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**GEOLOGICAL SURVEY**  
**PAPER 40-12**

**ZEBALLOS MINING DISTRICT AND VICINITY,**  
**BRITISH COLUMBIA**

**BY**  
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# Zeballos Mining District and Vicinity, British Columbia

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## INTRODUCTION

The Zeballos mining district comprises the country in the vicinity of Zeballos Arm on the west coast of Vancouver Island and is included mainly in the drainage basin of Zeballos River. Travel to Zeballos is by steamship or aeroplane. Roads and trails lead inland.

A rapidly growing mining industry in the district has led to many demands for geological information, and to meet this demand the writer was sent there by the Geological Survey in 1938 to assist the prospectors and operators and to collect information for this report.

The writer wishes to acknowledge the facilities afforded him and his assistants, W. Lindsay and C. H. Howatson, by engineering staffs and prospectors.

There is mute evidence that prospectors were in Zeballos Valley at an early date. Far up the North Fork of the river a dilapidated old cabin can be seen today where the modern prospector finds mining tools with handles rotted away and moss-covered specimens of quartz showing visible gold. Although placer gold was obtained from Zeballos River in 1907, no gold-bearing vein attracted much attention until the Tagore vein was staked in 1924. The King Midas group of claims on the North Fork was staked in 1926, and from its veins rich surface assays were obtained. By 1929 about forty mineral claims had been staked in Zeballos Valley. High-grade ore had been sacked from the Tagore vein by H. Malmberg and the property optioned to A. B. Trites, who was later to bring into production the rich Goldfield vein, discovered in June 1935 on Spud Creek-Goldvalley divide. Prospectors found gold in Spud Creek in the autumn of 1933 and this float was followed to its source in the granodiorite area high on the west-facing slope of Spud Valley. By February 1934 the Bloom vein, the Donaldson, and several other gold leads had been found. The Donaldson vein was opened up at the surface for 90 feet and became the first shipper in 1934 of high-grade ore from Spud Valley. The Privateer group was the initial group of claims to be staked on Spud Creek by Alfred Bird and associates in 1933, but the remarkably productive vein on this property was not discovered until August 1936. High-grade ore was shipped from the Privateer prospect in 1937, and through developments in 1938 it became the largest gold mine in the area.

Prolonged fine weather made it possible to carry out, in 1938, a great deal of preliminary surface work, building of mills at three mines, and general construction work. Zeballos has radio telephone service to Vancouver, a new wharf, warehouses, hotels, stores, pack-horses for trails, and motor service over the road leading up Spud Valley. In 1938 there were 375 to 400 men steadily employed on about thirty mining properties.

The earliest modern geological work in the district was done by H. C. Gunning in 1932, and his report was published in the Summary Report of the Geological Survey for that year. The report was accompanied by a geological map on the scale of 1 inch to 1½ miles. In 1938 five prelim-

inary geological maps were published by the Geological Survey covering Gunning's work on Vancouver Island. These cover the area bounded by latitudes  $50^{\circ}$  and  $50^{\circ} 15'$  and longitudes  $126^{\circ} 15'$  and  $127^{\circ}$  and another bounded by latitude  $50^{\circ} 15'$  and  $50^{\circ} 30'$  and longitude  $126^{\circ} 30'$  and  $127^{\circ}$ .

The writer examined mineral deposits of the west coast between Esperanza Inlet and Alberni Canal in 1935 and the results were published by the Geological Survey in Memoir 204. The deposits of the district have been described from year to year in the Annual Report of the Minister of Mines of British Columbia and the area has also been featured in the Bulletin of the Canadian Institute of Mining and Metallurgy.

### GENERAL CHARACTER OF THE DISTRICT

The district lies on the southwesterly slope of the Vancouver Range of mountains. West to the Pacific Ocean the mountains present steep slopes, rising to elevations of 2,000 and 3,000 feet. Near Zeballos Arm the mountains rise to 3,000 and 4,000 feet above sea-level, and in the background to the north and east, up Zeballos Valley, peaks over 6,000 feet high give character to the skyline of Zeballos and vicinity. The general elevation increases toward the divide of the range. The relief, also, is considerable, as the pass to the North Fork of Zeballos River is at altitude 1,200 feet.

