 15 miles westward on the route to Perkins Peak, James Mackill maintains a lodge offering good accommodation.

Blackhorn Mountain Section.

Following a discovery of gold-bearing quartz in 1936, there has been a good deal of prospecting activity at the head of Razor (Wolverine) Creek, a northward-flowing tributary of Mosley Creek (West Branch of the Homathko River). The work has been done principally on Blackhorn Mountain, which is on the western side of Razor (Wolverine) Creek, though some quartz discoveries have been reported on the eastern side.

A truck-road, 15 miles in length, runs southward from Tatla Lake to the north end of Bluff Lake. From this point a pack-trail about 2 miles in length, along the eastern side, leads to the south end of the lake. Near the north end the trail crosses precipitous bluffs for about 450 yards. It is more convenient to travel the length of the lake by boat. From the southern end of Bluff Lake the pack-trail continues to the head of Razor (Wolverine) Creek, a distance of about 15 miles. It runs through sections in which the trees have been killed by fire in the past few seasons. The grade of the trail is easy for most of its length. The trail up the main valley of Razor (Wolverine) Creek leads to temporary camps situated on the eastern side of a lake near the head of the creek. A branch trail climbs steeply up the

western side to a temporary camp, at 6,300 feet elevation, on the property of the Homathko Gold Mines, Limited. From the head of the lake a trail crosses to the west side and climbs to a temporary camp at approximately 6,950 feet elevation on the *Homestake* group of A. F. Rafferty.

The only topographical map of this section shows the peak known as Blackhorn as reaching an elevation of approximately 10,000 feet, and Razorback Mountain, east of the valley, is shown as reaching a height of 10,667 feet above sea-level. The lake near the head of the valley has been named Blackhorn Lake, is a little less than a mile in length and reaches a width of about a quarter of a mile. Its elevation is approximately 5,450 feet. The head of the lake is immediately at the toe of a glacier which occupies the valley-bottom from this point upward, rising rather steeply in a south-westerly direction. The eastern or south-eastern side of the valley near the head of Blackhorn Lake is precipitous and several hanging glaciers are to be seen above the level of the ice-tongue in the main valley. The western valley-wall is also precipitous in part. It is cut by several narrow chutes or draws and contains several small glaciers. Except on the steeper slopes the bed-rock is covered with talus or glacial debris of varying thickness.

The elevations of the workings and principal exposures, as determined by altimeter readings, range from about 6,775 to 7,575 feet above sea-level. The workings and the two temporary camps near them are above timber-line, a considerable handicap as it necessitates packing fuel and such timber as may be required for prospecting. There is some small balsam timber near the lake, and a more abundant supply of suitable timber farther down the valley.

Some forty-nine claims were reported to be in good standing in the fall of 1938. None of the claims has been surveyed and the writer saw comparatively few of the location posts or cairns. The following explanation of the positions of the various holdings is based on information supplied by the owners. It is understood that the ten *Homestake* claims, owned by A. F. Rafferty and associates, cross the valley above Blackhorn Lake and include, therefore, bluffy country south and south-east of the lake, the glacier-filled valley-bottom and ground on the western side of the main valley. Of the thirty claims held by Homathko Gold Mines, Limited, it is understood that two lie just east of the lake and the others lie on the west side of the valley extending northward from the *Homestake* claims for about 3 miles. However, it is understood that the *Black Horn* claim, owned by Mrs. R. Nicholson, of Tatla Lake, and the *Victor No. 2* claim, owned by J. Hamm, also of Tatla Lake, divide the company's claims into two blocks. Further, it is understood that the *Hunting Lodge* claim, owned by J. Mackill, of Kleena Kleene, is surrounded by claims in the company's south block, that the *Victor No. 1,* owned by G. V. Braid, of Tatla Lake, adjoins the *Victor No. 2* to the north-west, and that Rafferty's *Bonanza* group of six claims adjoins the company's northern block of claims to the north-west.

The writer visited this section early in September, and in addition to the time required travelling between Tatla Lake and the camp on the Homathko Gold property, spent four days examining workings and surface exposures. During this period some snow fell, accumulating on occasion to a depth of perhaps 1 inch; there were also heavy rains. These reduced the visibility and did not facilitate getting over the rugged terrain. Because of weather conditions it was not possible to visit all reported discoveries, though places where substantial work has been done were visited, as were also many showings where little work had been done. No showings lying east of Razor (Wolverine) Creek were visited by the writer. A surface cut and near-by outcrop on the *Golden Lode* claim were the only points examined in the northern block of the Homathko Gold Mines holdings. The adjoining *Bonanza* group and the *Victor No. 1* and *Victor No. 2* were not visited.

The report on this Blackhorn Mountain section is based on the writer's observations in September, 1938, and on the reports by O'Grady and Dolmage, previously mentioned. Available maps of the section are of small scale and are incomplete. For the purposes of this report the relative positions of the various workings and exposures were determined roughly by a combination of pace and compass surveys with triangulation, based on differences of elevations from altimeter readings, and on bearings and vertical angles, measured with a Brunton compass. These methods are necessarily subject to considerable errors.

The head of Razor (Wolverine) Creek lies approximately at the southern limit of the geological and topographical mappings by Dolmage (Geological Survey, Canada, Summary Report,

1925, Part A), which shows the section as underlain by rocks of Triassic age, with intrusive rocks of the Coast Range batholith lying not far to the west and south-west. The Triassic rocks are described as a "thick series of volcanic rocks—interbedded with some thin beds of argillite and lenses of limestone containing fossils of Triassic age." The Coast Range batholith is composed of quartz diorite and granodiorite.

The examination made in September, 1938, was confined to a belt about 3 miles in length on the west side of Razor (Wolverine) Creek. The belt examined generally lies between elevations of 6,800 and 7,500 feet. The highest rocks observed are greenstones, though in the steep slopes and crags which tower above the highest points visited there are probably beds or lenses of sedimentary rocks. The rocks exposed consist of greenstone, conglomerate, generally green in colour, dark, thin, platy argillaceous rocks, some bands of grey sericitic schist, and numerous light-coloured dykes and sills which cut the other rocks. The greenstones probably represent altered andesite. The pebbles and matrix of the conglomerate are so permeated with chlorite that from a distance of a few feet it is not readily distinguishable from the greenstone. The conglomerate is schistose at some points, but some green chlorite schist, which grades into massive greenstone, may represent highly chloritic sediments or the greenstone rendered schistose near its margin.

Owing to the difficulty in travelling along the steep easterly-sloping side of the valley, to interruptions of continuity by numerous dykes which extend high above the belt examined, and to the fact that the attitudes of the rocks show considerable variation, coupled with the fact that accumulations of ice or rock debris mask certain sections, the relationships of various rock-masses were not traced with certainty. Therefore, the interpretations which enter into the following description of relationships are subject to revision.

The belt examined extends in a general north-south direction for approximately 3 miles. The upper camp and the adit on the Homathko Gold Mines property are approximately 1 mile from the north end, and Rafferty's upper camp on the *Homestake* group is about half a mile from the south end. These camps furnish points of reference used in the following notes. For much of the southerly 2 miles, black, platy argillites were the lowest rocks observed. The top of this member of the formation ranges from about 6,800 feet elevation half a mile south of the adit to 7,200 feet elevation a little south of Rafferty's camp. The base of this member was not observed, but near Rafferty's camp a thickness of 300 feet is exposed. Green conglomerate overlies the platy argillites. A thickness of 300 feet of conglomerate was measured at one point. This may include some bands of argillaceous rock. Grey sericitic schist, probably varying in thickness and 50 to 60 feet thick at some points, tops the conglomerate. Green schist, grading upward into massive greenstone, immediately overlies the grey sericitic schist. North of the Homathko Gold Mines camp the underlying argillites may also be almost continuous, but of this the writer is less certain. However, the green conglomerate, topped by grey schist, in turn overlain by massive greenstone, was observed 1 mile north of the camp. Not far south of the camp massive greenstone outcrops in a spur projecting eastward into the valley. The greenstone appears to have a width of at least 1,000 feet from north to south and to extend westward right below the adit. The lowest point at which the greenstone was observed was at approximately 6,400 feet elevation, below which it continues for some distance at least and above which it appears to continue to just below the adit. The greenstone thus breaks the continuity of the platy argillites which, however, were seen at the proper elevations to the north and to the south, though their contacts with this greenstone are covered with debris. The presence of this greenstone is of considerable importance, as it is undoubtedly more favourable structurally for fissure-vein formation than the platy argillite and probably more than the green conglomerate.

Light-coloured granitic dykes and sills are prevalent and conspicuous. Many of the dykes have an east-west trend and stand almost vertically. They also vary in attitude. Between 1 mile and 1¼ miles south of the camp, dykes and masses of this rock form the greater part of the exposures. In the vicinity of Rafferty's camp and for some distance south dykes and sills are numerous and are particularly conspicuous in the black argillite which, curiously enough, appears generally to lie almost horizontally, though so cut by intersecting dykes that it appears as comparatively small masses of black, platy rock, separated by almost equal widths of dyke-rock. The compositions of the dykes vary considerably, but they are generally of the granodiorite to quartz diorite order and are commonly porphyritic. At a number of points these dykes cut the quartz veins without important displacement. South of

Rafferty's camp there are several cuts exposing quartz on either side of a diabase dyke and close to a granitic dyke. The nature of the exposure was not such that the relationships could be definitely determined.

Where bedding-planes could be recognized their strikes range from northward to 30 degrees west of north with low to moderate westerly dips. Schistosity, however, ranges from north-west with south-westerly dips to north-east with north-westerly dips. The dips are generally between 15 and 30 degrees, but occasionally reach 45 degrees.

There are numerous quartz exposures. In general, these are in the schistose rocks. Commonly quartz, as stringers or as narrow veins, follows the schistosity or bedding. At other points quartz occupies fractures which definitely cut across the host-rock. The occurrences observed are generally less than 2 feet wide and most of them range from 1 inch to 15 inches wide. Some of them are traceable for considerable distances, but quite a few are comparatively short lenses which are related to more persistent structural breaks. Commonly the quartz is present as numerous irregular stringers over widths of several feet. Usually there is some silicification of wall-rock, and in some cases, adjacent to veins and stringer-zones, the wall-rock has been largely replaced by quartz and carbonate for widths up to 9 or 10 feet. Some steeply dipping quartz veins were observed cutting across the strike of the schist, and of these some were observed to pass abruptly, in a roll, from this cross-cutting relationship to an attitude essentially conforming with that of the schist.

The quartz at various points contains sulphides, and commonly fine sulphides are disseminated in the silicified wall-rock. Generally the sulphides have been introduced after the quartz has been fractured, and occasionally they have replaced carbonate in fractures or small masses in it. Visible sulphides include arsenopyrite and pyrite, and some chalcopyrite, sphalerite, and galena occur locally, and pyrrhotite has been reported in a section examined microscopically. Free gold in fine grains is to be seen in some of the ore and has also been reported from microscopic studies. Some of the free gold found in material from the outcrops may represent surface concentrations, but visible free gold has been recognized in specimens from the adit away from any significant oxidation. In the notes on microscopic study of material from the Homathko Gold property, published in the 1937 Report of the Minister of Mines, it is suggested that the gold belongs to a period in the mineralization later than the deposition of the sulphides.

This is perhaps borne out by the fact that some vein material carrying fair sulphide mineralization does not assay very well in gold, and wall-rock, even though impregnated with sulphides, in most cases is practically barren. However, the sections carrying best values in gold are usually well-mineralized with sulphides, of which arsenopyrite is commonly the most abundant. Lacking sulphides or visible free gold, quartz sampled by the writer was essentially barren.

Numerous quartz-outcrops are to be seen at intervals in a length of 3 miles, and at several points interesting values in gold are found. In general, these exposures are in schist and the mineralization would be regarded as weak. Though there is a rough alignment for considerable distances there is also a good deal of variation in the attitudes of the various quartz veins and lenses. Though no one vein can be said to have been traced continuously for any great distance, the occurrence of numerous quartz-outcrops in the weaker rocks over a distance of 3 miles, with occasional sections yielding attractive values, is encouraging and with the results of a small amount of underground work suggest to the writer that there are fair chances of finding commercial ore-bodies in fractures in the more competent rocks near the quartz-outcrops. This statement must be modified to exclude the granitic dykes which cut the quartz veins and are therefore probably later than the gold mineralization.

Black Horn Claim.

This claim was recorded in 1936 in the name of Mrs. R. P. Nicholson, of Tatla Lake. It is understood to adjoin the *Golden Lode No. 2* claim to the south-east and, accordingly, lies between the northern and southern blocks of claims owned by Homathko Gold Mines, Limited. The writer was guided to the showings on the claims by J. Hamm, of Tatla Lake, owner of the *Victor No. 2*, recorded in August, 1938, which is said to lie just west of the *Black Horn*. The *Golden Lode No. 2*, on which a cut at 7,000 feet elevation is described under Homathko Gold Mines, Limited, and the *Black Horn* claim were reached by climbing north-westward up the slide from a point on the trail about three-quarters of a mile northward from the Homathko Gold Mines camp. The

showings are from one-half to three-quarters of a mile from the trail and 950 to 1,175 feet higher, at elevations from 6,775 to 7,000 feet.

The most northerly showing on the *Black Horn* claim is about 200 yards, somewhat east of south, from the *Golden Lode No. 2* cut at approximately 7,000 feet elevation. The showing consists of quartz exposed from north to south for about 100 feet. It is cut by a porphyritic dyke 30 feet from the north end. The quartz is from 1 inch to 4 or 5 inches wide for most of its length, but is about 1 foot wide at the north end where it contains a moderate proportion of sulphides. For most of the length the quartz follows the foliation of the grey schist host-rock. It strikes north 30 degrees west and dips 20 to 30 degrees westward. At the south end the quartz turns sharply downward to occupy a narrow fracture, striking east and standing almost vertically, which is exposed for 4 feet below the flat-lying vein. The flat-lying vein does not appear to continue southward, but from 35 to 50 feet southward at approximately the projection of the flat vein quartz about 3 inches wide is exposed, conforming with the schist. It, too, turns down in a steeply-dipping fracture, on the sides of which the schist is altered and impregnated with sulphides for a total width of about 18 inches. A short distance to the south, at approximately the same elevation, a vein is exposed cutting the schist at a small angle. The fracture strikes north-west and dips 45 degrees south-westward. Northward the outcrop rises along the face of a bluff, slowly cutting through the grey sericitic schist to green schist underlying massive greenstone, and gradually assumes the attitude of the schist, which strikes north 30 degrees west and dips 20 degrees south-westward. Quartz is traceable for about 120 feet, beyond which irregular lenses appear for another 75 feet. Near the lower and southerly end there is up to 18 inches of quartz along the sides of the narrow fracture. The wall-rock is altered and impregnated with sulphides so that a maximum width of about 4 feet shows evidence of mineralization. A porphyritic dyke 10 feet wide, striking north-eastward, cuts the mineralized band from 40 to 50 feet from the south end. Beyond the dyke the mineralized width narrows from 3 feet to from 6 to 18 inches with irregular lenses lying below the main vein at some points. The southerly 40 feet is the widest and best mineralized section. It contains galena and pyrite and some chalcopyrite occurring in small masses, though much of the mineralized material contains little sulphide.

The following two samples were taken 15 feet from the south end, they give a section across a mineralized width of 42 inches.

Description.	Gold.	Silver.
	Oz. per Ton.	Oz. per Ton.
20 inches quartz with sulphides	0.18	Trace
22 inches mineralized schist underlying the quartz	Trace	Trace

A cut has been made in this wide quartz-lens which, for convenience, will be referred to as "cut X," from which distances south-eastward were estimated roughly. There are several exposures lying to the south-east on which some stripping has been done. From about 350 to 480 feet south-eastward a reddish-weathered band is exposed. It consists of 3 to 6 feet of altered schist cut by many quartz stringers and impregnated with disseminated sulphide grains. A selected sample of the best mineralized material assayed a trace in gold and 0.2 oz. silver per ton.

Between 570 and 675 feet south-eastward a similar rusty lens about 5 feet in width is exposed with a cut about midway along the lens at about 6,760 feet elevation. Beyond this, the bluffs are precipitous and inaccessible for some distance, but about 1,300 feet south-eastward from cut X there is a cut at approximately 6,725 feet elevation. It is in shearing which strikes about north 30 degrees west and dips 20 degrees north-westward, and follows the foliation of the green schistose conglomerate in which it lies. Quartz is irregularly distributed along the shearing which is exposed for 60 feet northward and 80 feet southward from the cut. The quartz, usually 1 to 2 inches wide, swells at points to 8 inches and occasionally to 12 inches wide. Some of the quartz contains a moderate amount of sulphide minerals.

Homathko Gold Mines, Ltd.

This company, incorporated in May, 1937, acquired claims on Blackhorn Mountain which had been owned by L. Butler, N. Pohlman, C. Mackill, and associates. The thirty claims held include twenty-nine staked in 1936 and one staked in 1937. William Pohlman is president of the company. Prospecting and development-work have been carried on during the past three years. In the fall of 1938, L. H. Timmins, acting for the N. A. Timmins Corporation, of Montreal, acquired an option on the property. The property was described by O'Grady in the 1937 Annual Report of the British Columbia Minister of Mines, Part F, and as noted there a small quantity of ore milled by amalgamation on the property is reported to have yielded gold to the value of about $275.

The claims cover ground to the west of Razor (Wolverine) Creek, with the exception of two claims lying just east of Blackhorn Lake. According to information supplied by the various claim-owners, the company's holdings are divided into a north and a south block, separated by the *Black Horn* and *Victor No. 2* claims, owned respectively by Nicholson and Hamm. The south block, including fifteen claims on the west side of the valley, extends for the length of five claims from north to south. The camp is in the northern half of this block, at approximately 6,300 feet elevation, on a bench overlooking the lake. The most important workings on the property, an adit at approximately 7,100 feet elevation and a surface cut 85 feet above it, are in this block, about half a mile due west of the camp. The cut is at the top of a bluff overlooking a small cirque and the adit is about at the base of the bluff. Both lie just south of a narrow chute or draw which discharges into the cirque. As mentioned earlier in this report it is probable that massive greenstone extends downward from approximately the elevation of the adit to about the elevation of the camp and possibly lower.

The cut was driven 28 feet south 50 degrees west from the edge of the draw; thence 6 feet due west, crosscutting a roll in the hanging-wall. A rusty fracture, 2 to 8 inches wide, striking north-east and dipping 55 degrees north-west, is exposed along the south-eastern side of the cut. At the end of the 28-foot leg of the cut, quartz with included greenstone widens from a few inches near the first fracture, 6 or 7 feet above the floor, to 6 feet near the floor on the south wall of the 6-foot westerly extension of the cut. The hanging-wall appears to roll from a northerly strike to a north-easterly one and the dip, which is 30 degrees westward and north-westward higher up, appears to become steeper near the floor. On the north wall of the 6-foot westerly extension the width becomes less near the floor. Loose rock fragments on the floor of the cut and outside the cut obscured the extent of the showing. The wide showing was sampled where crosscut by the westerly extension of the cut. The 2 feet measured from the hanging-wall, normal to the dip, sampled on both walls of the cut, assayed a trace in gold and in silver. This material consisted of quartz with included schist and contained comparatively little sulphide. The adjoining 2 feet to the foot-wall assayed: Gold, 0.98 oz. per ton; silver, trace. The sample consisted of quartz with a good deal of sulphides and was taken from the south wall. As the wall of the working presented an unfractured, hard, fairly smooth surface, the sample was difficult to cut. O'Grady described this occurrence as it appeared in July, 1937, as a lens 21 feet long, up to 6 feet wide in the central part, and quoted the assays of three samples as follows:—

Description.	Gold.	Silver.
	Oz. per Ton.	Oz. per Ton.
Width, 8 inches at south end of lens	0.56	0.12
Width, 6 feet in centre	0.235	Trace
Width, 8 inches at northern end	0.06	Trace

Above the cut for 30 or 40 feet the schist is rusty and contains stringers and small, irregular lenses of quartz. The schistosity strikes about 10 degrees west of north and dips about 15 degrees westward. Fairly prominent joints striking 30 degrees west of north and dipping about 80 degrees north-eastward cut the schist. Southward from the principal cut, at about the same elevation, there are several shallow cuts in the first 150 feet and another at about 260 feet, beyond which there are exposures in bluffs which become inaccessible farther south. O'Grady described the showing to a point about 500 feet south, beyond which a rusty streak is seen for some distance. The cuts expose rusty schist or quartz, and in the bluffs

there is a fairly continuous quartz vein generally 2 to 4 inches thick, but occasionally swelling to a thickness of 10 or 12 inches. It appears to dip flatly to the west conforming to the attitude of the schistosity. The following information regarding sampling along these surface showings is taken from O'Grady's report:—

Distance.	Width.	Gold.	Silver.
Southward from principal cut—	Inches.	Oz. per Ton.	Oz. per Ton.
258 feet	8	0.14	Trace
343 feet	7	0.17	Trace
394 feet	12	0.82	0.1
About 500 feet	8	0.06	Trace

The adit, at 7,100 feet elevation, 85 feet below the principal cut, is driven through greenstone in which there are two prominent sets of joints which strike from 30 to 50 degrees west of north, the one set dips steeply to the north-east and the other low to the south-west. Near the inner end of the adit the greenstone is schistose. The adit which is driven approximately 100 feet north 65 degrees west crosscut a vein in the last 2½ feet and ended in schist. The position of the vein is about 18 feet north-west of the vertical projection from the narrow fracture in the cut above, and 10 or 12 feet north-west of the vertical projection from the wide lens. Assuming that this vein connects directly with the showings in the cut, the indicated dip would be about 80 degrees north-westward. The walls of the vein are irregular, but the average strike is north-eastward and the dip appears to be almost vertical.