Although the summer of 1938 was exceptionally free from rain the precipitation for the year was 98 inches. The run-off is rapid; the volume of water in Zeballos River fluctuates sharply, once winter snowbanks have melted from the higher elevations.

The chief agent of erosion in these mountains has been running water. It operated to produce the broad outlines of the topography previous to glaciation, and has operated in the time since to produce a fretwork, faithfully depicting local structures and lines of weakness.

The mountain and coastal features of this area combine with a mild climate to facilitate prospecting, mining, lumbering, and fishing. The number of mining claims recently staked is proof that these mountains are quite accessible or can be made so with a few roads and trails. In ascending the mountains, ladders well placed shorten many foot trails. On the Beano property an 88-foot ladder gives access to a deep box canyon, where ore-bodies outcrop.

### GENERAL GEOLOGY

*The Karmutsen volcanics* include altered andesite and basalt, pillow lava, breccia, tuff, and minor beds of limestone. In Zeballos district they underlie Haihte Range, northwest and southeast from its high peak, Rugged Mountain, and occupy a wide area. To the southwest, the Karmutsen volcanics in part underlie the Quatsino formation and in part are cut off by the Zeballos batholith and minor intrusive bodies to the south of it.

The boundary between the Quatsino limestone and the underlying Karmutsen volcanics is always sharp, and in many places is marked by a

fault. The basal members of the Karmutsen volcanics are not exposed in Zeballos district, but, according to Gunning, they overlie Permian beds in Buttle Lake area.

The Quatsino formation consists of several hundred feet of fine-grained or coarsely crystalline, dark grey limestone with minor intercalations of green flows and fine-grained, grey, green, or brown tuffs, which are particularly abundant towards the top of the formation. In Nimpkish area the upper beds of the Quatsino formation yielded small Triassic ammonites, and on Tasis and Alberni canals weathered limestone surfaces near the base of the formation expose poorly preserved crinoid stems.

Regionally, the Quatsino limestone beds attain a thickness of 500 to 2,000 feet, and the formation persists for miles and is of great value in tracing structure. Unlike the brittle volcanic rocks above and below it, this formation has apparently yielded at depth to rock flowage, and if offset at any point along its course, a fault of considerable magnitude may be suspected.

<sup>1</sup>"The Bonanza group overlies the Quatsino limestone conformably, and consists of a great variety of volcanic flows and fragmental rocks with interbedded sediments. The distinctive pillow lavas and amygdaloids of the Karmutsen volcanics are absent and their place is taken by green and grey andesitic, and more acidic light-coloured types with a minor proportion of black, basaltic rocks and very fine-grained amygdaloids. Fragmentals including green, purplish to red, and grey breccias, and the corresponding finer-grained tuffs or beds of consolidated volcanic ash, are very abundant. Crystal tuffs, resembling porphyries, are widely developed and there are a few coarse-grained porphyritic flows. Interbedded with all these, but most abundant near the base of the group are the sediments." A dark, pebbly conglomerate described by Webster<sup>2</sup> in the Tasis Canal section as "consisting of rounded masses from one to six inches in diameter" marks the base of the Bonanza group. Resting on the conglomerate is a well-bedded series of dark, iron-stained tuffs, grading upwards into thinly bedded, calcareous rocks. These rocks are followed by cherty limestone bands weathering yellowish brown, then massive, altered, crystalline basalt, much iron stained, compact to cavernous on weathered surfaces. These rocks strike north 65 degrees west, dip 30 degrees southwest, and extend south along the east side of the canal and north along the west side of it. On the east side of Zeballos Arm these flows are associated with reddish purple and greenish felsites, striking north 45 degrees west. Greenish amygdaloids occur on the west side of Zeballos Arm south of the narrow neck of land at the head of the eastern branch of Espinosa Arm; the amygdules contain epidote and quartz.

West from Zeballos Arm the section through the Bonanza group shows more tough massive basalt flows and felsites with interbeds of flinty tuffs, which have been much altered by igneous invasion. Up to the Port Eliza branch of Esperanza Inlet the formations of the Bonanza group dip uniformly southwest at angles greater than 45 degrees, but at the head of the Port Eliza branch dark volcanic rocks strike north 45 degrees west,

<sup>1</sup> Gunning, H. C.: Geol. Surv., Canada, Sum. Rept. 1932, pt. A II, p. 34.

<sup>2</sup> "Geology of the West Coast of Vancouver Island"; Geol. Surv., Canada, Ann. Rept. 1902-3, vol. XV, pt. A, pp. 54-76.

and dip 50 degrees to the northeast. To the west variable beds continue, some resembling flinty quartzites, and dip northeast.

At Tatchu Point the siliceous beds of the Bonanza group, which strike north 50 to 70 degrees west and dip 30 degrees to the northeast, are overlain in angular unconformity by marine strata of probable Tertiary age.

#### COAST RANGE INTRUSIVES

Numerous bodies of granitic rocks of the Coast Range intrusives cut the Vancouver group. Ore deposits formed during the period of intrusion occur not only in the invaded rocks but also in the upper parts of some of the small stocks and batholiths.

The earlier Coast Range intrusive rocks were gabbro and diorite and were followed by more acidic, granodiorite, quartz monzonite, quartz diorite, and associated porphyry dyke rocks. Dykes are numerous around the peripheries of the major intrusions, and are also common in the central parts of many of the granodiorite areas.

Both diorite and granodiorite are abundant in the area northwest from Nootka Sound, particularly in the rocks lying to the southwest of the Karmutsen contact. They are conspicuous on the shore west of Zeballos Arm and along Esperanza Inlet. A now famous massif, first mapped and described by H. C. Gunning as the Zeballos batholith, is the central feature in the geology of Zeballos district. At its borders the rock is quartz diorite intricately veined with thin, irregular, acidic dykes. Later dykes of feldspar porphyry, aplite-rhyolite, and andesite from 1 foot to 7 feet wide follow well-defined fractures. Mineral veins formed in fractured dykes and parallel fissure zones near the close of the period of magmatic activity.

#### STRUCTURAL GEOLOGY

The major structure of Zeballos district, involving members of Karmutsen, Quatsino, and Bonanza divisions of the Vancouver group, is a monoclinial fold, which strikes in general northwest and dips southwest at angles of 40 to 60 degrees. The upturned strata give evidence of warping, local folding, alteration through igneous intrusion, and some notable faulting.

The formation of this monoclinial structure was accompanied by some cross-flexuring of the beds. This was illustrated in tracing the Quatsino formation northwesterly for 30 miles from Tasis Canal. East of the canal the Quatsino limestone strikes north 75 degrees west; at the head of the canal it strikes north 25 degrees west, and holds this course to its contact with the Zeballos batholith. On the north side of the batholith, in Nomash Valley, the Quatsino strikes north 50 degrees west to the North Fork of the Zeballos, where it is intercepted by a fault. West of the North Fork, once it is clear of the Zeballos batholith contact, the formation takes a course north 25 degrees west, and in a short distance turns north 50 degrees west and holds this course without deviation for 8 miles across the headwaters of Artlish River.

The Quatsino limestone is a thick formation and its response to regional compressive stresses appears to have been quite different from that of the brittle volcanic rocks below and above it, which fractured,

whereas the limestone remained intact by bending through rock flowage. The Bonanza group was most affected by fracturing along north and south lines near the bends in the Quasino formation. The contact between the Karmutsen volcanics and the Quatsino limestone is marked by faulting at many points, and the volcanic rocks are twisted and contorted locally. The invasion of Coast Range intrusives, particularly the Zeballos batholith, caused faulting and other deformation in the rocks adjacent to it. Dykes related to the batholith have been sheared and faulted, indicating movement after intrusion, favourable to the formation of mineral veins.