The vein is composed of quartz with some carbonate, sulphides, and chlorite. The chlorite doubtless represents altered inclusions of wall-rock. The sulphides, present in greater abundance than in most exposures on the property, include pyrite, sphalerite, a little galena, some chalcopyrite, and fine-grained arsenopyrite. A little free gold was seen in some selected material stored at the portal. The vein, from 18 to 30 inches wide, was widest in the roof and in the south-west wall of the working, but becomes narrower toward the floor and in the north-east wall. A sample was taken across the vein on each wall about 2½ feet above the floor. The averages of widths and assays were: 25 inches; gold, 1.6 oz. per ton; silver, 1 oz. per ton. The adit crosscut a dyke of porphyritic granodiorite between 83 feet and 89 feet from the portal. The walls of the dyke are irregular, but the strike appeared to be about north 25 degrees east and the dip about 45 degrees north-westward.

It was reported that when work was suspended early in December drifting on the vein had been done both ways from the crosscut, the total amounting to 67 feet. In the drift to the north-east it is reported that the dyke was encountered and that the vein was picked up on the north-east side without much displacement. It was also reported that the drift to the south-west encountered a fault beyond which the vein was found displaced a short distance to the east. It was further reported that sampling of the vein in the drifts yielded values which are regarded as commercial.

Between points 500 feet southward and about 1,500 feet south 15 degrees east from the cut above the adit, the showings in the bluffs are inaccessible. For part of the distance debris or ice masks the bluffs above the elevation at which the outcrop might be expected. From the point, approximately 1,500 feet south 15 degrees east from the principal cut, there are shallow cuts or exposures on the surface, at considerable intervals, for 2,100 feet, on a general course of 15 to 20 degrees east of south. These showings range from 7,575 to 7,200 feet in elevation and over a considerable distance from east to west. It is apparent that they do not represent one vein, but they may be taken as indicating that there is a considerable zone in which veins occur. In these showings the quartz generally follows the foliation of the schist host-rock.

Near the north end of this series of exposures, at 7,575 feet elevation, and by calculation 1,700 feet south 13 degrees west from the adit, a thin granitic sill outcrops. The wall-rock is green schist striking north 15 degrees west and dipping 20 to 25 degrees westward. Irregular lenses of quartz and carbonate occur above and below the sill in a total thickness of 6 feet. Some of the lenses are fairly well-mineralized with galena, sphalerite, and pyrite. They also contain chlorite. The sphalerite is in small, almost black, resinous grains. A sample of selected well-mineralized material assayed: Gold, 0.20 oz. per ton; silver, trace.

Outcrops of the granitic rock are to be found for some distance to the north, and quartz-carbonate lenses to a maximum thickness of 1 foot are exposed at intervals to a point 300 feet northward in the bluffs overlooking the cirque. There, flat-lying quartz, 16 inches wide, turns to follow a joint and cuts sharply across the schist, but a few feet below turns back again to an attitude approaching that of the schist. At 7,325 feet elevation, east of the line of outcrops just described, there is a flat-lying outcrop of quartz 4 to 6 inches thick, which contains a little arsenopyrite and some free gold. The schist, adjoining the quartz, is altered and impregnated with sulphides. A sample across 7 inches of sulphide-bearing schist assayed *nil* in gold and silver. Southward the showings are at lower elevations and pass downward from green schist into the grey, sericitic schist. The most southerly showing in this series, at about 7,200 feet elevation, is on a bluff near a tongue of a small glacier.

Three groups of showings, the most southerly on the property, will be described next in this report. The writer did not go directly from the showing just described to these most southerly showings and conditions were not favourable for locating them closely. However, the nearest of the three is estimated to be about 1,700 feet south-westward from the showing near the tongue of the small glacier, and is, therefore, considerably west of the course on which the showings just described lie.

The most southerly part of the south block of claims is very rugged and granitic dykes are numerous. The three groups of showings are from 7,450 to 7,500 feet in elevation, each is near a draw or slide course. The middle one at 7,450 feet elevation, and some 6,000 feet southward from the camp, yielded encouraging assays. There, quartz 32 inches thick, is exposed for a short distance along the strike which is north-eastward, the dip is about 25 degrees north-westward. The quartz contains pyrite, galena, and sphalerite. Between 7 and 12 inches from the hanging-wall sulphides were plentiful, and this 5-inch section, sampled separately, assayed: Gold, 0.84 oz. per ton; silver, 1 oz. per ton. The 7 inches above and 20 inches below, in which the sulphides are less plentiful, assayed: Gold, 0.16 oz. per ton; silver, trace. The combined average is 0.26 oz. in gold across the full width of 32 inches. About 25 feet lower on the same slide course, two cuts about 25 feet apart expose 12 to 18 inches of schist impregnated with quartz and fine sulphides. This material was not sampled. A porphyritic dyke outcrops just north of the slide on which the cut is situated, and dyke-rocks occupy most of the section for 250 feet to the south. At the other two points, respectively 500 feet north and 500 feet south, quartz exposures strike between north-east and north-north-east and dip about 25 degrees westward. Sulphide mineralization is less than in the middle showing.

Northward from the cut above the adit the surface consists of glacial debris and talus, but at a few points a little rusty quartz is exposed. At approximately 1,300 feet north-east there is a cut exposing some quartz in schist, and about 200 feet farther north-east at 7,265 feet elevation a cut, known as the "galena showing," exposed a lens of quartz, 12 feet long. It strikes north-east and dips 45 degrees north-west, and conforms with the green schist in which it lies. The lens pinches out rapidly at the north-east end. It was not well-exposed in September, 1938. O'Grady described it as 20 inches wide at the south-west end and 24 inches wide at the north end. He took a grab sample from about 1 ton of mineralized quartz, which assayed: Gold, 0.80 oz. per ton; silver, 1.2 oz. per ton; lead, trace; zinc, 2 per cent. Flat-lying quartz is exposed at intervals to a point 400 feet to the north-east where the hillside becomes precipitous. The rock is schistose greenstone, striking north-eastward and dipping from 45 to 70 degrees westward.

The remaining surface showing on this property visited by the writer is on the *Golden Lode* claim, near the southern boundary of the northern block of claims. The showing is at 7,000 feet elevation at a point about 1 mile northward from the adit, and is just below bluffs a short distance north-west of a tongue of a glacier, to be seen from the trail, three-quarters of a mile north of the camp.

The exposure is in grey sericitic schist immediately overlying green conglomerate, and consists of a lenticular mass composed of quartz, carbonate, and incompletely replaced schist. The lens is exposed for a length of 50 feet, is 1 foot wide at the south end, 9 feet wide at a shallow cut 20 feet to the north, and 3 to 4 feet wide 30 feet farther to the north, where it is buried beneath talus. At the south end an east-west fissure, dipping steeply to the south, rolls to the north to conform with the north-striking schist which dips west at a moderate angle. The schist above is cut by many narrow, irregular quartz stringers, and is partly

replaced by vein material including some pyrite. There is a considerable quantity of fine, flaky, white mica in the resulting lenticular mass of replacement material.

At the cut 10 to 12 inches of quartz, occupying a steep southward-dipping fracture of east strike, rolls north to form the bottom of the lens. The quartz vein containing pyrite was sampled, and across 10 inches assayed: Gold, 0.14 oz. per ton; silver, 0.3 oz. per ton. A chip sample across 5 feet of the overlying replacement material yielded *nil* assays in gold and in silver.

Homestake. The *Homestake* claims, ten in number, owned by A. F. Rafferty, of Vancouver, and his associates, cross the valley of Razor (Wolverine) Creek above the lake. South-westward from the lake the bottom of the valley is occupied by a glacier. A sheltered position for a tent-camp has been found in a tiny cirque in the bluffs on the west side of the valley at about 6,950 feet elevation. The workings and principal showings on the property lie south-westward from the camp between 7,200 and 7,425 feet elevation. The workings examined are within 1,800 feet of the camp, on narrow benches along bluffs or on a talus-slope north of the bluffs. It was reported that there are other showings of importance farther to the south and west, and that some showings have been found in the bluffy ground across the valley to the north-east. The claims have been prospected each season since they were located in 1936.

The N. A. Timmins Corporation, of Montreal, had an option on the property for a short period but relinquished it in the fall of 1938. From the east side of Blackhorn Lake a pack-trail crosses the valley and climbs by a series of switchbacks to the camp in the little cirque. This camp can also be reached readily enough on foot from the upper camp on the Homathko Gold property, 1½ miles to the north; there is no trail for most of the distance, but the route across suitable points on the bluffs is not difficult.

In the vicinity of Rafferty's camp the black, platy sediments lie flat, but a short distance to the south they strike about north 30 degrees west and dip 15 degrees south-westward. Due west of the camp they are in contact with overlying green conglomerate at about 7,200 feet elevation. The dip of the contact brings it lower down, south of the camp, where it disappears beneath debris and ice. Light-coloured dykes which are conspicuous near the camp, are also numerous at several points to the south; they have an east strike and stand almost vertically or dip steeply. Most of the showings are in the green conglomerate or in green schist.

The most southerly cut visited is about 1,700 feet south of the camp at about 7,400 feet elevation. From a point 100 feet farther south, quartz and a zone of alteration are seen extending southward in the bluffs. Quartz is exposed on the surface or in cuts for much of the 500 feet northward from this cut. Two lenses of quartz, each about 1 foot thick, separated by about 4 feet of green schist, are exposed for a length of 5 feet, 35 feet south of the cut. The quartz is rusty and honeycombed. At the cut 2 feet of quartz containing some schist strikes north 20 degrees east and dips 65 degrees westward. The wall-rock is green, schistose conglomerate, of which the foliation strikes about north 30 degrees east and dips 30 to 35 degrees westward. The schist is rusty for 2 feet in the foot-wall and 6 feet in the hanging-wall of the quartz. Stripping, at several points in the 90 feet to the north, exposed quartz-lenses and irregular stringers over a width of about 15 feet. The quartz in the cut is traceable for 60 feet northward where, 10 feet to the east, there is a rusty honeycombed quartz-lens 1 foot thick. At 100 feet north of the first cut quartz, 12 inches wide, is exposed, from which 6 inches of quartz splits off to cut the formation vertically, then turns to follow the formation with moderate westerly dip, and is traceable for 35 feet to the north as far as a small creek. Unconsolidated material obscures the main quartz-bearing zone for this distance.

A second cut, about 165 feet north 15 degrees east from the first, has been driven 23 feet westward in the rock. This crosscuts several quartz-lenses which, with greenstone in which they occur, contain pyrite. Sampling of this material gave negligible values in gold and silver. The lenses strike about north-east and dip about 50 degrees north-westward. They probably are on cross-fracturing between a fracture, striking north 15 degrees east, about 6 feet west of the outer end of the cut, and another fracture, occupied by a greenstone dyke, about at the face of the cut, which can be traced for 75 feet due north. The fracturing or shearing near the outer end of the cut, striking north 15 degrees east, can be traced for 60 feet or so to a third cut, near which it is joined by a narrow, quartz-filled, cross-fracture

striking north-east, extending from the other fracture 20 feet to the west. In the north 15 degrees east fracture at the face of the cut there is 2 feet of quartz and sheared greenstone with some sulphides, and just west of this a sulphide-lens, 15 feet long and 27 inches wide, is exposed. The sulphide-lens consists largely of pyrite, but chalcopyrite and sphalerite were also recognized. Adjoining this to the west the greenstone contains disseminated sulphides. Three samples taken from west to east gave the following results:—

Description.	Width.	Gold.	Silver.
	Inches.	Oz. per Ton.	Oz. per Ton.
Greenstone, with quartz and some sulphides	29	0.02	0.2
Quartz and greenstone, with much sulphide	27	0.78	0.2
Quartz and greenstone, some sulphides	24	*Nil*	*Nil*

From this cut to the next the distance is 175 feet north 20 degrees east. Between 80 and 145 feet on this course there are several light-coloured dykes striking westward, a draw is crossed in the same interval. The cut on the north side of the draw exposed quartz 3 to 10 inches thick, striking north-eastward and dipping irregularly to the north-west, for 6 feet along the strike; 4 feet in the foot-wall it exposed a quartz-lens 10 inches thick. The wall-rock is green schist apparently not derived from the green conglomerate. From this point northward, talus below bluffs occupies the projection of the zone followed this far.

About 550 feet north-east, at approximately 7,200 feet elevation, a cut has been made in the face of the bluff just above the talus where a fault cuts the green conglomerate. The fault strikes north 15 degrees west and dips 50 degrees westward. Limy material on the footwall-side has been brought against the conglomerate hanging-wall of the fault. At the floor of the cut green dyke-rock occupies the fault, but higher up it does not appear. The rusty fault-gouge containing some quartz and pyrite was sampled and yielded *nil* assays in gold and in silver. In the 350 feet northward from this cut there are several light-coloured dykes.

From 400 feet north of the cut at 7,200 feet elevation a diabase dyke, 3 to 4 feet wide, is traceable northward, diagonally up the hill, for some distance. An altered, light-coloured porphyritic dyke lies a short distance to the east. Shearing, generally parallel with the dykes, was observed between the dykes and west of the diabase dyke. Quartz of varying thickness is developed in the shears. The shearing and the dykes strike north 10 degrees west and dip about 55 degrees westward. At three points, in about 200 feet along the outcrop, strippings or closely-spaced cuts over a distance of 30 feet from east to west crosscut the dykes and the shearing. The quartz is lenticular and up to 3 feet thick. Sulphide minerals are wanting or present in small quantity. A sample across the widest quartz exposure assayed *nil* in gold and silver. These cuts are about due west of the camp.

About 300 feet south-westward from the highest of these cuts, another cut exposes 8 inches of quartz with several quartz stringers in 4 feet of sheared greenstone striking north-eastward and dipping steeply to the north-west. The shearing is traceable to the south, but in general contains little quartz or sulphide. At 170 feet southward, quartz 8 inches wide is exposed, and at 200 feet quartz 30 inches wide is exposed. These showings strike about north 20 degrees east and dip steeply to the west. They are in fractures which run to the north-eastward-striking shear traceable north to the cut.

Perkins Peak Section.

Beginning with the 1935 season there has been a revival of interest in prospecting for gold-bearing quartz on Perkins Peak. Most of the activity has centred on the north-westerly slope of the mountain, where the *Mountain Boss* group was staked covering ground containing some old surface workings. The owners of the *Mountain Boss* group have prospected this ground in the past three seasons and have staked some additional claims. Workings on these claims were examined by the writer late in August, 1938. In 1938 some claims were staked in the same section for other interests. As little or no work had been done on these claims they were not examined.

The *Mountain Boss* group of eight claims was staked in 1935 and is held in the names of **F. Crosby, J. Peacock, and J. N. Killas, all of Prince Rupert.** Six claims constituting the

Mountain City group, staked in 1937, and the two *Mountain Chief* claims, staked in 1938, are held by the same owners.

Pack-trails leading to Perkins Peak leave the road which runs north-westward from Tatla Lake, near One Eye Lake, and go via Miner Lake. Two routes have been used recently in reaching a point near the south-west end of Miner Lake, from which point a pack-trail about 7 miles long climbs 2,100 feet to a temporary camp near the claims. Miner Lake lies in a south-westward-trending valley separated by a ridge, exceeding 5,000 feet in elevation, from the valley in which One Eye Lake lies. The writer travelled to the point south-west of Miner Lake by a route approximately 13 miles in length running south-westward from Kleena Kleene, which is at the south-east end of One Eye Lake, and is about 15 miles by road from Tatla Lake. This trip with saddle- and pack-horses took 4½ hours; the remaining 7 miles from Miner Lake to the camp required about 3 hours. The country traversed has been timbered with trees of moderate size. Considerable sections of the route from Kleena Kleene to Miner Lake have been burnt over and the trees have been killed. The other route is presumably that shown on maps of the area as leaving the road about 5 miles westward from Kleena Kleene and following a southerly course to the flat south-west of Miner Lake.

Perkins Peak, on the eastern flank of the Coast Mountains, rises to a height of 9,380 feet. The camp is in a small basin on the north-westerly slope at approximately 6,200 feet elevation. Above the basin talus-slopes rise to steep cliffs. A smooth talus-slope extends from a point about 2,000 feet westward to bluffs about three-quarters of a mile westward from the camp. On this slope, about half a mile from the camp, there are three surface cuts at elevations from 6,900 to 7,000 feet. The principal group of workings, consisting of eight open-cuts and an adit, is about 1 mile from the camp, beyond the bluffs, on a steep north or north-westerly slope which is cut by several gullies. These workings are at elevations ranging from 6,925 to 7,050 feet.

The geological mapping indicates that this section is underlain by rocks of Lower Cretaceous age intruded by a small diorite stock. The Lower Cretaceous rocks are described by Dolmage (Geological Survey, Canada, Summary Report, 1925, Part A) as "composed largely of thinly-bedded sandstone, black argillite, and, particularly in the vicinity of Perkins Peak, a considerable amount of volcanic breccia." The rocks exposed at the workings are chiefly light-coloured quartzite or sandstone, and black or dark grey argillaceous sediments, some of which are limy. These rocks in general strike somewhat north of east and dip southward at about 45 degrees. Basic, much-altered dykes were observed at some points in the workings, and there are exposures in the cliffs indicating light-coloured intrusives in sill and dyke relationship. In the vicinity of the principal group of workings there has been a good deal of disturbance of the beds, possibly owing in part to slumping down the almost precipitous slope. Quartz-lenses, of considerable width, occur along shearing which in general has the same attitude as the bedding, striking roughly east and dipping about 45 degrees south. There are also narrow quartz veins of irregular attitude, and at two points wider quartz veins are exposed cutting the bedding. Very considerable widths of sediments have been silicified. In the quartz and silicified wall-rock calcite is widely distributed. Sulphides, principally arsenopyrite, with some pyrite, occur as small lenses and aggregates disseminated through the silicified material and along some of the quartz-filled fractures. Gold values in unoxidized material are probably associated with the sulphides, though in general these values are low, and some samples containing moderate amounts of sulphides yielded *nil* or "trace" assays. The best values obtained by the writer were from a cut near the western end of the principal workings, where two quartz-filled fractures cut the bedding. A sample across 6 feet, including the veins and 2 feet of quartzite lying between them, assayed 0.24 oz. gold per ton; selected sulphides assayed 0.74 oz. gold per ton and 1 oz. silver per ton. Samples taken across the wide quartz lenses in the shearing yielded *nil* or "trace" assays in gold and silver. A specimen of sulphides taken from the floor of a drift on the adit-level, assayed: Gold, 0.12 oz. per ton; silver, trace. It is reliably reported that samples at a weak, rusty fracture, cut near the portal of this adit, yielded high assays in gold.

Some work was done on the property years ago. In the present activity, dating from 1936, old cuts have been cleaned out and extended. In 1938 some 230 feet of horizontal workings and an 18-foot raise were driven on an adit-level.

The three cuts about half a mile westward from the camp are driven into the northward-sloping, talus-covered mountain-side. Two of the cuts are close together, the lower exposes some quartz with indefinite boundaries. A few feet higher and to the south the second cut exposed a good deal of quartz and some sulphides developed in white quartzite in the 6 feet north of the face. The third cut is about 140 feet to the south-west and 90 feet higher. In a width of 8 feet there are several narrow quartz veins which strike south-east and dip to the north-east. The veins and the quartzite lying between them contain some sulphides. A curious feature was observed at this point—fine-grained sulphides, chiefly arsenopyrite, are found distributed along the margins of elongated, dark crystals in the quartzite. The crystals probably represent hornblende which has been largely altered to chlorite.

The principal group of workings, situated about 1 mile westward from the camp on the *Mountain Boss No. 3* claim, consists of eight surface cuts and an adit-level, all driven southward. The cuts are distributed over a distance of about 300 feet from east to west. An old cut, now almost completely filled with debris, lies about 250 feet farther to the west. The adit was driven from a point below the first two cuts.

The first cut, at approximately 7,045 feet elevation (the elevation of the adit is taken as 7,000 feet) crosscuts 16 feet of quartz containing pockets or lenses of sulphides, principally arsenopyrite. The foot-wall is irregular, but has a general strike of north 80 degrees west and dips 45 degrees southward. Two samples taken across an aggregate width of 14 feet returned *nil* assays in gold and in silver. Crushed and decomposed material extending 2 feet from the foot-wall was not sampled.