The outline of the Zeballos batholith is of interest and of probable economic importance. The batholith trends northwest and is shaped like an hour-glass, the narrow part being only three-quarters mile wide where crossed by Zeballos River. Zeballos Valley crosses the batholith at right angles, is 3,800 feet deep, and has flaring sides rising roughly at 20 degrees, so that the valley is about 5 miles wide 3,800 feet above its floor.

Many inclusions of limestone and volcanic rock occur on the slopes of the valley, and apparently are parts of a very large wedge-like mass of rock resembling a roof pendant that crossed the batholith at the present site of Zeballos Valley and extended downward almost to the present floor of the valley. The writer believes that such a rock mass formerly existed and that it has now been eroded away almost completely to expose the top of the Zeballos batholith. Evidence supporting the idea is provided by the boulders and gravels on the Zeballos Delta. Very few boulders or pebbles of granite are found in the delta despite the fact that the river crosses the batholith. The conclusion follows that the river cut its valley in rocks other than granite and has only very recently cut down to the roof of the batholith. The rock mass may not have been a wedge-shaped roof pendant, but may have attained this shape through faulting. Fault fissures containing gold-bearing quartz veins and striking northeast are common on the slopes of Zeballos Valley. The movement along any one fault has been small, but taking into consideration the number of such faults the total movement may have been considerable. It may be, therefore, that the so-called roof pendant was faulted so as to assume its wedge shape by successive down faulting from both sides and by greatest settling along its axis.

## ECONOMIC GEOLOGY

The mineral resources of Zeballos district are varied, although up to the present time only the gold-silver deposits are being developed. Gold-copper ores occur on several properties, as on the King Midas, where they are in close association with gold veins. Iron ores occur as magnetite bodies of good quality and size and cannot now be considered as too remote from transportation. Some pyrrhotite lenses, containing gold, occur in the Little Zeballos. Newly discovered lead-zinc replacement deposits in volcanic rock have been surface stripped and sampled near Hecate Channel on Nootka Island.

Various veins rich in gold content have been discovered in the Tagore, King Midas, White Star, Goldfield, Rey Oro, and Rimy mines. Some of the adit drifts, on these and other veins, discovered since 1935, have entered ore shoots near the surface or made ore continuously along different

lengths even up to 800 feet, as in the main Privateer vein. Several adits have been driven at the Privateer and Spud Valley mines and mineral content has been tested over vertical ranges of 600 to 700 feet. The ore is similar in appearance from one level to another, the vein widths changing not at all or very little, averaging 1 foot to 6 or 7 inches.

Mills at the Privateer, Spud Valley, and Rey Oro mines were in course of construction in 1938. The Northern Miner for October 1939 gives some interesting figures on production, mining, and milling costs. "Gold production to date from Zeballos exceeds two million dollars, and the annual output from now on should readily exceed that figure. Mills have been erected at the Mount Zeballos and Central Zeballos properties. Power is looked after by diesel units and fuel costs 8.6 cents at the townsite on tidewater and just over 10 cents at mines 4 to 6 miles up valley. Mining costs at Privateer run about \$4 per ton and milling costs about \$3.20; the total operating cost is \$11 plus per ton. Zeballos ore is not hard to mill and anywhere from 50 to 80 per cent of the gold is quickly and readily recovered by jig concentration after grinding. This concentrate is amalgamated to give gold bullion. At Privateer, cyanidation is practised and an overall recovery of 98 per cent is obtained. At Spud Valley, flotation concentration is carried out after the jig and the concentrates are shipped to Tacoma smelter. Mount Zeballos follows the same practice and Central Zeballos will do likewise. Spud Valley concentration ratio is about twenty to one and concentrates run around five ounces to give a total extraction of 98 per cent. At present, Privateer and Spud Valley profits run about half the production while at Mount Zeballos the proportion of profit is greater than that. In well under a year's milling, Privateer returned all pre-production expenditures in dividends."

## TYPES OF GOLD DEPOSITS

The gold deposits thus far developed, in Zeballos district, fall into three general classes:

- (1) Quartz veins in fissures.
- (2) Quartz veins in mineralized shear zones.
- (3) Placer deposits.