The second cut, which was largely filled with debris, appeared to be north of the projection of the quartz-lens. The third cut, about 100 feet west of the first, exposed 4 feet of quartz with scattered arsenopyrite, approximately in the position of the projection of the quartz from the first cut. The fourth cut exposes silicified material near its outer end and terminates at a much-altered basic dyke. In the fifth cut altered quartzite contains a good deal of quartz and some arsenopyrite over a width of 3 feet. In the sixth cut 1 foot of shearing contains quartz and arsenopyrite; the strike is north 70 degrees west and the dip 65 degrees southward.

The seventh cut is approximately 100 feet lower than the first and is just at the eastern side of a small draw. This cut exposes quartz, in fracturing, striking north across the bedding and dipping 30 degrees east. An upper vein, 3 feet wide, is separated by 2 feet of altered quartzite impregnated with quartz and sulphides from the lower vein 1 foot wide. The quartz veins and the intervening quartzite contain arsenopyrite, pyrite, and a little chalcopyrite. A sample across 6 feet, normal to the dip, including the quartz veins and the intervening quartzite, assayed: Gold, 0.24 oz. per ton; silver, trace. Selected sulphides, consisting of pyrite and well-crystallized arsenopyrite from the same place, assayed: Gold, 0.74 oz. per ton; silver, 0.1 oz. per ton.

The eighth cut, on the west side of the draw and somewhat north of the seventh, exposes quartz over a horizontal width of at least 16 feet. The quartz underlies 6 feet of sheared rock, the shearing strikes north 80 degrees west and dips 60 degrees southward. Toward the foot-wall the quartz is very much crushed, the foot-wall is not exposed. Two samples across an aggregate width of 14 feet, measured from the hanging-wall, yielded *nil* assays in gold and silver. This cut is 125 feet lower than the first.

The adit crosscuts the formation for 187 feet, it is driven south 25 degrees east from a point north-west of and 45 feet lower than the first cut. Between 70 and 90 feet from the portal the adit is just west of the vertical projection of the first cut. To about 105 feet from the portal the wall-rock is light-coloured, quartzitic material, much of which has been silicified and impregnated with disseminated grains of sulphide minerals. It is cut by a great many quartz veinlets and contains a good deal of carbonate. In the remainder of the working the wall-rock is dark in colour and may be described as argillaceous quartzite, though some of it is limy.

The siliceous rock near the portal is cut by joints which strike north and dip 45 degrees to the west. About 38 feet from the portal a small fracture, striking north 60 degrees west and dipping steeply north-eastward, was crossed. The fracture contains rust, and for a few inches south of it there is quartz with sulphides. A chip sample, taken along both walls of the working from 40 to 80 feet from the portal, representing quartzite with narrow quartz stringers and sparsely disseminated sulphides, assayed *nil* in gold and silver. At 87 and

90 feet from the portal, fractures which strike north 60 degrees west and dip almost vertically cross the adit; beyond them to 98 feet there is shearing and a good deal of quartz. There is also a considerable amount of sulphide, which is most abundant on the eastern side of the adit from 94 feet to 96 feet from the portal.

Between 106 feet and 112 feet from the portal there is a well-marked shear, striking north 50 degrees west and dipping 65 degrees southward, which has been followed by a drift for 25 feet eastward. It is about in the position where the continuation of the quartz-lens in the first cut would be expected. However, the quartz in this shear is confined to narrow stringers, and the strike is north 70 degrees west as against north 80 degrees east in the cut. Toward the face of the drift the amount of quartz at the floor increased materially over that in the roof. The floor was taken up for a depth of 4 or 5 feet for 14 feet west of the face, and exposed 3 to 5 feet of shearing containing a good deal of quartz and some sulphides. Two samples were taken 5 feet from the face. The first, 7 inches wide, taken at the foot-wall, assayed *nil* in gold and silver. This sample was found to contain about 7 per cent. sulphides. The adjoining 3 feet, containing about 2 per cent. sulphides, assayed a trace in gold.

At 138 feet from the portal a narrow, much-altered basic dyke was encountered. It was followed for 20 feet south 75 degrees east. The dyke is cut off in the roof by a flat, irregular slip. Vein-mineralization was not observed in this shearing.

To test the supposition that the quartz encountered in the surface cuts might have a low dip to the south, a raise approximately normal to the beds, which dip about 45 degrees southward, was put up from the end of the adit-crosscut. In its length of 18 feet the raise encountered only rock.

It is noteworthy that the strike of the shearing and fracturing on this level differs by about 30 degrees from that observed in near-by surface cuts. It is also noteworthy that the fracturing in the light quartzite dips vertically or steeply to the north, whereas shearing in the argillaceous rocks dips approximately with the bedding; that is, from 30 degrees to 65 degrees southward.

The writer did not sample the narrow fractures in quartzite in the adit but, according to reliable information, high values in gold were obtained in sampling the oxidized material in the small fracture crosscut 38 feet from the adit-portal. This was doubtless due largely to surface enrichment, but indicates the possibility that better values might be found in or along the fractures in the quartzite than in the wide quartz-lenses occurring in shearing in the argillaceous rocks, or along the contact between the quartzite and argillaceous rocks. As mentioned earlier in this report, the best values obtained by the writer were from samples taken at the seventh cut from quartz-filled fractures in quartzite, and this would seem to be the point most worthy of immediate exploration. The surface indications and the experience in the adit suggest that the wide quartz showings are lenticular, lack continuity along strike and dip, and have not yielded encouraging values.

Zeballos Area.

BY

John S. Stevenson and R. J. Maconachie.

Answer Group.* The *Answer* group, consisting of six claims, the *Answer Nos 1* to *6*, is held by H. A. Heywood and associates. The camp, consisting of two small buildings, is on the main road up the Zeballos River Valley, slightly over a mile from the beach. The main working, consisting of one adit, lies some 350 feet westward from the camp, at an elevation of 175 feet.

The adit is at the base of a small rock bluff, and had (April 18th, 1938) been driven 13.5 feet in greenstone in which there are small and irregular patches of basic, igneous rock, gabbroic or dioritic in composition. The fracture strikes south 65 degrees west and dips steeply to the north-west. The owners claim to have followed it to the south-west above the bluff, but any such tracing to the north-east is rendered impossible by the low-lying, swamp ground in that direction.

In the adit the fracture ranges in width from a hair-line to 8 inches, with an average width of 2 inches; the filling is essentially of quartz and calcite, with considerable rusty

* By R. J. Maconachie.

gouge. Mineralization is mainly by pyrite. Where the fracture attains its maximum width there is a dissemination of the gangue minerals and sulphides into the walls; where narrow, the filling is commonly frozen to the foot-wall and tight to the hanging-wall. There is no leaching of the wall-rock and no mineralization beyond the limits of the fracture.

Samples taken on April 10th and April 18th, 1938, were as follows:—

At portal plus 7 feet, across 3 inches of quartz with slight pyrite, in the face (April 10th, 1938): Gold, 1.20 oz. per ton; silver, 0.5 oz. per ton.

From portal plus 7.2 feet to portal plus 10.8 feet, over full width of fracture filling, ranging from 1 inch to 2 inches, and consisting of gougy, rusty calcite, a little quartz, one or two small patches of fine-grained, dark sulphides and a slight amount of coarser sulphides, mainly pyrite (April 18th, 1938): Gold, 1.04 oz. per ton; silver, 0.6 oz. per ton.

From portal plus 10.8 feet to face at portal plus 13.5 feet, over full width of fracture filling, ranging from 1 inch to 2 inches and mineralized as the preceding sample: Gold, 0.30 oz. per ton; silver, 0.3 oz. per ton.

At portal plus 13.5 feet, over 2½ inches of calcite, a little quartz and slight visible pyrite, in the face (April 18th, 1938): Gold, 0.04 oz. per ton; silver, trace.

At portal plus 13.5 feet, over 18 inches on the foot-wall of the preceding sample, mostly barren greenstone with some calcite veinlets: Gold, *nil;* silver, *nil.*

Beano Group.* The *Beano* group, reported to consist of twelve claims, the *Beano Nos. 1* to *4*, the *Lima Nos. 1* to *4*, and the *Pat Nos. 1* to *4*, staked by A. Stuart and associates, adjoins the *Friend* group on the west. Access at present is by the trail to the *Friend* group, and a branch trail leading off to the north to the camp-site which lies at an elevation of 1,480 feet. By this route the camp is 3 miles from the town of Zeballos. If developments warrant, a new route by way of the main Zeballos River Road and *Golden Gate* ground will probably prove to be the most practical.

Lying approximately 1,000 feet north of the camp, at an elevation of 2,600 feet, the showings have, as yet, had little development. The location of the outcrop on a 40-degree slope at the edge of a sheer canyon 150 feet deep does not lend itself to easy exploration.

The original outcrop was of decomposed basic rock, probably originally gabbro, surrounded by greenstone; no apparent structural relation between the gabbro and the greenstone was visible. Mineralization in the gabbro was irregular, chiefly by massive pyrrhotite.

Recent stripping has exposed two lenses of gabbro. From this stripping, which is insufficient to base comprehensive judgment of the occurrence, the lower lens, at an elevation of 2,593 feet, appears to strike north, dip 40 degrees east toward the lip of the canyon, and have a width of a little better than 4 feet. The hanging-wall has been exposed over an irregular area approximately 8 by 10 feet; the width has been exposed in the face of a crosscutting bench 19 feet long. Samples taken from the face of this cut across the full width exposed were as follows:—

No. 1.—At 3 feet from west end of the bench, across 50 inches of decomposed gabbro, little visible mineral: Gold, 0.80 oz. per ton; silver, *nil;* nickel, *nil;* platinum, *nil.*

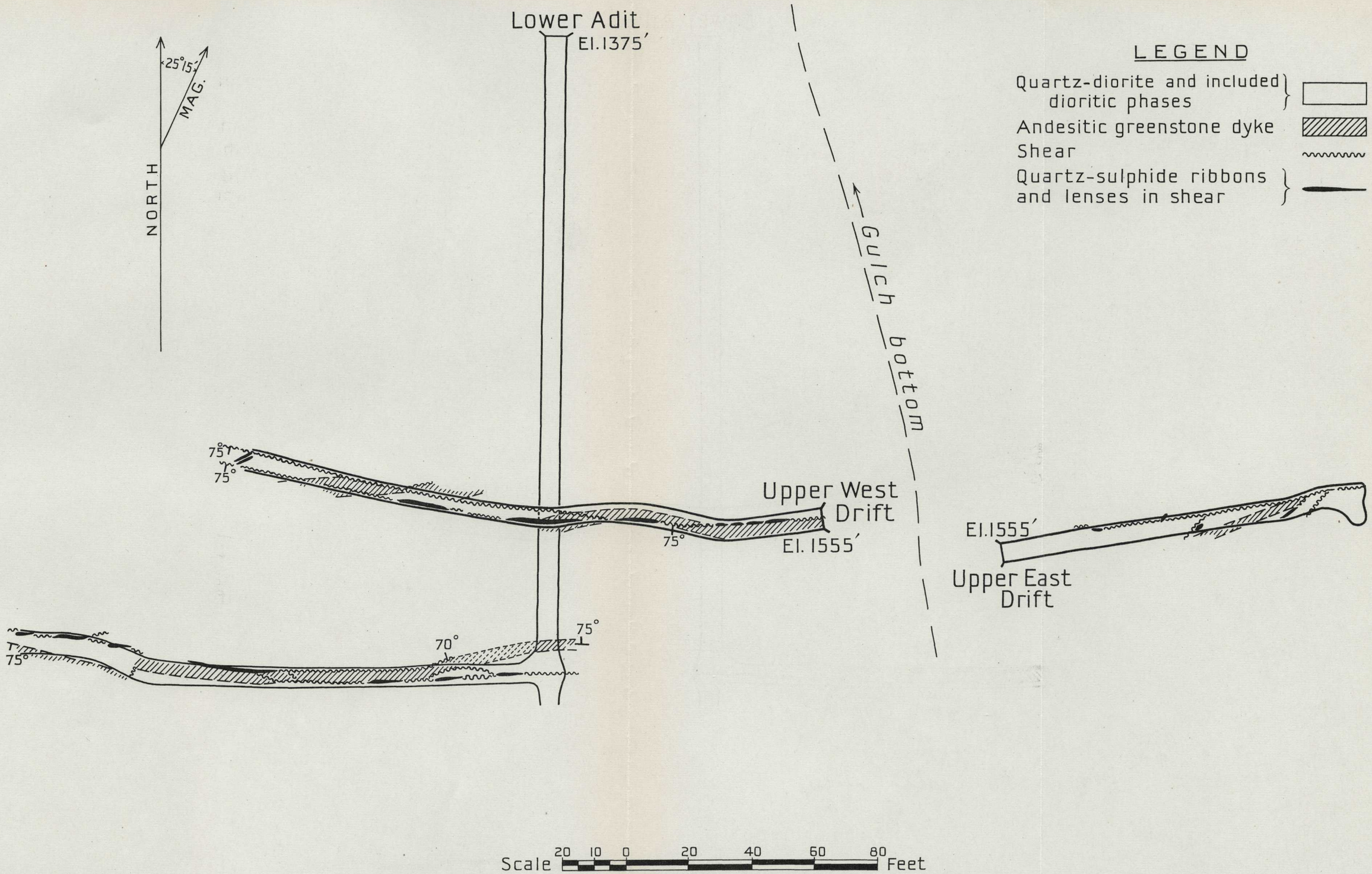
No. 2.—At 9 feet from west end of bench, across 28 inches of decomposed gabbro, containing one section of abundant pyrrhotite: Gold, 1.60 oz. per ton; silver, 0.2 oz. per ton; nickel, *nil;* platinum, *nil.*

No. 3.—At 15 feet from west end of bench, across 10 inches of decomposed gabbro, including 5 inches of almost solid pyrrhotite: Gold, 3.50 oz. per ton; silver, 0.1 oz. per ton; nickel, *nil;* platinum, *nil.*

No. 4.—A sample of massive pyrrhotite assayed: Gold, 9.38 oz. per ton; silver, 0.2 oz. per ton.

The upper stripping, at an elevation of 2,610 feet, had not exposed the formation as clearly and had only been blasted into at one location at the west end of the outcrop. From the available evidence it appeared that this may be a separate mass of gabbro separated from the lower one by greenstone. The total area stripped at this upper location was about 15 by 25 feet. One sample, No. 5, taken at the west end over 33 inches of very badly decomposed gabbro, carrying a little pyrrhotite, assayed: Gold, 2.76 oz. per ton; silver, trace; nickel, *nil;* platinum, *nil.*

* By R. J. Maconachie.



Central Zeballos Gold Mines, Limited (N.P.L.), underground workings. Modified from Company's plan; drift detail and geology by the writer.

Near the snow-covered floor of the ravine, some 200 feet south of these outcrops, there are exposures of similar material on the west wall of the canyon. At the time of examination (April, 1938) there had been no work done at that location and the significance of the occurrence had not been determined.

Central Zeballos Gold Mines, Ltd. (N.P.L.).†

The Central Zeballos Gold Mines, Limited (N.P.L.), owns the following mineral claims: *Extension Nos. 5* to *8*, staked in 1936 by N. H. McClary, *Extension Nos. 9* and *10*, staked in 1937 by Einar Ellingrud, and *A.B.*, *A.C.*, *A.D.*, and *A.E.*, staked in 1937 by Victor M. Davis. The original workings on the ground covered by the above claims were described by the writer in "Lode-gold Deposits of the Zeballos Area," British Columbia Department of Mines, 1938, pp. 21–22, under the name of *Extension* group. Since then three adits have been driven, the total underground work comprises approximately 690 feet as of September 10th, 1938, and the camp has been moved from Goldvalley over to Bibb Creek.

The camp may be reached by following a go-devil trail that leaves the main Zeballos Road at the *Privateer* mine and follows up the Zeballos Valley for 2 miles to the main camp near the mouth of Bibb Creek, at an elevation of 660 feet. The workings are up Bibb Creek Canyon, the lower adit being at an elevation of 1,375 feet and the upper two adits both at an elevation of 1,555 feet.

The rock-walls of the canyon rise precipitously from the adit-portals to the steep ridges above. However, a steep foot-trail goes from the upper adit westward up the mountain-side, one branch leading to the westerly showings and the other branch leading to the copper showings and to the original camp on the Goldvalley side of the ridge lying between Goldvalley and Spud Creeks.

The underground workings comprise three adits; a lower crosscut adit and drift at an elevation of 1,375 feet, and two upper drifts both at the same elevation of 1,555 feet. The lowest adit is reached by a good horse-trail up Bibb Creek Canyon and the upper two by a steep trail and guide-rope leading still farther up the same canyon. Tram-lines connect the upper adits with the lower, and the lower adit with a loading-platform at the camp.

The deposit consists of disconnected ribbons and broken lenses of quartz and sulphides that occur within a narrow complex shear-zone. The shear, in part follows, and badly faults, a greenstone dyke. The dyke has been highly leached and altered by mineralizing solutions and appears to have been of andesitic composition. Other than the dyke, the main rock formations in the adit comprise dioritic phases of the Zeballos batholith. The detailed relationship of the greenstone dyke, shear and quartz-sulphide lenses, are shown on the accompanying plan.

Sampling.—A number of samples were taken in the drifts to ascertain the manner of distribution of the gold. The detailed results of this sampling are given below:—

	Distance from Portal.	Width.	Gold.	Silver.	Lead.	Zinc.	Remarks.
	Feet.	Inches.	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	
Upper adit, west drift	21	14	0.20	Trace	*Nil*	Trace	Fourteen inches, width of crushed dyke in shear zone.
	30	1	2.60	1.8	*Nil*	1.1	Across 1-inch width of quartz-sulphide ribbon.
	48	30	Trace	Trace	*Nil*	*Nil*	Across full 2.5-foot width of crush zone in dyke, including gouge on both walls.
	60	2	4.74	2.8	*Nil*	0.9	Across 2-inch quartz-sulphide ribbon.
	60	6	0.04	Trace	*Nil*	0.1	Across full width of gouge and crushed rock accompanying last sample.
	84	18	0.72	0.8	*Nil*	1.1	Across 18-inch crush zone, including one 3-inch quartz-sulphide ribbon.

† By John S. Stevenson.

Detailed Results of Sampling—Continued.

	Distance from Portal.	Width.	Gold.	Silver.	Lead.	Zinc.	Remarks.
	Feet.	Inches.	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	
Upper adit, west drift	100	14	0.86	1.0	*Nil*	0.3	Across 10-inch crush zone, plus 4 inches of quartz and sulphides.
	120	8	0.08	Trace	Trace	Trace	Across 4 inches of crush zone and 4 inches of quartz and sulphides.
	134	30	Trace	Trace	*Nil*	*Nil*	Across full width of fractured and leached greenstone dyke.
	180	----	Trace	Trace	*Nil*	*Nil*	White gouge from fault on south wall.
	180	2	4.6	5.6	5.1	7.5	Across full width of diagonal quartz-sulphide stringer in face.
Upper adit, east drift	30	8	0.06	Trace	*Nil*	*Nil*	Across full width of crush zone, including 1-inch quartz-sulphide ribbon.
	114	3	0.02	Trace	*Nil*	*Nil*	Across full width of crush zone, including bordering gouge.
Lower adit, westward from crosscut	22	18	Trace	Trace	*Nil*	*Nil*	Across 18-inch zone of crushed and leached diorite, containing 1 inch of lean quartz.
	40	8	Trace	Trace	*Nil*	*Nil*	Across 8-inch zone of crushed dyke and gouge.
	40	----	Trace	Trace	*Nil*	*Nil*	Thin hard films of black gouge on either side of above zone.
	70	32	0.06	Trace	Trace	*Nil*	Across full width of white leached dyke between bordering fault surfaces, including black gouge on either wall.
	77	36	Trace	Trace	*Nil*	Trace	Ditto, but without gouge.
	94	1	7.60	5.4	0.3	1.1	Along fairly continuous 1-inch ribbon of quartz and heavy sulphides.
	100	8	0.04	Trace	*Nil*	*Nil*	Sample across typical crush-zone with only a little crushed quartz, no sulphides.
	116	3	6.70	1.2	Trace	1.5	Across maximum or 3-inch width of a lenticular quartz-sulphide ribbon, 30 feet long.
	152	8	0.10	0.5	*Nil*	Trace	Across an 8-inch width of lean crushed and sugary quartz.
	160	¾	3.80	3.0	0.8	2.3	The ½- to ¾-inch band of quartz and heavy sulphides bordering a 6-inch width of lean quartz at this point.
	160	6	0.01	Trace	*Nil*	*Nil*	Across full 6-inch width of lean quartz.
	160	----	Trace	Trace	*Nil*	*Nil*	Seam of white gouge in footwall of last sample.
	170	5	8.10	3.5	*Nil*	0.6	Across full width of quartz sulphide vein in face, best width and vein-section seen.

The results of the sampling, as given in the above table, indicate that: (1) The gold occurs only in the quartz-sulphide ribbons or lenses; (2) only very little gold occurs in the badly crushed and leached rock and gouge of the main shear-zone (more gold, of course, would be expected in crushed sulphides); (3) the greenstone dyke itself contains very little gold, neither where badly leached and fractured nor where lying between well-defined shears.

Surface Workings.—The surface workings consist of several open-cuts and trenches that, with the exception of the first, trace out the continuation of the greenstone dyke for approximately 2,150 feet westward over the crest of the hill. The strippings and two open-cuts immediately above the portal of the upper west drift expose sheared rock and vein-matter

similar to that found in the underlying section in the drift; the surface showings adjacent to the upper drifts were described in 1938 in "Lode-gold Deposits of the Zeballos Area," pp. 21–22.

The many open-cuts that lie westward beyond these immediate showings will be described serially from east to west.

In a north-eastward-trending gulch, at a point approximately 145 feet above and 250 feet westward from the portal of the upper west drift, a small cut exposes two intersecting, vertical shears, a 4-inch shear striking east and a narrow 1- to 3-inch shear striking north-eastward down the gulch. Two quartz-sulphide lenses branch from the main or east-west shear into the south-westerly angle between the two shears. These lenses range from 1 inch to 3 inches in thickness. The rock formation consists of leached phases of the quartz diorite.

Fifteen feet above and approximately 100 feet westward from the last showing, a trench or open-cut has been driven south 70 degrees east for 12 feet into the hillside. No well-defined shear or quartz-sulphide veins were seen in either the trench or in the 15 feet of stripping extending southward from the face; however, the trench exposes a leached section of the greenstone dyke in diorite.

Seventy-five feet above and 350 feet westward from the last trench a combined stripping and small open-cut in the bed of a north-eastward-trending gulch exposes a 30-foot length of shear, striking north 73 degrees west and containing 12 to 14 inches of shattered diorite and 2 to 8 inches of gouge, but no quartz-sulphide vein-matter. This shear lies 1 foot to 2 feet northward from a westward-trending section of the greenstone dyke, here 3 feet wide.

Twenty-five feet above and 300 feet westward from the last cut and on the westerly side of the summit, the greenstone dyke is exposed for 20 feet vertically in the face of a westward-facing bluff. The dyke is conspicuously fractured by joints which strike parallel to it, but are opposed in dip—i.e., dip 75 degrees northward. There is neither any well-defined shear-zone nor any quartz and sulphides in this showing.

In a flat 150 feet below and at a place approximately 100 feet westward from the last or bluff exposure, a shallow stripping and a pit 5 by 3 feet deep, 50 feet beyond the stripping, expose the greenstone dyke, here 2 feet wide, but there is neither any accompanying shearing nor vein-matter.

One hundred and ninety feet below and 150 feet westward from the bluff showing, a low bluff exposes a 2-foot width of greenstone dyke; shear and vein-matter are absent.

Forty feet below and 30 feet westward from the last showing, the greenstone dyke was seen in a long rock chimney; it was possible to get to only 15 feet of the exposure, but the dyke appeared to be similar in all respects to the last.

Copper Showing.—A showing of chalcopyrite occurs in the bed of and up the sides of a rocky canyon at a point 500 feet above and approximately 800 feet southward from the upper adits.

Chalcopyrite and pyrrhotite occur disseminated throughout a dense, siliceous green rock that consists mostly of diopside; the mineralization responsible for the formation of these sulphides, and of the lime silicate, diopside, represents high temperature replacement of limy sediments. The zone of maximum sulphide deposition is 20 feet wide, strikes east, and appears to dip 75 degrees north.

The same zone of disseminated chalcopyrite and pyrrhotite is reported to extend westward and eastward over the mountain.

During 1938, high-grade ore was mined from the drifts and shipped to Tacoma, production for the year being 152 oz. of gold and 91 oz. of silver from 31 tons of ore.

Friend Group.* This group of eight claims, the *Friend Nos. 1* to *8*, and the adjacent *Pioneer* group of seventeen full claims, the *P. Nos. 1* to *11*, *P. Nos. 13* to *18*, and six fractional claims, the *P. Fr.*, the *P. Nos. 1* to *3 Fr.*, and the *P. Nos. 5* to *6 Fr.*, are being prospected and developed by the Pioneer Gold Mines of B.C., Limited. The *Friend* group was staked by A. Stuart, A. MacDonald, and C. Smith in September, 1937.

The area covered by these claims lies on the west side of the Little Zeballos River and is drained by Friend and Beano Creeks. The present camp, on the *Friend No. 1* claim, is reached either by 2½ miles of trail from the beach at the mouth of the Little Zeballos River or by 3½ miles of trail from the town of Zeballos. The latter route is the one in common use

* By R. J. Maconachie.

in back-packing supplies at the present time. This trail from the town attains an elevation of 483 feet within a horizontal distance of a quarter of a mile from the beach in climbing the steep bluffs on the coast-line. Although the trail is on comparatively easy grade above the bluffs, this sharp rise renders this route impractical for anything but back-packing. If developments in the Little Zeballos area warrant an improved trail it should be made either from the mouth of the Little Zeballos River or, utilizing part of the Zeballos River Road, over *Golden Gate* ground and into the area from the north-west.

As is common in the district, the area over which the claims are staked is rugged, deeply incised, and difficult for travel.

The camp for the present operations, accommodating ten men, on the *Friend No. 1* claim, at an elevation of 1,163 feet, is close to a small stream of insufficient flow for any but small domestic use. Any permanent camp would have to be on *Friend No. 3* claim to the west, where there is considerable level ground. Beano Creek, Friend Creek, or the Little Zeballos River provide enough water for small, year-round milling operation. There is a good stand of hemlock, cedar, and balsam on the property.

Development (April 6th, 1938) has been concentrated on two exposures, one close to the camp on the south-west side of Friend Creek and the other, at an elevation of 1,743 feet, on the same side of the creek, 2,000 feet distant from the camp in a north-east direction. The area being prospected is underlain by varying phases of greenstone lying on the south-west of a mass of basic intrusives.

At the lower workings, near the camp, the original showing consisted of a narrow, high-grade quartz vein exposed below a small waterfall on Friend Creek. On this vein, striking south 50 degrees west and dipping almost vertically in greenstone, an adit was driven into the south-west wall of the creek. Within narrow limits the vein weaves and pinches; the maximum width where it swells is 6 inches. Mineralization is by pyrite, arsenopyrite, and slight amounts of galena, sphalerite, and chalcopyrite. Free gold is visible.

At 27 feet from the portal of the drift the vein is cut off by a fault striking north and dipping 75 degrees east, which is clearly seen on the left wall but is obscured on the right wall by a series of fractures striking south 30 to 60 degrees east and dipping 60 to 90 degrees north-eastward. The adit has been driven on line for a distance of 49 feet from the portal, although past the fault there was nothing to follow but a very narrow, barren stringer which does not appear to be the continuation of the main fissure. At 49 feet a crosscut was driven 47 feet in a direction south 38 degrees east in heavily fractured greenstone in an effort to pick up the faulted continuation of the vein. In this work, at 15 feet from the intersection of drift and crosscut, on the south-west wall there was exposed a 1-inch quartz stringer, slightly mineralized by pyrite and arsenopyrite, striking north 18 degrees east and dipping 84 degrees eastward. This stringer pinches out in the back before reaching the north-east wall of the crosscut.

Four feet from the face of the crosscut a stringer of quartz and calcite was intersected; the width is commonly less than 1 inch; the strike is south 40 degrees west and dip 87 degrees north-westward. At the time of examination (April 6th, 1938) a drift on this vein had just been collared in the right wall of the crosscut. As there are indications at the fault in the drift that movement has been to the south-east, and as, by reason of the topography, the face of the crosscut is very close to the surface, this stringer offers the only hope for a continuation of the main fissure in these workings. A sample taken from this stringer, mineralized by pyrite, assayed: Gold, trace; silver, trace.

Other sampling included one across the main vein from the surface exposure at the creek. This sample, across 3 inches of quartz, probably containing free gold, assayed: Gold, 6.10 oz. per ton; silver, 1 oz. per ton. Another across the vein, 2 inches, just north-east of the fault, assayed: Gold, 4.60 oz. per ton; silver, 0.5 oz. per ton.

At the upper location a cut was being faced up on a narrow quartz-filled fracture striking south 80 degrees west and dipping 55 degrees northward. The exposure is on the steep wall of Friend Creek; on the east wall of the creek the fracture is displaced some 35 feet to the south indicating that the present course of water follows a line of faulting.

At the cut the fracturing is within a dioritic dyke striking in the same general direction as the fracturing, and apparently considerably more competent than the surrounding greenstone. On the foot-wall of the fracture the dyke has a width of 3 feet, unsilicified; on the

hanging-wall of the fracture a width of probably 6 to 7 feet, silicified and mineralized by pyrite and arsenopyrite.

A sample across the vein at this point, 9 inches, mineralized by pyrite, arsenopyrite, and sphalerite, assayed: Gold, 0.06 oz. per ton; silver, 0.1 oz. per ton.

A sample across 3 feet of dyke on the hanging-wall of the fracture assayed: Gold, 0.01 oz. per ton; silver, trace.

Golden Gate Group.†

The *Golden Gate* group comprises the following mineral claims: *Golden Gate, Golden Gate No. 2,* the *Nabob,* and the *Tagore,* staked in 1936 and 1937, and owned by D. Lutes, of Ceepeecee; Alex. MacDonald, Alfred Bird, and Chas. W. Smith, of Zeballos. This group extends from the old *Tagore* workings eastward across the Zeballos River and up the moderately steep, heavily-wooded hillside of the easterly side of the main valley.

The workings include the old *Tagore* workings and recently made open-cuts and an adit on the *Golden Gate* claim. The *Tagore* workings include an adit, a shallow shaft, and surface cuts on the westerly bank of the Zeballos River. The *Tagore* has been described by Gunning; no work had been done since then to the time of the writer's first visit to the area in 1937. The following description is taken from the report by Gunning, Geological Survey, Canada, Summary Report, 1932, Part A II., p. 37 A II.:—

" The *Tagore* group of claims straddles Zeballos River about 1½ miles above its mouth. The vein is on the west bank of the river and was discovered in 1924 by J. West and A. Ostman. Known as the Eldorado at this time, it was systematically prospected and abandoned by an English syndicate in 1925. In 1929 it was optioned as the Tagore, by A. B. Trites, from Messrs. Malmberg and Nordstrom, of Quatsino. About 2 tons of ore, unofficially reported to have assayed about 20 oz. in gold to the ton, was shipped, but apparently results were not satisfactory, for the property lay idle until 1932, when Malmberg, Nordstrom, and four associates commenced mining on a small scale, under an agreement with A. B. Trites. By September a shipment of 4,500 lb. had been made and the smelter returns indicated an assay value of 2.63 oz. of gold and 2.52 oz. of silver a ton; a gross value at that time of $50.50 a ton. The property is on the main Zeballos River trail and accomodation consists of two small cabins and a blacksmith shed.

" The vein consists of quartz or quartz and calcite with a small to very large proportion of pyrrhotite, zinc blende, chalcopyrite, galena, pyrite, and native gold. Pyrrhotite and zinc blende are the most abundant, and pyrite and galena are very minor constituents. Native gold was seen only during microscopic examination of polished surfaces of the ores and then as small, scattered grains in sulphide or gangue. A very small amount of an unidentified grey mineral was also noted. The quartz is white and finely crystalline to coarse and vuggy. It is much more abundant than calcite which is quite locally, but in some places abundantly, developed. The vein has been followed for a total distance of about 50 feet and varies from a barren, tight fissure to an exceptional maximum width of about 15 inches. It trends north-east, along a well-defined fissure, and the dip is vertical. The rocks in the vicinity are Triassic flows, tuffs, limestone, and other sediments of the Bonanza group cut by a multitude of dykes and irregular bodies which vary from a very dark quartz gabbro containing abundant magnetite to light grey and white micropegmatite. These Coast Range intrusives are very abundant for about 1 mile south of the property, but do not continue far to the north. The Triassic rocks are much contorted and somewhat faulted and generally have very steep dips.

" The vein fissure cuts fine-grained, green, banded tuffs and crystalline limestone which strike 10 degrees north of east and dip very steeply north. Towards the north-east end of the vein these rocks are cut by a northerly-trending diorite dyke, about 7 feet wide, which, on the west side, is partly replaced by white to light grey quartz-augite-albitite. Within the limits of this dyke there is practically no ore in the fissure. The whole productive part of the vein is in the dense, brittle tuffs which have been extensively altered, in large part before the vein was formed, to garnet, epidote, and chlorite. Immediately north-east of the dyke the vein has been developed by a shaft to a depth of 15 feet. Just north of the dyke the vein was found to split into two parts; one continued north-east but died out within 8 feet, the other turned to 10 degrees north of east, approximately along the bedding, and had been followed for 14 feet at the time of examination. The vein pinched and swelled along this

† By John S. Stevenson and R. J. Maconachie.

part, sometimes forming a narrow network of small veins in the volcanics, but, at the junction of the two parts, widths up to about 15 inches of good ore were encountered for a few feet. The vein continued 15 feet south-west of the dyke, in an open-cut, and then encountered altered crystalline limestone in which the ore soon ceased although the fissure continued. The limestone member is probably about 6 feet thick and dips steeply north; it was extensively altered to a mixture of garnet, diopside, quartz, calcite, and zinc blende, with some albite and apatite, before the vein was introduced, and, in heavily weathered portions, exhibits casts of fossils. No search has been made for the vein immediately south of the limestone, this part of the surface being drift-covered, but the writer understands that some ore was encountered in the limestone immediately beneath a narrow lamprophyre dyke that strikes 13 degrees north of east and dips 36 degrees south, above the south end of the vein. Unfortunately, the collar of the shaft is at the edge of the high water-level of Zeballos River, so that further development to the east would have to be well underground in order to avoid excessive inflow of water.

"For several hundred feet to the south-east of this vein the ground was prospected by pits and open-cuts in 1925. Some low-grade, contact metamorphic mineralization, including considerable zinc blende, was found in the same types of rocks that are exposed near the vein, but no similar vein was encountered. It is noteworthy that the vein cuts and is definitely later than the contact metamorphic zinc mineralization in the adjoining rocks."

The work on the *Golden Gate* claim consists of some open-cutting on a vein at an elevation of 800 feet on the east side of the river, and an adit 90 feet below the vein outcrop. The *Golden Gate* workings are reached by a trail approximately half a mile in length from the Zeballos River Road. In 1937 the work consisted of a combined stripping and open-cut some 50 feet in length, along which a little blasting had been done.

The vein is a quartz-filled fissure that weaves, pinches, and swells from 1 to 5 inches in the irregularly-sheared rock. The vein-filling is quartz with small amounts of chalcopyrite and pyrite; inasmuch as the vein has been opened for only a short distance below the surface, considerable rust occurs in the quartz. The rock-formation is a variable greenstone, consisting of phases that range from gabbroic through dioritic to andesitic; the areas of the different phases being quite irregular and the transitions gradual.

The following samples taken in the original open-cut in 1937 indicate the values and nature of associated mineralization:—

Location from North End of Stripping.	Description.	Assay.		
		Gold.	Silver.	Copper.
		Oz. per Ton.	Oz. per Ton.	Per Cent.
5 feet	Across 4 inches and along 2 feet of quartz veinlet with considerable chalcopyrite, some rust	4.0	0.4	1.5
12 feet	Across 4 feet and along 1 inch of quartz, with less chalcopyrite and much rust	0.2	0.2	0.5
16 feet	Across 5 inches and along 1 inch showing considerable pyrite, some chalcopyrite	0.12	Trace	Trace
46 feet	Across 5 inches and along 1 inch showing considerable pyrite, some chalcopyrite	1.30	0.3	Trace

Development-work since 1937 consists of a series of surface cuts and strippings and the driving of a crosscut to intersect the vein approximately 90 feet below the outcrop.

The new work exposes more extensively the tight quartz-filled fissure in sheared and variable greenstone displaying phases ranging from andesite to gabbro.

The stripping, along the side-hill to the south from the original open-cut, suggests continuity for an additional distance of some 300 feet in that direction. Two small cuts have been made on strike to the north of the original exposure.

The work to the south exposes the vein having widths ranging from a crack to a maximum, at one location, of 12 inches. Where the fracturing is filled and has normal vein characteristics average widths are less than 3 inches.

At the most southerly point of the open-cut the vein is exposed as 2 inches of rusty quartz, carrying slightly visible pyrite; the strike is due north and the dip 65 degrees east-

ward. The walls are andesite, slightly mineralized with pyrite. A sample across 2 inches of vein material assayed: Gold, 3.80 oz. per ton; silver, 1 oz. per ton.

Thirty feet to the north of this sample, at the centre of 20 feet of stripping, the mineralization appears to have followed a more flatly-lying fracture leading off the main fissuring which is a narrow band continuing on its general northerly strike.

The branch fracture strikes north 55 degrees east and dips at 50 degrees to the south-east; the walls are poorly defined and the occurrence really comprises a dissemination of quartz and a slight amount of pyrite along a line of minor weakness rather than a defined fissure-vein structure.

For the next 190 feet to the north a little irregular stripping exposes only very narrow fissure widths. From 232 feet north of the previous sample the vein has been stripped northward for a distance of 35 feet. At the south end of this cut it has a width of 4 inches; 5 feet to the north of this southern limit a sample across 3 inches of rusty quartz containing very little visible mineral assayed: Gold, 0.92 oz. per ton; silver, 0.1 oz. per ton. For the remaining 30 feet of this stripping the fissure ranges in width from a crack to 1 inch. The strike is north 10 degrees east and the dip indefinite.

Fifty feet north of the previous sample a small cut exposes 12 inches of quartz breccia, well mineralized with pyrrhotite, chalcopyrite, and pyrite, from across which a sample assayed: Gold, 0.16 oz. per ton; silver, 0.4 oz. per ton.

From this sample to the north end of the cut, a distance of 11 feet, the vein ranges from 4 to 7 inches in width, generally sparingly mineralized. The strike in this section is north 15 degrees east and the dip 65 degrees to the east.

Six feet north from the end of this cut is the southern end of the original stripping, and it is approximately below this location that the crosscut intersects what is apparently the downward extension of the vein.

The adit is driven in a direction north 80 degrees east, from a point some 90 feet below the outcrop, and at 125 feet it crosscut vein material striking north and dipping at 65 degrees to the east. At the time of examination (April 11th, 1938) drifting to the north had just commenced.

The vein material in the face of the crosscut is comprised of quartz mineralized by pyrrhotite, pyrite, and some chalcopyrite. At the north side of the face the quartz occurs as narrow stringers; at the south side it is stronger and confined to a single width. The vein-walls are of greenstone with dioritic phases on the foot-wall side. Mineralization appeared to be confined to the quartz although the operators report some on the foot-wall of the vein where first intersected.

A sample from the face across 3 inches of quartz, well mineralized, assayed: Gold, 0.74 oz. per ton; silver, 0.05 oz. per ton.

Golden Peak Group.† The Zeballos Gold Peak Mines, Limited (N.P.L.), a public company with registered offices at 540 Columbia Street, New Westminster, is stated to have bonded from the owners six full claims and a fraction, contiguous to the *Goldfield* group on the south-east and extending north-eastward from the valley of Spud Creek over the ridge between that and Goldvalley Creek. The property is reported to include the following mineral claims: *Red Star, Green Star, Blue Star, Golden Peak, Bloom Fraction, Golden Peak No. 2, Golden Peak No. 3,* staked by Alfred Bloom (deceased) and Albert Bird in 1933.

The camp, at an elevation of approximately 1,250 feet, is reached by a trail, half a mile long, that leads south-eastward up the hillside from the Spud Creek Bridge of the new road up the valley. Most of the workings are some 200 feet higher up the hillside and are reached by trail leading northward and westward from the buildings; however, one working, the adit on No. 4 vein, is some 760 feet northward along the hillside from and at approximately the same elevation as the camp, and is reached by trail therefrom.