Pyrrhotite, arsenopyrite, pyrite, chalcopyrite, and galena may all occur in a 6-inch quartz vein, either in the Vancouver volcanics or the Zeballos granodiorite. The gold ores range from extremely complex to simple quartz veins carrying native gold and auriferous pyrite. The gold veins may be frozen to the walls in part, or free with gouge developed along the walls. The quartz in the fissures varies much in texture from open and vuggy to compact. In some veins the sulphides form persistent bands or lenses, whereas in others they occur in irregularly scattered segregations or blotches. The quartz veins in fissures have well-defined walls, which may exhibit a very slight amount of hydrothermal alteration. The vein-filling of open fissures is clearly indicated. Values are not known to be higher at the intersections of veins than elsewhere.

It is definitely established that some quartz bearing fissures in Zeballos area persist with little deviation for considerable distances; for distances

ranging from 500 to 1,500 feet are regarded as not unusual there in the tracing of mineralized fractures at the surface.

In regard to fault fissures found within the Zeballos batholith, shear zones and sheeted zones are characteristic, and from the fissure-veins short branch veins extend along joints. Within the batholith shearing is localized and occurs parallel to the axes of high ridges. Some of these shear zones and crush zones should prove persistent both horizontally and in depth, in following the sides or crests of the ridges. A broad, mineralized shear zone has been opened up to some extent at the North Star property on the east side of Goldvalley Creek.

Fissures may extend from well within the granodiorite across the contact and far out into the invaded formations.

The most productive mineral veins and the majority of those found in the Zeballos area are transverse to the northwest trend of the Vancouver Range. Most of the veins dip to the east or south at steep angles. Local structural conditions controlled the strike and dip.

The contacts bounding the Zeballos batholith are sinuous and show no sign of displacement through faulting. The northeast contact on the Nomash slope is steep and on Spud Valley slope the southwest contact goes beneath volcanic beds at an angle of 65 degrees. One definitely post-mineral fault has been observed in the volcanics of Spud Creek; it offsets a narrow mineral vein on the Privateer claims, the west side of the fault having moved southeast a few feet parallel to the contact of the batholith. Most mineral veins that have been followed underground in Zeballos area show some differential movement in places, yet are notably free from post-mineral faulting or dislocation.

The gold values contained in a typical gold-quartz sulphide vein of Zeballos district will be high or low depending on whether the vein fractured and remained receptive during part or all of the period of mineralization. Some veins show a complete filling of fine-grained, dark grey quartz of the earliest stage, a variety containing dusty arsenopyrite and pyrite, whereas the most productive veins usually show only a fringe of such quartz along their walls. J. S. Stevenson<sup>1</sup> notes that the last manifestation of vein mineralization is that of quartz in irregular veinlets crossing the ore bands; this quartz carries no sulphides and apparently no gold.

Veins in shear zones may be confined to either the foot-wall or the hanging-wall side, or may occur as abundant small quartz stringers within pyritized wall-rocks. Shear zones may be seen adjacent to dykes, sills, or competent members in a rock formation. Sheeted and crushed areas in granodiorite afford possibilities of large, low-grade, disseminated gold deposits such as have been opened up at the North Star property on Goldvalley Creek.

The presence of gold in the gravels along the Zeballos River bottom has served as a clue in the search for the lode deposits, for the gold was found to be chunky and evidently had not been carried any great distance. In view of the number of gold veins that have come to light in recent exploration of the area, it would seem that the gravel flats along and adjacent to the main stream and some of its tributaries should be tested in some systematic way.

<sup>1</sup> Geology and Ore Deposits of the Zeballos Area, B.C.; Can. Inst. Min. and Met., Bull. No. 324, 1939.

### Golden Gate-Tagore Group

*References:* Gunning, H. C.: Geol. Surv., Canada, Sum. Rept. 1932, pt. A II, pp. 38, 39.  
 Bancroft, M. F.: Geol. Surv., Canada, Mem. 204, 1937, p. 17. Stevenson, J. S.:  
 B.C. Dept. of Mines, 1938; Lode Gold Deposit of Zeballos Area, pp. 5, 6.