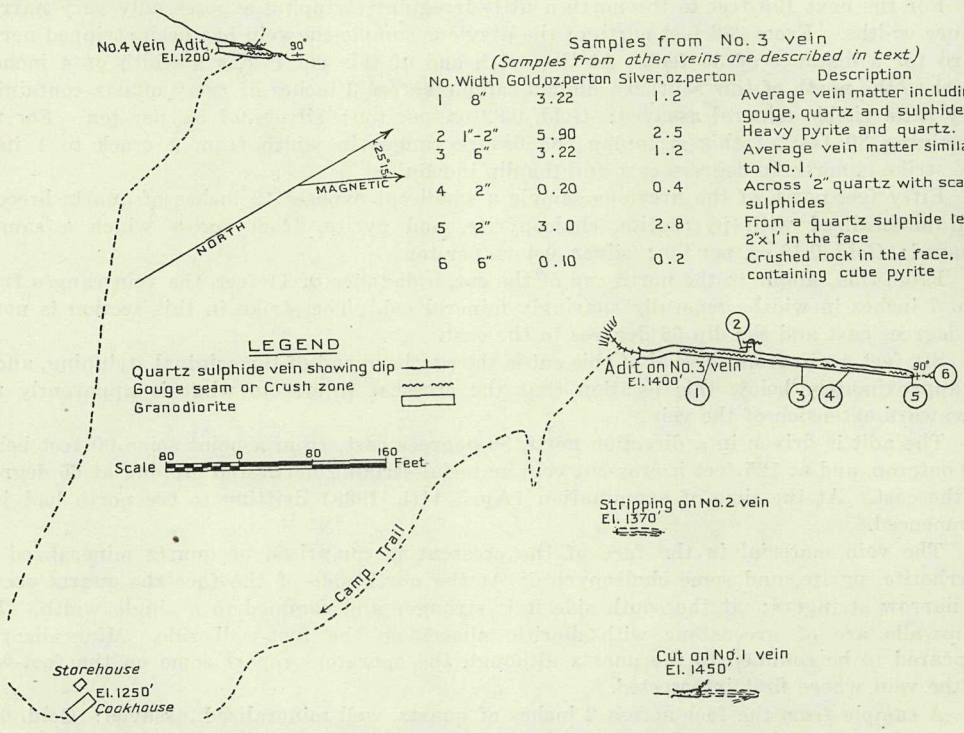
The hillside in the vicinity of all the workings is the typical steep, heavily-wooded type common to the area.

The various adits and surface workings have been driven on four different shear and crush zones that vary in width and in quantity of quartz-sulphide vein-matter. These shears all possess approximately the same strike, north 32 degrees east, and are approximately

† By John S. Stevenson and R. J. Maconachie.

vertical. The minerals found in the veins, include, in addition to quartz, pyrite as perfectly-developed cubes scattered in clusters in the crush-zone, and apparently not accompanied by gold, and pyrite associated with a small amount of galena and sphalerite in the quartz-bands, and apparently accompanied by gold values. The rock is the typical quartz diorite that is rather thoroughly bleached in the crush-zone.

In addition to the four veins previously known it is reported that two additional ones have since been found, having apparently the same general characteristics as to width, mineralization, and strike as the earlier discoveries. On these two veins no development has, as yet, been attempted.



Samples from No. 3 vein
(Samples from other veins are described in text)

No.	Width	Gold, oz. per ton	Silver, oz. per ton	Description
1	8"	3.22	1.2	Average vein matter including gouge, quartz and sulphides.
2	1"-2"	5.90	2.5	Heavy pyrite and quartz.
3	6"	3.22	1.2	Average vein matter similar to No. 1
4	2"	0.20	0.4	Across 2" quartz with scant sulphides
5	2"	3.0	2.8	From a quartz sulphide lens 2"x 1' in the face
6	6"	0.10	0.2	Crushed rock in the face, containing cube pyrite

Golden Peak. Plan showing locations of four principal veins and workings (as of September, 1937), modified after company's plan.

On No. 1 vein there is a cut at an elevation of 1,450 feet. This cut has been driven in a direction north 32 degrees east along a strong vertical break that forms the south-easterly wall. This break is 2 inches in width, and is filled by gouge and a lenticular, discontinuous stringer of quartz and heavy sulphides ranging from 1 to 2 inches in width. A sample taken along a 1-foot length of this discontinuous 1- to 2-inch veinlet assayed: Gold, 14.4 oz. per ton; silver, 5 oz. per ton. The face of this cut, which is 25 feet high, 7 feet wide at the base, and 10 feet wide at the top, shows the above-mentioned gouge-seam and veinlet on the south-east; then a 6-inch aplite dyke striking with the break but dipping 70 degrees north-westward; then in the north-westerly wall a strong shear-zone, striking north 17 degrees east, approximately vertical, and consisting of gouge and thoroughly crushed, leached quartz diorite; the width of such crushed material ranging from 2 to 10 inches. Clusters of unbroken pyrite cubes and an occasional discontinuous, narrow quartz stringer occur in the crushed zone; a sample taken across 6 inches of this material assayed: Gold, 0.20 oz. per ton; silver, trace.

Above this cut the steep hillside has been stripped for some 85 feet, thereby exposing the continuation of the main or south-easterly break of the cut. At the upper end of the stripping the fracturing is manifested by a sheeted zone 3 to 4 feet wide, consisting of closely-spaced, tight joints accompanied by the usual 1-inch border of leaching. At this place the zone is joined from the east by a strongly-sheared zone, 8 inches wide, and by a 2-inch

gouge-seam, both striking north 18 degrees east and vertical; this is the system that seems to carry the structure north-eastward up the hillside.

An adit was driven on the No. 1 vein, from a point 40 feet below the open-cut, the drift face was, on April 13th, 1938, 62 feet from the portal. It is timbered for the first 22 feet, but the remaining 40 feet displays on the north-west wall a 1-inch stringer, widening in one place to 5 inches and narrowing to a seam at the face. The strike of this fissuring is north 35 degrees east and dip vertical to steeply north-westward. From the timber to the face there is also a fissure seam exposed on the south-east wall which strikes north 25 degrees east and dips vertically or steeply north-westward. Both these fissures are filled with quartz and gouge mineralized by slight pyrite; both show bleaching of the quartz diorite walls for 1 inch on either side. Less intense effects of hydrothermal alteration are evidenced for 1 foot on the north-west walls of both fissures and, in the case of the left-hand one, this width is slightly pyritized.

A sample taken across 42 inches at the face was made up as follows from north-west to south-east across the face; 3 inches of fresh quartz diorite, 12 inches decomposed, pyritized quartz diorite, ½ inch gouge representing the north-west seam; 14 inches fresh quartz diorite, 12 inches decomposed and rusty quartz diorite, ½ inch gouge and quartz representing the south-east seam. This sample assayed: Gold, 0.01 oz. per ton; silver, trace.

The work on No. 2 vein consists of a small cut and short stripping. The face of the cut exposes, in the south-easterly side, a narrow vertical, sheeted zone striking north 32 degrees east. This zone is 13 inches wide and consists of badly-leached, pyritized quartz diorite with three quartz-sulphide stringers one-quarter to 8½ inches in thickness. A sample taken across this sheeted zone assayed: Gold, 0.80 oz. per ton; silver, 0.6 oz. per ton.

No. 3 vein has been followed by an adit some 540 feet long. The shear-zone, nearly vertical and striking north 32 degrees east, consists of highly-crushed rock and gouge, the aggregate width of which ranges from 6 to 26 inches. The vein-matter is a discontinuous band from 1 to 3 inches wide of quartz and heavy sulphides, which consist of pyrite and some arsenopyrite.

The lengths of vein-matter are from 2 to 70 feet in individual sections. The short crosscut in this working crosses a veinlet, strike north 10 degrees east, dip vertical, that consists of 1 to 2 inches of heavy pyrite and quartz; a sample across this 1- to 2-inch veinlet assayed: Gold, 5.90 oz. per ton; silver, 2.5 oz. per ton. The face of the crosscut shows a 2- to 4-inch gouge-seam that contains slickensided rounded fragments of barren quartz, and this break contains no continuous vein or veinlet of quartz, and probably therefore represents one of the few truly post quartz-vein shears in the area. The various samples taken along the main break indicate that the best values are with the narrow and discontinuous quartz-sulphide stringers, and that gouge, uncontaminated by quartz stringers, contains but little gold.

The No. 3 adit has been advanced on the vein to the present face at 540 feet from the portal. At 325 feet the vein swells to 12 inches from the 2- to 3-inch width prevailing for the preceding 25 feet, having on this swell gougy seams on either wall and a centre filling of decomposed, slightly pyritized quartz diorite. After this it narrows again to the 350-foot mark. From 350 feet to 450 feet the vein is strong between walls which are vertical or dip steeply to the south-east; in this section widths range from 3 to 12 inches, with an average of probably 7 inches. The filling is principally of quartz, slightly mineralized by pyrite and sheeted parallel to the walls by narrow bands of discoloured quartz, gouge, and fine-grained sulphides. From 300 to 450 feet the strike is north 35 degrees east with practically no variation. At 311 feet a tight fracture was intersected by the north-west wall of the drift and is carried on that wall to 344 feet, from which point it swings to the east to a junction with the main vein at 360 feet. As it approaches the main fissure the width of altered quartz diorite between the two is well mineralized by pyrite.

At 450 feet there is gouge mixed with the quartz and at 455 feet the walls, particularly the north-west one, become weakened by a series of fractures slightly divergent to the north. One of these fractures, well defined and attaining a maximum width of 4 inches, filled with quartz, gouge, and a little pyrite, is, by a changing in its strike to the north-east and a slight northerly change in the direction of the drift, traceable to the face of the drift. The main fissure, on the south-east wall of the drift, well maintained, with a gouge, crushed quartz diorite and quartz filling to 503 feet, pinches to a gouge-seam at 526 feet. At the face of the drift

the two fissures are evidenced by two seams 6 inches apart. Short of the face, in the back of the drift between the two fractures, there is a series of joints in the quartz diorite. These parallel the walls of the main fissures; some are gouge-filled. Sampling in this adit was as follows:—

At 484 feet, across 3 inches and along 6 inches on the left hand branch fracture, solid, fresh quartz dark in colour by ribboning, with moderate pyrite mineralization: Gold, 0.01 oz. per ton; silver, trace.

At 484 feet, across 21 inches between the two fractures, of decomposed quartz diorite carrying two narrow gouge seams and one quartz stringer slightly pyritized: Gold, trace; silver, trace.

At 484 feet, on the main vein, across 4 inches of fresh ribboned quartz well mineralized by pyrite: Gold, trace; silver, trace.

At 447 feet, on the main vein, across 4 inches mainly solid quartz, slight pyrite, well-defined ribboning: Gold, 0.10 oz. per ton; silver, trace.

At 390 feet, on the main vein, across 8 inches fresh quartz well ribboned, moderate pyrite mineralization: Gold, 0.02 oz. per ton; silver, trace.

At 353 feet, across 26 inches, including ½-inch seam of gouge and fine pyrite on the north-west side of the back, and 2 inches of pyritized quartz and 3 inches of gouge forming the main vein on the south-east side; the remainder of the width was made up of decomposed quartz diorite, carrying slight pyrite, lying between the two fractures. This sample assayed: Gold, trace; silver, trace.

The adit on No. 4 vein has not delineated any definite vein as yet, although it breaks into the wall of a heavy crushed zone 6 to 18 inches in width that contains scattered pyrite cubes; a sample taken across 18 inches of this material assayed: Gold, 0.10 oz. per ton; silver, trace. A branch slip from this zone extends north-eastward across the back; this contains some heavy sulphide, but a sample along it assayed only: Gold, 0.12 oz. per ton; silver, 0.1 oz. per ton. This slip joins a 5-inch crush-zone that continues along the south-easterly wall of the drift to the face. A sample taken of this material assayed only traces in gold and silver.

Homeward Mines Syndicate, Ltd.*

The Homeward Mines Syndicate, Limited, of 703 Royal Bank Building, Vancouver, B.C., owns the following mineral claims: The *H. and J. Nos. 1* to *9*, staked in 1937 by H. E. Smith, and the *Pat Fractional*, staked in 1938 by R. Dudley Smith. These claims constitute the property formerly known as the *Golden Horn*. The property is in the Nomash Valley, approximately 2½ miles up-stream from the junction of the Nomash River with the main Zeballos. The claims are on the south-west side of the valley and extend north-eastward from the vicinity of Mount Lukwa toward the valley-bottom.

At present the showings are reached by a pack-horse trail that leads from Ryan's warehouse at the *Privateer* mine up the Zeballos and Nomash Valleys. A foot-trail branches from the main pack-horse trail at a point 4 miles from Ryan's warehouse and side-hills southward up the mountain-side for a distance of 1½ miles from the valley-bottom at an elevation of 530 feet to the camp at an elevation of 1,580 feet.

The camp and workings above are on a steep mountain-side that slopes approximately 30 degrees north-eastward down from Mount Lukwa. The slope is covered with a dense growth of 4- to 10-inch timber and, excepting in the watercourses, by only a small amount of underbrush.

The prospected showings consist of five east-west shears in quartz diorite. The shears range from 1 inch to 10 inches in width, and with the exception of one each contains a narrow 1-inch quartz-sulphide ribbon. The sulphides are not abundant and consist of pyrite, fine-grained arsenopyrite, and small amounts of sphalerite and galena. At the time of examination (September 11th, 1938) the workings consisted of only a few strippings and open-cuts.

The first three workings, at elevations of 1,885 feet, 1,895 feet, and 1,965 feet, extend south-westward up the hillside from the camp. These are pits that were still mostly in slide-rock; the bed-rock was not sufficiently well exposed for examination.

At an elevation of 2,115 feet and south-westward from the last, a cut has been driven in a direction south 80 degrees west for 25 feet to a 12-foot face. The cut follows a narrow shear that ranges from 1 inch to 6 inches in width and contains a lenticular quartz-sulphide

* By John S. Stevenson.

ribbon ranging from 1 inch to 2 inches in thickness; pyrite and arsenopyrite constitute the sulphides.

At a place approximately 100 feet northward from the last cut, a showing outcrops in the bed of a north-eastward-flowing creek. The showing comprises two east-west shears, a southerly one consisting of 1 inch of gouge, with no quartz or sulphides, but conspicuously bordered by 8 inches of leached quartz diorite, and the other, a northerly one, 6 feet from the southerly, consisting of small quartz-sulphide lenses in crushed rock and gouge that ranges from 6 to 10 inches in width. A sample of the vein-matter assayed: Gold, 0.50 oz. per ton; silver, 0.1 oz. per ton.

The first cut on what is called "the main vein," is at an elevation of approximately 2,150 feet. It is a small cut exposing a steep, east-west shear that ranges from 2 to 5 inches in width, and contains, in addition to gouge and crushed rock, a one-half inch ribbon of quartz and fine-grained pyrite and arsenopyrite with fine-grained sulphides.

The largest cut seen on the property is one on the same vein as the last cut, but 100 feet farther westward up the hillside. The shear in this cut is similar to that in the last except that the quartz-sulphide ribbon increases to 1½ inches in thickness. A few specks of sphalerite and galena were seen amongst the pyrite and arsenopyrite.

At the same elevation as, but a short distance north from, the last cut is what is known as the "high-grade cut." This is a small cut that exposes a steep, east-west shear, ranging from 3 to 9 inches in width and containing a quartz-sulphide ribbon ranging from 1 inch to 3 inches in thickness. A sample of the vein-matter assayed: Gold, 0.50 oz. per ton; silver, 0.1 oz. per ton; arsenic, 3.5 per cent.

King Midas Mining Co.*

The King Midas Mining Company, c/o J. L. Peterson, 509 Vancouver Block, Vancouver, B.C., owns the following mineral claims: *Yauco Fraction, Yauco No. 12, Big Ben Fraction, Goldrock Fraction*, staked in 1935 by A. O. Noakes, and the following Crown-granted claims: *Goldrock Nos. 1* and *3*, *Yauco Nos. 2, 4, 5, 6*, and *7*, and *Big Ben Nos. 1* to *4*.

The claims extend two abreast up both sides of the North Fork of the Zeballos River for a distance of 9,000 feet from its junction with the Nomash River. The camp and workings, about 1 mile up-stream from the junction, are reached by following the pack-horse trail up the east side of the North Fork of the Zeballos River.

Near the workings the banks of the river are steep and rock bluffs are common. With the exception of a narrow bench on the east side of the river, the valley-walls rise steeply from the river-bottom to the tops of the adjoining ridges. The slopes are heavily wooded, but near the ridge tops, the wooded areas are interspersed with numerous bare rock bluffs.

The recent work has been done on two types of narrow fissure-zones within andesitic greenstone. One type of fissure-zone is relatively open and ranges from 1 inch to 9 inches in width; the shear contains narrow discontinuous lenses of quartz with small amounts of pyrite, arsenopyrite, and in one showing, the "Lynch vein," it contains abundant sphalerite. The other type of fissure-zone is relatively tight, ranges from 1 inch to 8 inches in width and is more or less completely filled by a pinching and swelling ribbon of quartz that contains considerable pyrrhotite, pyrite, and chalcopyrite.

The older, now inoperative, workings on this property are described as the *Marks* property by Gunning in Summary Report of the Geological Survey, Canada, 1932, Part A II., pp. 39 A II. to 42 A II., and also in the Annual Report of the British Columbia Minister of Mines, 1932, p. 205.

The following excerpt from Gunning's report, pp. 39 A II. to 42 A II., describes these older workings; no work was being done on these at the time of the writer's examination (September 12th, 1938):—

"Several small gold veins on the property had not received a great deal of development at the time of examination, but the most promising, on the west side of the north fork a short distance below Fault Creek, had been opened up on the surface by several cuts, and an adit had been started towards it from the bank of the river. The vein occupies a fissure in dense, green, volcanic rocks and strikes 5 degrees east of south, dipping steeply east or vertical. It maintains its southerly trend for about 100 feet, being exposed throughout most of this distance by open-cuts. At the south end it makes an abrupt swing, along an intersecting fissure,

* By John S. Stevenson.

to a south 30 degrees west course and is exposed in this direction for about 10 feet past the turn. In two small cuts 75 and 125 feet horizontally to the south-west narrow widths of similar vein material have been found and these may represent a continuation of the vein. If so, the vein may be said to have been found on the surface at intervals for a total distance of about 235 feet. Where exposed it varies in width from a maximum of about 6 inches to ½ inch or less and consists of fairly coarsely crystalline, and in places crustified or banded, quartz with zinc blende, arsenopyrite, pyrrhotite, chalcopyrite, and pyrite. The sulphides constitute from less than half to the bulk of the vein. In addition, arsenopyrite is sometimes disseminated abundantly through the wall-rock, particularly in the west wall, for an inch or more from the edge of the vein. Ninety feet below and 80 feet east of the central part of the best exposed part of the vein an adit has been started from the edge of the north fork of Zeballos River. It had been driven 50 feet in September, 1932, encountering andesitic flows and some dykes. Since then it is reported that at about 75 feet from the portal, almost vertically below the outcrop, a vein system nearly 6 feet wide was encountered, and that the vein system consisted of five, nearly parallel, small veins, varying from 2 to 5 inches in width, mineralized with sulphides similar to those in the surface exposures. Also, that the country rock in the vein system was mineralized with small veinlets and disseminated sulphides. Gold values across the 6 feet were sufficiently good to encourage further development along the vein and this work, the report indicates, is being proceeded with.

" The vein does not outcrop in the bed of Fault Creek some 200 or 300 feet north of the surface exposures and, indeed, apparently dies out on the surface, within 40 or 50 feet north of the point under which the adit has been driven. Irregular replacements of low-grade copper mineralization appear immediately north of the end of the vein, but exposures were not sufficiently good to disclose the relation of this material to the gold-bearing vein.

" A small sample of a complete section of the vein from the surface was collected by the writer and submitted for assay.[1] It consisted of about 50 per cent. quartz, with zinc blende, arsenopyrite, pyrite, and a little chalcopyrite and pyrrhotite, and assayed 2.84 oz. of gold and 0.82 oz. of silver a ton. Much higher values have been reported from the vein and undoubtedly could still be obtained, but it was thought that the small sample might represent something near an average of the material in the vein.

" Polished specimens were examined under the microscope and tiny, scattered specks of free gold were noted in most of them, generally closely associated with zinc blende and (or) chalcopyrite, but occasionally isolated in quartz. No free gold was noted in arsenopyrite, either in the vein or in the wall-rock, although that mineral is somewhat crushed and in part veined by chalcopyrite. A small amount of a very soft and sectile bronze-coloured mineral was noted in two surfaces but could not be identified. Also a little galena was observed.

" Several hundred feet farther north, half-way up some bad bluffs about 150 feet east of the river, a similar vein is exposed for a few feet along the same limestone-volcanic contact. It is about 2 inches wide and is fairly heavily mineralized with pyrrhotite, chalcopyrite, and a little zinc blende. Mr Marks reports good gold values from this place and also informs the writer that he has succeeded in finding the " Glory Hole " vein about 250 feet south of the main showing (in the falls). It is questionable whether gold values warrant further work on the vein, but if they do prospecting for it along the strike should be fairly simple. It may be reasonably expected to continue to follow the limestone-volcanic contact as long as mineralization persists and this contact is a pronounced structural feature trending east of south and swinging farther to the east of the north fork as it goes south. It crosses a large sink-hole over half a mile south of the " Glory Hole " and could be found easily at several places in the intervening distance by moderately shallow trenches.

" A few hundred feet below the adit, in the bed of the north fork, there is an area of possibly 7,500 square feet on the west side of the stream, over which very rough pyritic, green to brownish, volcanic breccia is cut by dark-grey to greenish feldspar-porphyry dykes and is mineralized sparsely with a number of small, lenticular veins carrying quartz, pyrrhotite, pyrite, chalcopyrite, and zinc blende. The largest of these veins exposed is only 2½ inches wide and about 12 feet long and the veins are not very abundant. Previous samples taken across the stream-bed for a width of nearly 100 feet were reported to have averaged close to $9 in gold a ton. The writer collected samples of the pyritic, altered volcanic, being careful

(1) All new assays reported were made by A. Sadler, Mines Branch, Department of Mines, Ottawa.

to avoid all mineralized quartz stringers. They assayed: Gold, none, and silver, 0.18 oz. a ton. A specimen of the largest and most heavily mineralized quartz stringer was polished and examined under the microscope; in about 1 square inch of surface there were seven, visible, tiny specks of free gold, either alone in quartz or with zinc blende and (or) chalcopyrite in veinlets in the quartz. Also, a little arsenopyrite was identified.

" On the opposite bank of the stream a small area is underlain by contorted grey to white, crystalline limestone with interbedded, fine-grained brown tuff. The brown material is very pyritic and near or in it are one or two, small, discontinuous stringers of quartz and calcite carrying sulphides. The pyritic material was again sampled and it assayed no gold and 0.1 oz. of silver a ton. A specimen of one of the richer stringers containing considerable arsenopyrite and some zinc blende assayed: Gold, 0.41 oz., and silver, 0.19 oz. a ton. Judging by these results it would seem that the pyritic, altered rocks of this area contain very little or no gold, whereas the small quartz veinlets contain fair values in that metal. No individual stringer is sufficiently large or continuous to encourage development and it seemed unlikely that there is sufficient high-grade material of this sort scattered through the rock to produce any important quantity of commercial ore. As the few samples obtained can hardly be taken to definitely prove this point, however, it might be advisable to channel-sample more promising sections across definite minable widths.

" There are several other places on the Marks property where small quartz stringers carrying gold values have been found, but none has showed sufficient promise to encourage development.

" The copper mineralization on the property is on the west side of the north fork and north of Fault Creek. For about 2,500 feet north of this creek andesitic flows and fragmentals are intruded by many grey to green, feldspar porphyry dykes and are considerably fractured and locally sheared. They have been extensively chloritized and mineralized, either very irregularly or along bedding or shear planes, by mixtures of quartz, epidote, pyrite, chalcopyrite, and pyrrhotite. Development has been concentrated in an area about 200 feet long, north and south, and from 100 to 125 feet wide, west of the river-bed, some 800 feet north of Fault Creek. Here several open-cuts have been made on the steep hillside and they reveal some fine copper ore. Exposures between the scattered cuts are poor, however, so that it is difficult to form an accurate picture of the occurrence. But it seemed to the writer that the principal mineralization trends about parallel to the north fork and that well-mineralized material forms from 15 to 20 per cent. of the total width of about 125 feet partly developed by cuts, the remainder being altered and pyritic volcanic. The volcanic rocks near the upper showings appear to strike about north 15 degrees west (nearly parallel to the river) and dip at 45 degrees or less to the west. Both north and south of this principal section the mineralization is less promising. To the north, large bodies of quartz are exposed along the bank of the stream, but they generally contain only a meagre amount of chalcopyrite and pyrite. To the south there is much less quartz and what little copper there is occurs in chloritic volcanics with pyrite. In the Quatsino limestone on the east side of the river there are many pockets and small, irregular bodies of pyrrhotite with some chalcopyrite, but nothing sufficiently persistent to encourage development. One or two of the porphyry dykes along the creek-bed are themselves mineralized along joints and cracks with narrow seams of quartz, pyrrhotite, and chalcopyrite.

" South of Fault Creek there are one or two showings of similar, irregular copper mineralization in the volcanics, but none has as yet received any extensive development.

" On the whole, it seems that there is an extensive low-grade copper mineralization on the claims which, under favourable market conditions, would merit some further development. At present, with copper around 6 cents a pound and no appreciable precious metal content reported from the deposits, they are naturally receiving no attention."

In the westerly group, a showing, referred to as the " new showing " crops out on the south, rocky wall of Fault Creek, approximately 200 feet west of its junction with the north fork. The exposure is a shear 3 to 6 inches in width, striking south 20 degrees west and dipping 45 degrees south-eastward. It consists of sheared greenstone and a narrow ribbon of quartz containing bands of abundant arsenopyrite and smaller amounts of chalcopyrite, pyrrhotite, and sphalerite. A sample of this vein-matter assayed: Gold, 0.60 oz. per ton; silver, 0.1 oz. per ton; copper, trace; arsenic, 3.1 per cent.

Seventy-five feet up-stream from the east showing a tight, irregular quartz stringer crops out for 20 feet in the south wall of the canyon; it strikes south 80 degrees east and dips 55 degrees southward. The quartz contains a little pyrite and chalcopyrite; a sample of the vein-matter assaying: Gold, trace; silver, trace; copper, 1.2 per cent.; arsenic, *nil.*

The third main exposure in this westerly group is that known as the "Lynch vein." This is exposed in an open, side-hill cut dug into overburden and decomposed shear material; the cut is 30 feet long in a north-south direction and has an 8-foot face. The showing is a vertical shear-zone striking north. It is 9 inches wide and consists chiefly of shattered, decomposed greenstone that encloses a discontinuous quartz vein from 1 inch to 3 inches in thickness. The quartz vein contains greenstone inclusions of pyrite, chalcopyrite, and abundant sphalerite, all the minerals being badly oxidized. A sample of this oxidized vein-matter assayed: Gold, 1.84 oz. per ton; silver, 0.2 oz. per ton; copper, 0.5 per cent.; zinc., 2.8 per cent.; arsenic, *nil.*

Inasmuch as both veins on the west side of the north fork a short distance below Fault Creek, and the copper ore exposed in open-cuts 800 feet north of Fault Creek, have been described by Gunning, and since it is reported no subsequent work has been done on them, they were not examined by the writer.

The second group of showings includes the "Trail vein" and "Glory-hole vein."

The first showing on the Trail vein is approximately 2,300 feet northward from the camp-cabin along the trail that follows the east side of the north fork. The showing consists of a tight, vertical shear 8 inches wide that strikes north 10 degrees east. This shear contains a more or less frozen quartz vein ranging from 5 to 8 inches in thickness and containing pyrite, chalcopyrite, and pyrrhotite. The vein, as such, is exposed by one trench 50 feet long, and 50 feet farther north by another shorter combined stripping and trench. Apparently the same vein is exposed at a point about 250 feet farther northward along the trail and on the south side of a westward-flowing creek. The creek-bed and a small stripping on its south bank expose a 15-foot length of vein. The vein strikes north 12 degrees east, dips 65 degrees east, and consists of two tight lenses of quartz along the strike that range up to 7 inches in greatest thickness. However, the quartz vein-matter dies out northward along the strike of the shear. The quartz contains pyrite, chalcopyrite, and abundant pyrrhotite. A sample of the vein-matter assayed: Gold, trace; silver, trace; copper, 0.8 per cent.; zinc, *nil.*

The Glory-hole vein crosses a creek-bed along the rim of a waterfall. The creek flows westward into the north fork at a point about 1,200 feet up-stream from Fault Creek. The rim of the waterfall is about 100 feet eastward from the river and 80 feet above it; it is also about 150 feet westward below a point in the trail half a mile northward from the camp-cabin. The vein strikes north 50 degrees west and dips 75 degrees north-eastward. It is a quartz-filled fissure-vein ranging from 1 inch to 5 inches in thickness; the accompanying fissure ranging from 5 to 10 inches in width. The quartz contains pyrite, chalcopyrite, and abundant pyrrhotite. A sample of typical vein-matter assayed: Gold, 0.20 oz. per ton; silver, trace. The rock-formations consist of white, crystalline limestone on the foot-wall side and of andesitic greenstone on the hanging-wall side.

Mount Zeballos Gold Mines, Ltd.*

The Mount Zeballos, formerly Farris Zeballos Gold Mines, Limited, of 1508 Standard Bank Building, Vancouver, B.C., owns the following mineral claims: *A.X.*, *B.X.*, *J.*, *S.B.*, *4X*, *B.G.*, staked in 1936 and 1937 by H. E. Smith and P. M. Monckton, and the *Twinco*, *St. George*, *Flobald*, *Hans*, *Big Apple* fractions, staked in 1938 by S. H. Davis, and the *Hank* fraction, staked in 1938 by H. Kinvig.

These claims lie westward from and immediately adjacent to those comprising the *Goldfield* property of the Spud Valley Gold Mines, Limited.

The camp is on Spud Creek, approximately 800 feet down or northward from the camp of the Spud Valley Gold Mines, Limited, or is 5½ miles by truck-road from Zeballos Post-office.

The main workings, comprising two adits at points 875 and 650 feet respectively above the camp on Spud Creek, are on the steep west side of Spud Creek Valley, with which they are connected by a good pack-horse trail.

* By John S. Stevenson.

Close to the workings, the hillside, sloping steeply eastward into Spud Creek, is well covered with heavy timber and the slope is uninterrupted by rocky bluffs at the elevations of the adits.

Geologically the property comprises a conformable series of metamorphosed porphyritic rocks in the upper adit and a uniform mass of andesitic greenstone in the lower adit. Both groups of rocks have been cut by a north-eastward-trending break that constitutes the vein-fissure. The fissure ranges in width from 2 inches to 2 feet and contains discontinuous ribbons and lenses of quartz and sulphides, the ribbons ranging from 2 inches to 10 inches in thickness, and the lenses from 2 inches to 2 feet in maximum thickness.

The workings consist of two adits, a lower at an elevation of 1,600 feet and an upper at 1,825 feet, both driven south-westward as drifts on the vein-shear. The prospect-cuts that had been dug previous to the underground work were not examined by the writer.

The lower adit has been driven south 50 degrees west along the vein to the face at a point 445 feet from the portal. Unfortunately the drift is lagged from the portal for a distance of 215 feet. From the end of the lagging to the face, a distance of 230 feet, the vein-shear continues in the back and in this length occasional patches of barren shear alternate with quartz-sulphide ribbons.

Although consisting for the most of a single crush-zone ranging from 2 to 6 inches in width, the shearing often becomes compound and the several fracture surfaces will enclose lenticular areas or horses of wall-rock. The quartz and sulphides commonly form a single ribbon, usually approximating 2 inches in width, but a few lenticular sections swell to greater thicknesses.

The rock-formation in this lower adit is massive, andesitic greenstone.

The upper adit has been driven south 50 degrees west along the vein to the face for a distance of 424 feet from the portal (September 14th, 1938). As in the lower adit, lengths of barren shear alternate with lengths of quartz-sulphide ribbons. The shear ranges from 2 to 12 inches in thickness and occasionally to short bulges 2 feet in thickness; the quartz-sulphide ribbons range from 2 to 10 inches, but an occasional lens may reach 2 feet in its thickest section. The sulphides frequently constitute a large proportion of the vein-matter and comprise abundant pyrite, with smaller amounts of sphalerite, chalcopyrite, and galena. The texture is definitely banded by the alternation of quartz-sulphide bands within the main ribbon.

Porphyritic rocks prevail in the upper adit. These rocks constitute a conformable series, the gradational members of which strike approximately north 40 degrees west and dip 50 degrees south-westward. They vary considerably in colour, from white to mottled green and white to greyish brown. With the exception of the whitest phase they are all porphyritic in the hand specimen, the brilliantly reflecting feldspars are conspicuous. Under the microscope most of these rocks are seen to consist of clear albite-plagioclase set in a fine-grained ground-mass frequently consisting of albite and quartz. In one section taken from the porphyritic rock at the face (424 feet from the portal), a few unreplaced angular fragments consisting of feldspar laths arranged in a coarsely diabasic texture, were seen; these fragments suggest the unreplaced fragments of an original andesitic greenstone.

A dominantly white, quartzitic-looking phase occurs in the upper adit between points 100 feet and 120 feet from the portal. This rock is in sharp contact with the definitely porphyritic rocks on either side. In a few places it is definitely banded, the banding strikes and dips with the contact—namely, north 50 degrees west and 50 degrees south-westward.

Operations on the property at the time of examination consisted of the driving of both drifts on the vein.

Rey Oro Gold Mining Co., Ltd.*

The Rey Oro Gold Mining Company, Limited, a private company, of 811 Hall Building, Vancouver, B.C., owns the following mineral claims: *Lone Star*, staked in 1934 by Alec McDonald, the *J. and E.*, staked in 1936 by Edward G. Brown, and the *K.* and *Axe* fractions, staked in 1937 by H. E. Smith. The workings are on the north-easterly side of Goldvalley Creek between elevations at camp of 1,300 feet, and at the highest working of 1,600 feet.

The main showing consists of a strong shear-zone striking north-eastward and approximately vertical. This shear-zone contains a lenticular quartz-sulphide ribbon which ranges

* By John S. Stevenson.

from a knife-edge to 5 inches in thickness. Recent work has been concentrated on driving a drift, raises, and intermediate levels on this vein, and of mining high-grade ore from it.

The other workings consist chiefly of open-cuts and strippings which have been driven on individual joints, usually filled with a quartz-sulphide stringer ¼ to ½ inch in thickness; these also strike north-eastward up the hillside from the creek-bottom.

The rock formation in all the workings is quartz diorite.

The following excerpt from "Lode-gold Deposits of the Zeballos Area," British Columbia Department of Mines, 1938, pp. 20–21, describes those surface workings on which very little work has been done since the examination for that report:—

"The showings, all on the north-easterly side of the creek, will be described consecutively up the creek from the one nearest the office.

"No. 1 is a stripping at an elevation of 1,315 feet and 220 feet in a direction south 55 degrees east from the office; it is 60 feet south-east from the foot-log across the creek. It is a stripping 10 feet long, exposing the junction of two joints, one of which strikes north 45 degrees east and dips 80 degrees south-east, the other north 33 degrees east and nearly vertical, in the quartz diorite; where they join the rock is fractured for a width of 1 foot; there is very little mineral in these joints.

"No. 2, 20 feet south-easterly from No. 1, is a stripping that exposes two or three veinlets, striking easterly, that range from ¼ to ½ inch in width and contain scattered grains of pyrite, arsenopyrite, and galena.

"No. 3, at an elevation of 1,325 feet and 210 feet in a direction south 28 degrees east from No. 1, is merely a showing that exposes a sheeted zone, strike north 50 degrees east, dip vertical, that is 18 inches wide and carries small amounts of arsenopyrite; although the rock immediately adjacent to the joints is somewhat leached, there is very little gouge developed.

"No. 4, at an elevation of 1,335 feet and 30 feet in a direction south 65 degrees east from No. 3, commenced as an open-cut and now (December 15th, 1937) an adit 22 feet long, has been driven in a direction north 42 degrees east along a 1-inch quartz veinlet, striking north 42 degrees east and dipping 85 degrees south-easterly, that contains both grey massive and crustiform quartz with heavy pyrite and a little galena. In addition to the usual 1- to 2-inch zone of leaching on either side of the veinlet, there are recurring films of gouge. The same veinlet is exposed 25 feet south-westward from the portal, where it is of a similar character. It is to be noted that the north-westerly wall of this cut is broken by side-joints, and that each joint is filled with a thin seam of gouge and bordered by a ½-inch zone of leaching. A sample, taken along 2 feet of the ½-inch quartz-sulphide veinlet 20 feet outside the portal, assayed: Gold, 14.40 oz. per ton; silver, 5.6 oz. per ton. A sample from the face of the adit consisting of a ¼-inch quartz-sulphide veinlet and 2 inches of leached quartz diorite assayed: Gold, 0.01; silver, trace. Another sample of a ½-inch veinlet with no adhering quartz diorite assayed: Gold, 0.90 oz. per ton; silver, 0.1 oz. per ton. A sample of the quartz diorite alone that accompanied the last sample assayed: Gold, 0.06 oz. per ton; silver, trace.

"No. 5 showing, at an elevation of 1,420 feet and 260 feet in a direction south 60 degrees east from No. 4, is a combined adit and open-cut, the aggregate length of which is 34 feet. This working has been driven north-east for 34 feet along a curving shear that crosses and follows for short distances a series of joints that come into the shear at a small angle. The shear is widest in the face where it constitutes a zone 2 feet wide, and is cut by curving gouge-slips and so crushed that it is a mass of leached, disintegrated quartz diorite. The foot-wall shear in this zone strikes north 70 degrees east, dips 60 degrees north-westerly, and the hanging-wall shear strikes north 95 degrees east and dips 60 degrees north. The shear-zone is cut by a few criss-crossing stringers of quartz 1 to 2 inches wide, and containing small amounts of pyrite and arsenopyrite. In addition to the quartz in the face, the only other occurrence of appreciable size was a lens 2 feet long and 2 inches wide in the shear at a point 18 feet from the mouth of the cut. Arsenopyrite and pyrite occur disseminated in small amounts in the vicinity of the 95-degree joints.

"The following samples were taken in this cut and adit:—

"(1). A bulk sample from a quartz-pyrite-arsenopyrite lens, 1 foot long by 2 inches thick in the face, assayed: Gold, 0.10 oz. per ton; silver, trace.

"(2.) A sample of the abundant grey-black gouge, 2 inches thick, in the hanging-wall of the shear, assayed: Gold, 0.01 oz. per ton; silver, trace.

"(3.) A 14-inch channel sample taken across the back and consisting mostly of disintegrated quartz diorite assayed: Gold, 0.10 oz. per ton; silver, trace.

" A small showing beyond the mouth of the cut and in the creek-bottom was seen to be a quartz veinlet ½ inch wide that contained abundant sulphide.

" No. 6 is a showing in the bed of a branch creek, at an elevation of 1,500 feet and 660 feet in a direction south 85 degrees east from the office. It is a sheeted zone 18 inches wide formed by joints spaced 2 to 8 inches apart, each of which is accompanied by the usual leached border and disseminated pyrite. The only quartz occurs as discontinuous ½-inch stringers.

" No. 7, or the McDonald stripping, in the bed of the same creek as No. 6, is at an elevation of 1,600 feet and is 220 feet in a direction north 80 degrees east from No. 6. This is a sloping stripping in the bed of the creek exposing a zone 12 to 18 inches in width and consisting of tight joints and a 2-inch blue quartz veinlet. Towards the upper end of the stripping the zone is more open and consists of alternating layers of gouge, crushed rock, and blue quartz veinlets; fine pyrite is abundantly disseminated through the quartz. A sample taken across 12 inches of the mixed material assayed: Gold, 0.01 oz. per ton; silver, trace."

Since the writing of the above report extensive underground work, comprising approximately 650 feet of drifting, crosscutting, and raising, has been done on the showing or vein described as No. 4 in the above excerpt. Several tons of high-grade ore have also been mined from the workings.

The main adit, which is on No. 4 vein, has been driven north 53 degrees east for 27 feet; thence along the vein north 43 degrees east for 280 feet; thence north 28 degrees east for 7 feet; and, lastly, north 53 degrees east for 50 feet to the face (September 8th, 1938), a total distance of 364 feet with a net drift-length on the vein of 357 feet. At 116 feet from the portal a crosscut has been driven south-eastward at south 62 degrees east for 33 feet, and at south 51 degrees east for 40 feet; this intersects only one tight fissure that strikes north 53 degrees east and dips 75 degrees south-eastward at a point 63 feet from the drift. At two points along the drift, raises have been driven and intermediate levels driven on the vein from the raises. At a point 126 feet from the portal a short raise goes up for 2 feet to a short intermediate level that has been driven south-westward for 22 feet and north-eastward for 17 feet. In this drift the quartz-sulphide ribbon ranges from 2 to 4 inches in thickness but dies out in the north-easterly face, although the vein-shear continues as a crush-zone 4 to 18 inches in width. A sample across 4 inches of quartz and sulphides assayed: Gold, 4.24 oz. per ton; silver, 1.5 oz. per ton; lead, *nil;* zinc, 0.5 per cent.

At 230 feet from the portal a raise has been driven on the vein, which dips 77 degrees south-eastward, for 96 feet to the surface (as measured from the main drift to the collar). From this raise three intermediate levels have been driven south-westward on the vein, a lower level at 8½ feet from the floor of the drift for 45 feet, a middle at 16 feet for 28 feet, and an upper at 24 feet for 10 feet, as measured south-westward from the drift. In these intermediate levels the vein varies from a ribbon conspicuously banded by quartz and sulphides and ranging from 1 inch to 3 inches in thickness to a ribbon of crushed sulphides, ranging from ⅛ to 1 inch in thickness. A sample along a 2-inch ribbon in the 7-foot face of the middle level assayed: Gold, 13.2 oz. per ton; silver, 2 oz. per ton; lead, trace; zinc, 2.1 per cent.