The Golden Gate-Tagore group consists of six mineral claims, staked in 1936 and 1937 and owned by D. Lutes, Alex. MacDonald, Alfred Bird, and Chas. W. Smith. A. B. Trites had optioned the Tagore in 1929 from Messrs. Malmberg and Nordstrom of Quatsino. The last work done on the Tagore was under the direction of Conrad Wolffe in 1933. The property was optioned to Golden Gate Zeballos Mines, Limited, of Vancouver, in 1937. Two claims, end on, cross Zeballos River and join up with a block of four claims on the east side of the valley. The motor road crosses the property about  $1\frac{1}{2}$  miles from Zeballos. Some 5 tons of very high-grade ore has been taken from the Tagore vein. A sample of the ore assayed by J. R. Williams and Son, Vancouver, B.C., on July 30, 1931, gave 35.66 ounces gold a ton and 3.6 per cent copper.

The Golden Gate-Tagore claims are underlain by the bedded flows and sediments of the Bonanza group. The rocks have been tilted so that they now strike north 40 degrees west and dip 70 degrees southwest. The property lies on the northeast side of a belt of intrusives that cut the rocks of the Bonanza group. Gabbro-diorite and aplite dykes are associated with the veins. All the rocks are abundantly jointed and fissured.

The mineral veins are fissure fillings in both the intruded and intrusive rocks. The quartz veins carry pyrite, chalcopyrite, and pyrrhotite in irregular bunches or patches, and where exposed at the surface show rusty weathering. The veins are not conspicuous in the topography or even where they outcrop in a stream channel. The gold content varies greatly from one point to another along any section of vein.

The Golden Gate vein, located on the east side of Zeballos Valley, strikes due north and dips 70 degrees east, following a fissure in gabbro, which appears to be a dense, cherty to granular greenstone in its present altered condition. The vein pinches and swells from 1 to 5 inches at the surface, but shows a width of 8 inches 93 feet below the surface in the 20-foot drift from the crosscut, at altitude 700 feet. The vein-filling is quartz with small amounts of the sulphides, chalcopyrite, and pyrite, which occur in patches and bunches both at the surface and underground.

Recent work done on the Golden Gate vein consists of surface stripping and open-cuts in tracing a newly discovered vein 460 feet. At altitude 700 feet and 93 feet down from the vein outcrop an adit was driven, encountering the vein at 140 feet and drifting north on it 20 feet where it shows an average width of 8 inches.

According to Alex. MacDonald, assays across average widths of 6 inches, at intervals along the Golden Gate vein, varied from \$6.32 to \$232 gold a ton. At 5 feet from the north end of the stripping of the vein a sample taken by J. S. Stevenson of the British Columbia Department of Mines assayed 4 ounces gold, 0.4 ounce silver, and 1.5 per cent copper a ton.

The Tagore vein is on the west side of Zeballos River and strikes south 38 degrees west and dips 77 degrees northwest. It has been explored by two short adits and a shaft. In the vicinity of the shaft the vein



follows a well-defined wall. The vein in the shaft appears to be a branch of a larger vein striking south 55 degrees west and dipping 85 degrees northwest.

According to H. C. Gunning, who examined the Tagore at a time when work was in progress on the vein, the whole productive part of the Tagore vein is in the dense, brittle tuffs that have been extensively altered, in large part before the vein was formed, to garnet, epidote, and chlorite. Where the fissure cuts a 7-foot diorite dyke immediately southwest of the shaft it was practically barren. The vein is exposed southwest of the 7-foot dyke in an open-cut, and then encountered altered limestone in which the ore soon ceased but the fissure continued. North of the dyke the vein was seen to split into two parts, one continued northeast and died out in 8 feet, the other turned 10 degrees north of east and had been followed for 14 feet.

### Van Isle Group

*References:* Ann. Rept., Minister of Mines, B.C., 1935, p. F40. Bancroft, M. F.: Geol. Surv., Canada, Mem. 204, 1937, p. 16. Stevenson, J. S.: B.C. Dept. of Mines, 1938; Lode Gold Deposits of Zeballos Area, p. 6.