In the main drift the vein-shear lacks appreciable quartz-sulphide vein-matter until from a point 50 feet from the portal. At this point the vein-shear consists of 1 inch to 2 inches of quartz and sulphides, 10 inches of leached and partly crushed rock, and a little gouge. The back of the drift is lagged from here to 93 feet. From 93 feet to 170 feet, that is to a point under the north-easterly end of the intermediate level above the first chute, the quartz-sulphide ribbon is fairly continuous, ranging from ⅛ inch to 2 inches in thickness; in the sub-level above it ranges from 2 to 4 inches. However, from 170 feet to 183 feet the quartz-sulphide ribbon, that is the ore, dies out, but the shear continues as a zone consisting of crushed rock and numerous gouge-slips and occasional ½-inch lenses of crushed sulphides. From 183 feet to 243 feet the shear again contains a fairly continuous quartz-sulphide ribbon that ranges from 1 inch to 3 inches in thickness, but from 183 feet to 307 feet the ribbon is badly sheared. In this section the vein-matter occurs only as paper-thin sheets of crushed sulphides lying within the crushed rock and gouge of the shear, the sheets rarely number more than two across the width of the shear. The shear-zone ranges from 1 inch to 1 foot in width, and

dies out at 307 feet as a slip containing from ¼ inch to 1 inch of gouge. From 307 feet to 314 feet the drift bends slightly northward for 7 feet to intersect a second shear similar in strike and shear content to the first. This shear comes into the north-westerly wall at 305 feet, as a zone 2 inches wide consisting of crushed rock and gouge, but containing no sulphides. When the sulphides in the first shear died out, the drift was turned northward for 7 feet and the second shear following from 314 feet to the face at 364 feet. The second shear contains from 2 inches to 1 foot of gouge, crushed rock, and paper-thin streaks of pulverized sulphides.

The similarity of this second shear with the first in strike and kind, and the absence of any apparent connecting fault-surface, suggests that the two shears are parallel, *en echelon* breaks.

Numerous slips, striking east, join the second shear from the north-east; these do not continue into the other wall, but do enter the shear and off-set the paper-thin sulphide streaks. Because of lagging in the back, these slips were not seen on either side of the first shear in the main drift, but similar ones were noted to the north-west of the shear in the open-cut when it was first being explored. These fractures are relatively tight, but all are bordered by a narrow ½-inch zone of leaching and some contain a thin film of gouge. It is suggested that the fractures are shear-fractures and that they probably connect the two main shear-zones.

Hand-mining from the main drift and from the intermediate levels has been in progress throughout the greater part of year, and the ore has been milled in a 10-ton Sundfelt mill.

Rimy Group.* The Man O' War Mines, Limited, of the Bank of Toronto Building, Victoria, B.C., owns the *Rimy Nos. 3* to *8* mineral claims. These claims were staked in 1934 and 1935 by R. A. Pitre, W. J. Pitre, and Chas. Henri. The property is near the top of the mountain-side that slopes into Goldvalley Creek in the vicinity of the *Rey Oro* property. It is reached by a steep pack-horse trail that leaves Goldvalley Creek at the *Rey Oro* camp, at an elevation of 1,300 feet, and follows up the hillside in a series of switchbacks to the *Rimy* camp, at an elevation of 1,940 feet. A foot-trail leads from the camp to the lower adit at an elevation of 2,270 feet, and to the upper adit at 2,420 feet.

The hillside in the vicinity of the workings is covered by a thick growth of large timber; it is very steep, and bluffs and steep, rocky watercourses are numerous.

The deposit consists of a quartz-sulphide fissure-vein in quartz diorite.

At the time of the examination (September 8th, 1938) there were only two main workings; one, an upper adit 150 feet long, and another, an open-cut being faced-up for a lower adit at a point 150 feet below the upper one.

The upper adit has been driven as a drift eastward for 150 feet from the bed of a small draw at an elevation of 2,420 feet. The vein strikes south 84 degrees east and dips 80 degrees south. It is a strong shear ranging from 4 to 10 inches in width and containing, besides crushed rock, a continuous quartz-sulphide ribbon that ranges from 1 inch to 3 inches in thickness. The quartz-sulphide ribbon usually lies closest to the foot-wall; it is succeeded by crushed rock, or breccia, and, lastly, by a fairly continuous film of black gouge on the hanging-wall. The rock formation is quartz diorite.

At the time of examination, operations consisted of driving a lower adit 150 feet below the upper adit, and of mining high-grade ore from the upper. Production for the year was 44 oz. gold and 51 oz. silver from 19 tons of ore.

Torres Zeballos Mines, Ltd.* The Torres Zeballos Mines, Limited, of 475 Howe Street, Vancouver, B.C., owns the mineral claims *Omega Nos. 1* to *4*, staked in 1937 by John Hagmo, and the *Omega Fractional*, staked in 1938 by C. J. Heaney. The property is on Pandora Creek, a creek that flows south-eastward and joins the Zeballos River at a point approximately 700 feet north-westward across the river from the mouth of Spud Creek. The camp is at an elevation of 1,260 feet, approximately 1 mile upstream from the junction of Pandora Creek with the Zeballos River.

The property is reached from the main Zeballos Road by crossing the river on a suspension foot-bridge at a point approximately half a mile south-westward from the *Privateer* mine. A foot-trail leads from the north-westerly end of the bridge, past the old *Jack of Spades*, now *Maquinna*, camp, up the mountain-side diagonally across to the south-

* By John S. Stevenson.

easterly bank of Pandora Creek, and up this to the camp and workings close to the creek-bottom; from the end of the bridge to the camp the horizontal distance is only about 1½ miles, but the trail is very steep and slow for most of the distance.

The camp and workings are in a steep-walled but accessible section of the valley-bottom, but both up-stream and down-stream the creek flows through a series of canyons and is relatively inaccessible. The main showing on the property comprises two strongly branching shears in greenstone and diorite.

The shears, ranging from 4 to 12 inches in thickness, contain within their walls a mass of crushed rock and gouge, all of which has been thoroughly leached. Scattered grains of crushed pyrite, lenses of coarsely cleavable calcite, and a small amount of broken vein-quartz are scattered at infrequent intervals within the gouge and crushed rock. Small amounts of fine-grained sphalerite, galena, and arsenopyrite are disseminated in both the calcite and quartz.

In the vicinity of the workings diorite predominates, but 250 feet up-stream from the adit tongues of granitic rock, intrusive into the diorite, become abundant. The workings comprise one short adit and some surface strippings in the creek-bed a short distance up-stream from the one camp-building (as of September 6th, 1938).

The portal of the adit is on the north-easterly side of the creek at an elevation of approximately 1,320 feet—that is, up-stream from and 70 feet higher in elevation than the camp-cabin.

The adit, 44 feet long, has been driven from approximately creek-level in a direction north 40 degrees east as an open-cut for 10 feet, then as an adit in the same direction for 16 feet, then at north 58 degrees east for 28 feet to the face (September 6th, 1938). At the portal it follows a strong shear that strikes north 55 degrees east and dips 80 degrees south-eastward. However, approximately 6 feet from the face the portal shear is joined by a vertical shear, striking north 60 degrees east, which comes into the north-westerly wall of the adit at a point 15 feet within the portal.

A sample taken of the face across 6 inches and along 2 feet of white gouge and crushed rock within the shear assayed: Gold, 0.01 oz. per ton; silver, trace. A sample taken from a 12-inch by 2-foot pile of brown muck within the shear and evidently representing a concentration of material carried down the shear from the surface and reported to contain zinc, assayed: Zinc, *nil*. A sample taken across a 10-inch width of leached wall-rock containing a few irregular ¼-inch stringers of quartz and fine pyrite, assayed: Gold, *nil;* silver, *nil*.

The rock formation in the adit comprises greenstone and diorite. Dense greenstone occurs in both walls of the cut and on both sides of the south-easterly shear, but in the adit it follows along only the south-easterly wall and only in the hanging-wall side of the south-easterly shear; the greenstone is conspicuously leached in the vicinity of the shear. Medium-grained diorite forms the north-westerly wall of the adit and occurs on either side of the north-westerly shear; the diorite is also conspicuously leached near the shear. Both rocks show traces of contact metamorphism in the development of small brown patches of biotite hornfels. The presence of tongues of quartz diorite, 250 feet up-stream from the adit, indicates the close proximity of the body of granitic rock responsible for both the metamorphism of the diorite and greenstone and the mineralization of the shear-zone.

Two hundred feet up-stream from the adit a small cut in the south-westerly bank of the creek exposes ½-inch barren calcite vein in a narrow shear that strikes north 70 degrees west and dips 65 degrees northward.

Van Isle Group.†

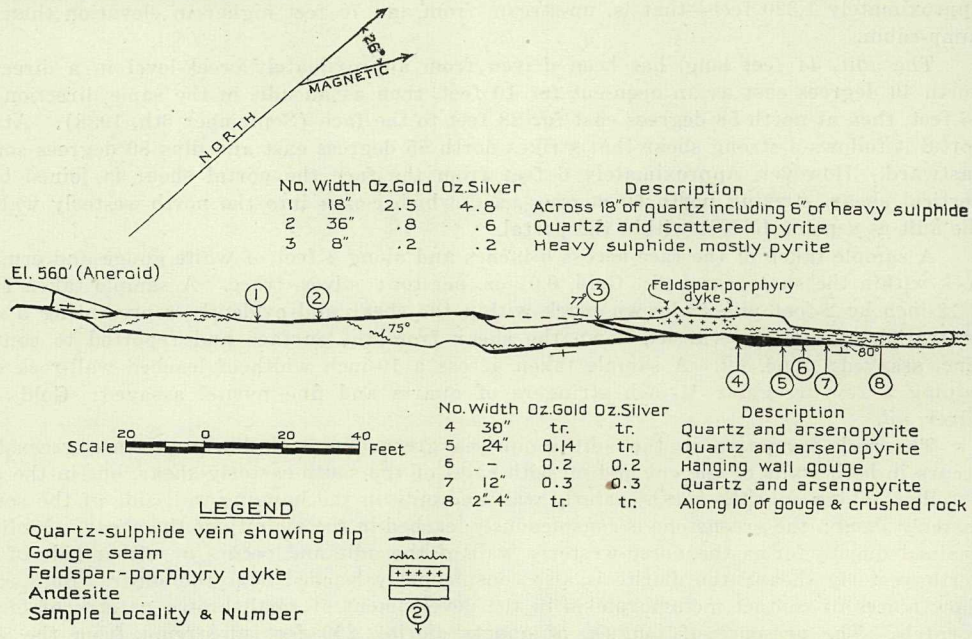
The *Van Isle* property, formerly owned by Man O' War Mines, Limited, but now by Privateer Mine, Limited, consists of the following claims: *Van Isle Nos. 1* and *2*, *Blue Ox Nos. 1* and *2*, *Wolverine*, *Pedro*, *Silver Bear*, staked in 1933; and the *Riverside* and *V.I. Nos. 1* to *4*, staked in 1937. The workings consist of several combined stripping and open-cuts and two adits. The surface cuts are reached by a trail one-third of a mile from the old camp and the upper adit by a precariously perched Jacob's ladder up the north-easterly side of the canyon. New camp buildings have been erected on the side road between the main Zeballos River Road and the old camp site on Van Isle Creek.

† By John S. Stevenson and R. J. Maconachie.

The surface workings are on the steep, heavily-wooded hillside on the south-westerly side of the south-westerly fork of Van Isle Creek; they extend south-westward from the creek-bottom, at an elevation of 650 feet, up the hillside to an elevation of 880 feet; a short distance beyond this the slope, at an elevation of 1,000 feet, flattens for 200 feet before changing direction to a westward slope. Most of the cuts have sloughed badly and only those which were open at the time of the examination (September, 1937) will be described.

These cuts have been driven on a south-westward-striking shear that ranges in width from a tight joint to a sheared zone 12 inches wide, consisting of broken rock and varying amounts of quartz, with fine-grained pyrite and arsenopyrite.

The lowest cut, at an elevation of 780 feet, has been driven in a direction south 45 degrees west for 16 feet. The north-westerly wall of the cut shows a fractured zone 8 inches in width that contains at one place, 3 feet from the portal, a lens of quartz 8 inches long and 2 inches wide, the quartz containing scattered pyrite and arsenopyrite. A sample taken across this lens assayed: Gold, 0.22 oz. per ton; silver, trace. A thin lens of sulphide, 1 inch thick and 2 inches long, occurs in the floor on the south-easterly side of the cut. The face, 5 feet high, contains four equally-spaced, tight joints striking south 45 degrees west and dipping 78 degrees north-westward; the most north-westerly joint is a continuation of the fracture in the same wall, described earlier.



Van Isle. Plan of part of the upper adit (as of September, 1937) by chain-and-compass survey.

South-westward and 45 feet higher up the hillside, a showing under a tree-root exposes a lens of quartz 2 feet long and 8 inches wide. This contains very little sulphide, but lies between strong walls.

Farther south-westward along the strike and up the hillside at an elevation of 850 feet, a stripping 10 feet long exposes a strong shear ranging from 8 to 12 inches in width, and containing fragments of blue quartz that have been cut by numerous fractures paralleling the usual south-westerly strike of the shear. This quartz contains finely disseminated arsenopyrite. A sample taken across an 8-inch width of the best-mineralized portion assayed only traces in gold and silver.

The last working, a 15-foot stripping farther south-westward up the hillside, begins at an elevation of 880 feet, exposes a section of the shear, ranging from 10 to 12 inches in width, that contains numerous ½-inch stringers of both blue quartz and vuggy quartz; small amounts of pyrite and arsenopyrite were seen in the quartz. A sample taken across 10 inches of shear, where the quartz and sulphides, pyrite and arsenopyrite, were heaviest, assayed:

Gold, trace; silver, 0.4 oz. per ton; and one across 8 inches of crushed rock without any quartz or sulphides assayed traces only in gold and silver.

The crest of the hill is some 50 feet above this cut, the slope flattening for 200 feet and then sloping steeply westward.

The upper adit, at an elevation of approximately 560 feet, has been driven north-eastward into the steep canyon-wall of the north-easterly branch of Van Isle Creek. Above the portal the vein has been exposed up the bluff-face for some 100 feet. A quotation from the Annual Report of the Minister of Mines, British Columbia, for 1935, page F 40, describes the nature of the vein as it was then, at the time of "facing up" for the adit:—

"A fissured zone, strike north 45 degrees east and dip 80 degrees north-west, in porphyritic andesite has been mineralized by quartz, pyrite, pyrrhotite, galena, and sphalerite. This fissured zone of crushed andesite, where examined, is 3 feet wide and contains quartz-sulphide veins that range in widths from 2 to 12 inches. The quartz is milky and is massive, not crustiform; pyrite, the most abundant sulphide, is fine-grained and is usually in bands parallel to the walls of the vein; pyrrhotite and sphalerite are disseminated in small amounts amongst the pyrite. A grab sample taken in the open-cut from part of a quartz vein 3 inches wide, and containing a little pyrite, assayed: Gold, 0.90 oz. per ton; silver, 0.10 oz. per ton."

Although the general features of the vein-structure may be seen in the accompanying plan, a few additional notes may be given. From the portal to 145 feet in, the main break is approximately constant in attitude and uninterrupted by major deflections from a uniform strike of north 42 degrees east and a vertical dip. In this section the main break, with a clean-cut hanging-wall and accompanying gouge, is persistent, the quantity and nature of vein-matter varies, the width of the vein ranging from 2 inches to 3 feet, and the sulphides in the narrower bands of 2- and 4-inch widths, and in one place an 8-inch width. In these sulphide-bands pyrite predominates; arsenopyrite, as contrasted to farther in, occurs there only sparingly.

Branch fissures along this section include a ⅛-inch joint at 34 feet and a similar break at 84 feet respectively from the portal. At 145 feet from the portal, the main vein, still striking 42 degrees and dipping 77 degrees north-westward, splits into two smaller ones that cross the drift and join with another vein at 160 feet and 172 feet respectively from the portal, to make a parent vein that strikes north 38 degrees east and dips 80 degrees north-westward. The other vein spoken of was broken into at a point 120 feet from the portal; it is a strong quartz-sulphide vein maintaining a fairly constant width of 4 inches to its junction at 160 feet and 172 feet with the branches from the first vein. Between 165 feet and 185 feet the drift cuts a tongue of feldspar porphyry, the attitude of which was indeterminate because the rock in the opposite (south-easterly) wall of the drift was obscured by the vein. Beyond this point a widening of the drift permits a better examination of the vein-matter in the so-called parent vein (*see* above). This vein consists of quartz, in places abundant coarsely-crystallized calcite, and arsenopyrite; arsenopyrite is here the most abundant sulphide, and others are almost absent; this contrasts with the comparative scarcity of arsenopyrite nearer the portal. The width of the vein ranges from 30 inches at 188 feet to 2 inches at 210 feet, and finally appears to disappear into a slip at 220 feet. It is to be noted that a marked shearing, manifested by numerous closely-spaced slips in the back, begins at 182 feet and continues to 220 feet, where the relief of stresses has been concentrated in three main gouge-filled fissures that apparently also represent a continuation of the vein-structure but which lack quartz-sulphide vein-matter—the vein-matter ended, as stated above, at 220 feet. As seen in the face, these three gouge-slips average 1 inch in thickness and one of them contains ¼ inch of calcite; sample No. 8 indicates that the gouge and accompanying crushed rock contains little gold.

The rock formation of this adit is, with the exception of the tongue of feldspar porphyry, both altered even-grained and altered porphyritic andesite.

In an effort to gain more complete information on values in the upper level, samples were taken at 10-foot intervals for the first 105 feet of the drift. The assays of these samples are as follows:—

At portal plus 5 feet, across 11 inches, along 3 inches, including in the width 4 inches solid quartz well mineralized by pyrite, pyrrhotite, and sphalerite, and 7 inches of barren siliceous gouge: Gold, 0.18 oz. per ton; silver, 0.6 oz. per ton.

At portal plus 15 feet across 8 inches and along 6 inches of rusty decomposed material carrying streaks of good mineralization: Gold, 0.16 oz. per ton; silver, trace.

At portal plus 25 feet across 6 inches along 4 inches, the width being made up by 3 inches of solid quartz with fair mineralization and 3 inches of gouge: Gold, 0.02 oz. per ton; silver, trace.

At portal plus 35 feet across 4 inches and along 4 inches of rusty decomposed vein material, containing little visible mineral: Gold, 0.02 oz. per ton; silver, trace.

At portal plus 45 feet across 4 inches and along 4 inches rusty decomposed vein material with fair mineralization: Gold, 3.56 oz. per ton; silver, 2.8 oz. per ton.

At portal plus 55 feet across 3 inches and along 6 inches of rusty vein material containing good mineralization: Gold, 0.44 oz. per ton; silver, 1 oz. per ton.

At portal plus 65 feet across 2 inches and along 6 inches of fresh quartz well mineralized: Gold, 3.34 oz. per ton; silver, 2.1 oz. per ton.

At portal plus 75 feet across 3 inches along 6 inches of almost pure quartz with little visible mineral: Gold, 0.42 oz. per ton; silver, 0.2 oz. per ton.

At portal plus 85 feet across 1 inch along 8 inches of banded quartz containing little visible mineral but banded by dark streaks of fine-grained sulphides: Gold, 1.52 oz. per ton; silver, 0.9 oz. per ton.

At portal plus 95 feet across 3 inches and along 7 inches of rusty gouge with little visible mineral: Gold, trace; silver, trace.

At portal plus 105 feet across 1½ inches along 10 inches of good strong quartz banded by fine-grained sulphides and containing a fair amount of other mineralization: Gold, 0.36 oz. per ton; silver, 0.6 oz. per ton.

At a point 205 feet below the upper adit a second adit has been driven south-eastward in andesite. At 382 feet this crosscut intersected what was assumed to be the downward extension of the vein exposed in the upper drift. Continued crosscutting proved a second zone of mineralization 76 feet beyond the first. From the evidence underground in the upper adit and from the surface exposures two such intersections were expected owing to a branching of the main vein, and fulfilment of this condition at the lower level lends authority to the assumption of downward extension.

At the first intersection the vein strikes north-eastward and dips at 80 degrees to the north-west. The quartz is fresh, with some vugs and comb structure. General shearing rather than single fissuring has created horses of andesite within the limits of the quartz. Mineralization is by pyrrhotite, arsenopyrite, pyrite, and a little sphalerite. Samples were taken at this location as follows:—

Across 28 inches on the south-west wall, including a narrow width of andesite in centre of shear, slight mineralization: Gold, trace; silver, trace.

Across 16 inches on the north-east wall, full width of quartz, slight mineralization; Gold, trace; silver, trace.

Select sample of the best mineralization obtainable from muck broken at the intersection and by one swipe on the left wall: Gold, 0.01 oz.; silver, trace.

At the second intersection the exposure, though narrower, is similar to the first. The quartz strikes north 32 degrees east, dips at 75 degrees to the north-west, and splits and branches within a zone of shearing. Samples taken are as follows:—

Across 6 inches on the south-west wall, quartz and calcite gangue and good mineralization by pyrrhotite, pyrite, and arsenopyrite: Gold, 0.12 oz. per ton; silver, 0.3 oz. per ton.

Across 3 inches on the north-east wall, mainly quartz and calcite, with little mineral: Gold, 0.16 oz. per ton; silver, trace.

Across 13 inches of andesite on the foot-wall of the shear on the south-west wall, including two 1-inch stringers of quartz and a small amount of pyrite: Gold, trace; silver, trace.

The first of these two mineralized zones is presumed to be the vein upon which the upper adit was driven. The intersection in the lower tunnel is some 60 feet south-west of the portal of the upper tunnel so that at the present time no data are available as to conditions vertically below the mineralization exposed on the upper level. Drifting to the north-east from the lower crosscut was under way in April, 1938, but ceased some time prior to September, 1938.

Zeballos Goldspring Mines, Ltd.*

The Zeballos Goldspring Mines, Limited, of 1016 Hall Building, Vancouver, B.C., owns the *Goldspring Nos. 1* to *6* mineral claims, staked in 1937 by John B. Madsen. The camp and the showings are on the south side of the valley of Fault Creek, a south-eastward-flowing tributary of the North Fork of the Zeballos River. The camp may be reached by following a steep foot-trail westward up the mountain-side from the *King Midas* camp on the North Fork of the Zeballos River. The *King Midas* camp is reached by a pack-horse trail that follows up the east bank of the North Fork of the Zeballos River, for a distance of 1 mile, measured from its junction with the Nomash River.

The camp and workings are on the south side of the steep-walled valley of Fault Creek. The workings are on fissure-veins that follow up the steep and, in part, bluffy valley-wall; an average slope of 45 degrees was determined for the hillside.

The showings on the property consist of two north-south fissure-veins in andesitic greenstone.

The only workings at the time of the writer's visit were strippings on these veins and an open-cut which was being started as an adit on the easterly of the two veins. This adit is 300 feet westward above both Fault Creek and the camp, the elevation of the adit being 1,555 feet.

The easterly vein is exposed for a considerable distance in the bed of a watercourse tributary to Fault Creek. The writer traced it in the rocky bed of the watercourse from the adit open-cut to the bottom of a rock chimney at a point 100 feet above open-cut; it is reported to have been found at various places up the hillside beyond this chimney.

In the section seen, the quartz vein ranges from 1 inch to 8 inches in thickness, and the accompanying rusty, sheared greenstone from 5 to 12 inches; the shear and vein strike south 75 degrees east and dip 60 degrees north-eastward. The sulphides include abundant pyrite, occasional patches of abundant chalcopyrite, and minor amounts of sphalerite and galena. A sample of heavy pyrite taken from the vein 15 feet above the adit open-cut assayed: Gold, 1.54 oz. per ton; silver, 0.5 oz. per ton, and a sample across the full 8-inch width of the vein, including 5 inches of scattered pyrite from the same place, assayed: Gold, 0.40 oz. per ton; silver, 0.1 oz. per ton.

The lowest stripping on the westerly vein is at an elevation of 1,450 feet, and approximately 150 feet above a point in Fault Creek that is 700 feet up-stream from the camp.

The vein is discontinuously exposed by strippings in the overgrown bed of a small watercourse flowing northward into Fault Creek. The shear and vein strike south 20 degrees west, dip 70 degrees eastward. The shear ranges from 1 inch to 5 inches in width and contains either a few 1-inch ribbons of quartz or a single ribbon ranging from 1 inch to 3 inches thick. Sulphides are less abundant in this than in the easterly shear previously described, the only sulphide, pyrite, occurs in small amounts. A sample taken along a 1-inch ribbon of quartz for 2 feet at an elevation of 1,350 feet, assayed: Gold, 0.30 oz. per ton; silver, trace. A sample taken near the base of a rock chimney at an elevation of 1,465 feet, for 5 feet along a quartz ribbon ranging from 1 inch to 3 inches in thickness, assayed: Gold, 0.20 oz. per ton; silver, trace. A sample taken at an elevation of 1,550 feet along 1 foot of a lean but strong 3-inch quartz ribbon, assayed: Gold, trace; silver, trace.

SPECIAL REPORTS.

Typewritten copies at 25 cents each are available to those who specially request reports on the following properties:—

Quadra Island: Geiler Group; Rebecca Group.
Read Island: Solyman-Freja Group.

* By John S. Stevenson.

PROGRESS NOTES.

BY

J. A. MITCHELL AND JAMES STRANG.

LODE-GOLD DEPOSITS.

BRIDGE RIVER CAMP.*

Pioneer Gold Mines of B.C., Ltd.—H. T. James, general manager; E. F. Emmons, general superintendent. Development-work on the main vein continued in 1938, and was confined mainly to the levels between 14 and 26. In that section of the mine the drifting on intermediate levels completed the blocking-out of ore indicated by previous years' work. This work will be continued on incompleted levels in 1939. This development work accounted for 5,985 feet of lateral development and 3,034 feet of raising.

Work on No. 4 shaft was continued and practically completed by December 31st. This shaft will open up three new levels—27, 28, and 29—for exploration during the coming year. The advance in sinking and shaft pockets amounted to 518 feet for the year.

Ore hoisted during the year totalled 142,775 tons; the milled tonnage amounted to 123,304 tons.

The average employment during the year was: Mine, 197; mill, 27; surface, 59; and salaried officials, 32.

Bralorne Mines, Ltd. (N.P.L.).—Richard Bosustow, general manager; D. N. Matheson, general superintendent; E. J. Chenoweth, mine superintendent. During 1938 a total of 15,888 feet of lateral exploration and development-work was done in the *Bralorne* mine; also 1,586 feet of raising, 94.5 feet of sinking, and 13,202 feet of diamond-drilling.

The average employment during the year was: Mine, 303; mill, 18; surface, 51; and salaried employees, 36.

The installation in the *Crown* shaft of an Ingersoll-Rand double-drum electric hoist, with a rope speed of 1,000 feet per minute and a pull of 15,000 lb., was completed in February, and since then has been in constant service. Most of the development-work was done on the 14th and 12th levels, which are serviced by this shaft.

The compressor building was enlarged and a new 2,100-foot Ingersoll-Rand compressor was installed.

A new coarse-ore bin and sorting plant was constructed during the year. These additions doubled the coarse-ore storage and made it possible to eliminate practically all dilution from the mine run.

B.R.X. (1935) Consolidated Mines, Ltd.—E. R. Shepherd, manager. Early in the year a pilot-mill was erected at this property to determine the average value and correct processing of the large amount of low-grade ore indicated by several thousand feet of development upon the shear-zone.

It was necessary to drive a ventilation and auxiliary exit raise, 12 by 5 feet in section, a total distance of 710 feet in material too low-grade to sustain milling costs. Because of this, and limited finances, the mill had to be shut down until the raise was completed. On November 9th this was accomplished, but there was a temporary shut-down on November 20th. Before the end of the year operations were resumed. The average employment for the year was: Mine, 23; surface, 19; mill, 7, when operating; salaried officials, 4. The development footages are: 1,596 feet of drifting, 213 feet of crosscutting, and 710 feet of raising.

Holland Gold Mines, Ltd.—Frank L. Holland, general manager; John S. Holland, mine foreman. An exploratory adit on this property was advanced to a point over 600 feet from the portal. A crew of five men (maximum) was employed and power-drills were used.

Ho Bo Prospect.—Pioneer Gold Mines of B.C., Limited, drove a prospect adit on this property during 1938.

Golden Ledge Syndicate.—Chas. Plaxton, general manager. Ninety-six feet of hard-rock tunnel was driven at this property during the year.

* By J. A. Mitchell.

Mix Gold Mines, Ltd.—Howard Cameron, managing director. Three hundred and seventy-five feet of crosscut tunnel was driven on this property during the year. In addition to this some diamond-drilling was done.

Lucky Strike Gold Mines, Ltd.—Grant Mahood, managing director. In addition to surface stripping and open-cutting, it is reported that 70 feet of 5- by 7-foot rock tunnel was driven on this property.

Gem.—At the *Gem* mine, operated by this company during 1938, first under the supervision of J. M. Hill and later under G. Donald Emigh, there was accomplished 115 feet of drifting and 257 feet of crosscutting, this in addition to surface work. Work commenced on July 2nd and finished on December 23rd. During this time an average of five miners, one blacksmith, and a cook were employed.

Taseko Lake Area.*

Taylor-Windfall Gold Mining Co., Ltd.—S. H. Davis, superintendent; R. H. Stewart, consulting engineer. At the *Taylor Windfall* mine an adit tunnel was completed to effect a connection with the old workings, which were flooded to a depth of 120 feet. The head of water was reduced by an advance drill-hole from the face of the tunnel and the final drainage completed by blasting this drill-hole; sulphuretted hydrogen escaping from the drill-hole caused a temporary suspension of operations.

After the connection was made, a section of the old workings was enlarged. A shaft-station was cut, and a shaft sunk 121 feet. At 100 feet below the collar a second shaft-station was cut for the new 300-foot level. A crosscut was then driven 70 feet south-eastward to intersect the vein at 58 feet. Drifting on the vein in a north-easterly direction was then carried on until operations ceased on November 8th, when the face was at 81 feet. Water seepage increased noticeably below 50 feet during shaft sinking but at no time amounted to more than 10 gallons per minute.

The mining operations consisted of 604 feet of new tunnel, 210 feet of enlarging of old tunnels, 30 feet of raising, 121 feet of shaft sinking, and 2 shaft-stations.

Hi Do Gold Mines, Ltd.—At this company's property a tent-camp was established at a safe site and about 3 miles of trail made. In addition to numerous open-cuts, an 88-foot adit was driven on No. 5 vein and about 10 feet of tunnel, now caved, was driven in an attempt to locate the source of rich gold-bearing quartz float.

The tunnelling was mainly done in 1937 but has not been previously reported.

Chilcotin Area.*

The following properties in the Chilcotin District were apparently inactive during 1938: Morris Gold Mines, Limited, *Langara*, *Standard*, and *Argo* was surveyed, *Vick* on which assessment-work has been filed for ten years in advance.

Lillooet Area.*

Grange Consolidated Gold Mines, Ltd.—Joseph McPherson, mine manager; John Bennett, consulting engineer. Operations ceased at this property on June 22nd, 1938.

S. F. Mead, of Clinton, is reported to have done extensive open-cutting and to have driven 23 feet of tunnel on what is thought to be the Dawson vein near Clinton.

Ashcroft-Kamloops Area.*

Vidette Gold Mines, Ltd.—D. B. Sterrett, general manager; Richard Avison, mine superintendent. During 1938 there was accomplished at the *Vidette* mine, 1,865 feet of drifting, 1,196 feet of crosscutting, 904 feet of raising, and 2,152 feet of diamond-drilling.

This work developed portions of the *Bluff* and *Broken Ridge* veins above the 4th level and the new " 70 " vein on the 3rd and 4th levels. Finances were inadequate to carry on development, and at the beginning of March it was found necessary to run the mill in order to meet the operating costs. Under this arrangement only two or three crews can be kept on development-work and the progress is slow. The mill was treating 20 to 25 tons per day and the gold production was about 14 oz. daily.

The employment averages for the year are: Mine, 46; mill, 9; surface, 38; and salaried employees, 7.

* By J. A. Mitchell.

Savona Gold Mines, Ltd.—In the early part of the year it is reported that 94 feet of crosscutting and drifting was done on this property. The mine was idle at the end of the year and the workings were reported to be flooded.

Martel Gold Mines, Ltd.—A. E. Jamieson, managing director. When inspected in April, this mine was being worked one shift by contractors. Six men were employed. Work was suspended in the early autumn.

Coronation Gold Prospect.—J. Johnson, managing director. Two or three men were employed intermittently, driving an incline on this property.

Squamish Area.†

Ashloo Gold Mines, Ltd.—This property is situated about 28 miles by road and trail from Squamish, on the Ashlu River. The mine worked the greater part of the year, closing down the last two months due to transportation difficulties in winter weather. The winze was continued from the 1,100- to the 1,000-foot level and a little development-work done on each of these levels. Practically all the ore for the mill came from stopes and raises between the 1,200-foot level and the surface. About 27 men are employed, 15 men underground and 12 on the surface and mill.

Texada Island.†

Gem Gold Mines, Ltd.—This mine remained closed until the latter part of the year when it was reopened. Some development-work is being carried out on the 150-foot level. Five men are employed.

Zeballos District.†

Privateer.—Owned and operated by the Privateer Mine, Limited, is situated in Spud Valley and 4 miles along the highway from the beach. A great deal of development-work has been carried out at this mine during the year. Levels developed from the surface are the 600-, 800-, 900-, 1,000-, and 1,100-foot, all connected by a system of raises with stoping carried on between the 1,000- and 800-foot levels. Before the mill was built, 1,541 tons of ore was shipped to Tacoma, and since then 6,679 tons have been treated in the mill. A 75-ton cyanide mill was completed in September and went into operation. A modern Diesel power plant and air compressors have been installed, the air compressors supplying 1,150 cubic feet of air. Up-to-date bunk-houses, cook-house, and dining-room have been built, with accommodation for well over 130 men.

Spud Valley Gold Mines, Ltd.—This property is about 2½ miles farther up Spud Valley than the *Privateer* mine. Four workings have been driven, Nos. 1, 2, 4, and 8. No. 1 tunnel and No. 4 tunnel have been driven through the mountain to the Goldvalley side. A three-compartment raise was driven from No. 4 tunnel to No. 2 adit and No. 3 level was broken off this raise. Stopes were started on No. 4 level and No. 3 level, the ore being sent to the mill during December; 1,702 tons were treated. A 50-ton mill was ready for operation early in December. A new Diesel power plant capable of producing 475 horse-power and an aerial tramway from the mine to the mill were erected during 1938. New camp buildings, bunk-house, cook-house, and dining-room capable of accommodating forty-eight men, have been built.

White Star Group.‡—At this property work was resumed on October 16th, since when an appreciable amount of development has been done under the management of T. D. Pickard. This includes a new drift adit on the No. 1 vein at 1,088 feet elevation (or 122 feet lower than the upper adit), from which a crosscut was being driven towards No. 2 vein. A 2-drill Ingersoll-Rand Diesel-driven compressor was installed and new buildings include power-house and office. George Moffat, foreman, is in charge of a crew of eleven men.

Sidney Inlet District.†

Sidney Inlet Mining Co., Ltd.—This company's copper property is at Sidney Inlet on the west coast of Vancouver Island, and was formerly operated as the *Indian Chief* mine by the Tidewater Company. The old mill and wharf were dismantled. The mill is a 120-ton concentration plant using flotation process, with bunkers and aerial tramway system to convey the ore from the mine to the mill. New bunk-house and cook-house were built at the beach

† By James Strang.
‡ By B. T. O'Grady.

and the old camp buildings at the mine rehabilitated. The portals of Nos. 2 and 3 adits were cleared out and retimbered, track was laid in these adits and connections were made underground to the Green adit which is driven from the surface on the other side of the mountain. Development-work was started on the faces of Nos. 2 and 3 levels and ore for milling purposes was taken from No. 223 stope pillars. A total of 4,553 tons of ore was produced from September to December. Some 2,200 tons of ore was treated from the dump outside, making a total of 6,750 tons through the mill.

Herbert Arm Section.†

The Premier Mining Company have taken over the *Abco* mines at the head of Herbert Arm. Sixteen men are employed. So far the work consists of repair-work and exploratory work.

COPPER DEPOSITS.†

Howe Sound Area.

Britannia Mining and Smelting Co., Ltd.—C. P. Browning, general manager; C. V. Charlton, secretary-treasurer; C. G. Dobson, mine superintendent. This mine is one of the largest producing mines of British Columbia, and although the price of export refinery copper was lower in 1938 than in 1937, the output and number of men on the pay-roll was steadily increased. The number of men employed in the mine, surface, and mill toward the end of the year totalled 1,300. The production from all the mines amounted to 2,206,992 tons. The recovery of metals was augmented by the operation of the copper precipitation plant which continued to treat the mine waters. From this tonnage 33,337,978 lb. of copper, 12,449 oz. of gold, 161,912 oz. of silver, and 74,951 tons of pyrite were produced.

Development-work totalled 26,208 feet or 4.96 miles, made up as follows: Drifting, 7,177 feet; crosscutting, 3,996 feet; raises, 12,880 feet; powder blast workings, 1,915 feet; sinking, Victoria shaft, 240 feet. In addition to this there was a total of 20,303 feet of diamond-drilling.

During the year the 41-01 raise system was completed giving a continuous ore-pass raise between the 2,700- and 4,100-foot levels. The No. 3 crusher was installed on the 3,900-foot level in this raise system. The 39-0 raise was completed to the 3,500-foot level, this completes a through airway and manway from the 4,100-foot tunnel portal to the 2,700-foot level, and provides good ventilation for all the workings off No. 4 shaft.

MERCURY DEPOSITS.*

Empire Mercury Mines.—Alex. J. Fraser, superintendent; R. F. Brown, of California, construction engineer. At the *Manitou* mine, operated by the above company, development-work done during the year consisted of 318 feet of drifting, 160 feet of crosscutting, 200 feet of raising, and 14 feet of sinking.

A small tonnage of ore was reduced in the mill. This mill has a capacity of 10 tons per twenty-four hours but has worked only intermittently to date.

An average of five men was employed in the mine and eight on the surface.

CHROMIUM DEPOSITS.*

Chrome Pit.—John O. Williams, superintendent. This property is 4½ miles west of Ashcroft, B.C. A syndicate known as the Calgary Mineral Syndicate had four men on this property, employed in uncovering a supposedly large body of chromite mineralization of good grade. This property was located by Lester Starnes, of Ashcroft, B.C., in August, 1938.

PLACER-GOLD DEPOSITS.*

Brodt's Placer.—Luther Fritz, watchman. Brodt completed 134 feet of shaft through hard-packed gravel, but was driven out by the Fraser River water. He later died and Luther Fritz was appointed as watchman. It is reported that coarse gold was recovered from the bottom of the shaft.

† By James Strang.

* By J. A. Mitchell.

The following placer operations were inactive during the year: B.C. Gold Dredges, Limited; Fraser River High Bar Placers; Northwest Mining and Development Company; Bridge River Placers.

A few leases were worked by hand at Franch Bar, Watson Bar, and at the head of Churn Creek.

QUARRIES, SHALE, AND CLAY PRODUCTS.†

Burrard Inlet.

Coast Quarries, Ltd.—T. Burrows, superintendent. Conditions at Granite Falls quarry were generally found to be good. Work during the year has been intermittent. The stone from this quarry is used for general construction-work. The number of men when fully employed ranges from seven to ten.

North Vancouver Area.

Deeks Sand and Gravel, Ltd.—T. O. Burgess, superintendent. Work has been fairly steady throughout the year. Plant equipment at this property is kept in good condition, and every care taken to operate safely. Six men are employed.

Cascade Sand and Gravel Co.—W. A. McCullum, superintendent. Conditions were generally found to be good. Ten men are employed.

B.C. Sand and Gravel Quarry.—K. Morrison, superintendent. This plant worked only occasionally during the year. When working, six men were employed.

Fraser River Delta Area.

Gilley Bros.' Quarry.—Situated at Silver Valley, Pitt River. The stone from this quarry is used in general construction-work. Conditions generally are found to be good at this plant.

Maryhill Sand and Gravel Quarry.—Operated by Gilly Bros., Limited, and situated on the banks of the Fraser River. This plant is kept in very good condition. About sixteen men are employed fairly regularly throughout the year.

New Westminster District.

Clayburn Company, Ltd.—This company's plant is situated at Kilgard, about 50 miles east of Vancouver. Fireclay, firebrick, and various forms of refractory forms as well as common brick and sewer-pipe are produced. The fireclay is obtained from deposits at Kilgard worked by underground methods similar to coal-mining. A shale quarry is operated in conjunction with the mines. About 1,200 tons of fireclay and 275 tons of shale was produced. Seventy men are employed, ten of these being in the mine.

Gabriola Island.

Gabriola Shale Products, Ltd.—Charles T. deLong, manager. This property resumed operations for the 1938 season on May 27th, and gave employment for twenty-eight men until the plant closed down on December 6th for the winter months. The shale is put through the processing plant adjacent to the quarry, where an excellent quality of brick is manufactured and sold principally in the Vancouver market.

Saanich Inlet, Vancouver Island.

B.C. Cement Co.—Operating two quarries and a cement plant at Bamberton. About twenty men are employed in the quarries, with a total crew of around 105 men for the whole plant.

Nelson Island.

Vancouver Granite Co.—This company operates a dimension-stone quarry on Nelson Island. Work here has been intermittent throughout the year.

Texada Island.

Pacific Lime Co.—This company operates two limestone quarries at Blubber Bay, producing quicklime, hydrated lime, and various limestone products. Labour disputes have inter-

† By James Strang.

fered with the regular working of the plant, but twenty-four men are regularly engaged in the quarry. The plant and quarry are kept in good condition. O. Peele is manager.

B.C. Cement Co.—This company operates a limestone quarry on the opposite shore of Blubber Bay from the Pacific Lime Company. The limestone, after passing through crusher plant, is shipped to the cement plant at Bamberton. Seven men are employed. Robert Hamilton is in charge.

Vananda Quarry.—A limestone quarry supplies limestone to various pulp-mills and crushed limestone to the coal-mines of Vancouver Island. Fourteen men are employed.

Fitzhugh Sound, Mainland Coast.

Koeye River Quarry.—P. Christenson, owner. There are two small quarries operating here supplying limestone for the Pacific Mills at Ocean Falls. They are located on Koeye River about 7 miles south of Namu. These quarries can now take care of the entire requirements of the Pacific Mills for lime rock. Twelve men were employed. A total of 7,343 tons was produced.