The Van Isle group consists of twelve claims, some of which were staked in 1933 and others in 1937, and is now owned by Privateer Mine, Limited. It is located on the east side of Zeballos Valley on Van Isle Creek. A short branch road leads to the camp from the main Zeballos highway  $3\frac{1}{2}$  miles from the town of Zeballos. The camp was built by Man-O-War Mines, Limited, who brought the property along to its present stage of development.

The deposits on the property are northeasterly striking gold-quartz-sulphide veins. The development work consists of several combined strippings and open-cuts and adits at two levels. The first underground exploration done on this property was started in August 1935 and total length of adit on the property in August 1938 amounted to over 1,100 feet.

The claims are underlain by even-grained and porphyritic andesite of the Bonanza group, which has been intruded by one or more feldspar porphyry dykes, such as cut the Zeballos batholith to the north of the property. The andesite flows are thin, striking north 45 degrees west and dipping 40 degrees southwest. The rocks are jointed and fissured in diverse directions.

The main Van Isle vein follows a typical fault in the andesitic rocks of the Bonanza group. The fault shear is 3 feet wide, contains quartz stringers, and locally is completely filled with quartz holding some calcite and bands or blotches of sulphides. The sulphides include pyrite or arsenopyrite chiefly, but pyrrhotite, galena, and sphalerite are present. The gold values vary with the amount of sulphides in the vein, and some very good milling ore has been opened up in the upper adit. The corresponding length of vein opened up at the lower adit shows lower gold values, though there is no noticeable change in vein widths, the vein averaging 6 inches to 1 foot in width.

The Van Isle vein has been drifted on for 240 feet in the upper adit at altitude 560 feet. On the surface the vein follows a gully where open-cuts made at intervals up to altitude 880 feet show vein matter over

widths of 10 to 12 inches. The lowest open-cut at altitude 780 feet driven south 45 degrees west for 16 feet shows an 8-inch fracture zone, some quartz, and scattered pyrite and arsenopyrite. J. S. Stevenson obtained a sample from this cut assayed: gold, 0.22 ounce a ton; silver, a trace. The face of this cut shows closely spaced jointing striking southwest and dipping 78 degrees northwesterly.

An adit at altitude 236 feet (224 feet below the upper level) is a crosscut for 382 feet and then follows the vein for 410 feet. The position of the vein at this level indicates that it dips 83 degrees northwest between this level and the upper level and strikes north 42 degrees east. The vein has not changed in width or appearance. It consists of pyrite, zinc blende, pyrrhotite, quartz, and calcite.

The lower adit was advanced 65 feet beyond the main vein to intercept a 4-inch vein occurring in the upper adit and at the surface. A drift was run on this 4-inch vein to the northeast for 160 feet.

### Privateer Group

*References:* Geol. Surv., Canada, Mem. 204, 1937, pp. 13-14. B.C. Dept. of Mines; Lode Gold Deposits of Zeballos Area, 1938, pp. 8-13.

The Privateer group comprises a block of claims covering an area of about 360 acres; it is owned by Privateer Mine, Limited, D. S. Tait, Secretary, 601-9 Bank of Toronto Building, Victoria, B.C.

The property is  $4\frac{1}{2}$  miles from the Zeballos wharf and is served by the Spud Valley motor road. It is east of and adjoins the Van Isle group and extends east across Spud Valley as far as the Britannia B group. Two claims, Privateer and Privateer No. 7, contain the present Privateer mine, which is on the northeast side of Spud Creek where the hillside rises steeply from about altitude 390 feet.

The ore deposits on the property are gold-quartz-sulphide veins, and represent open fissure filling in rocks bordering the southwest contact of the Zeballos batholith. Rapid development has been possible on the Privateer property on account of the high-grade character of the ore. The vein found in August 1936 by John Roy Ildstad gave assay returns from bronzy pyrite of 55 ounces gold to the ton; this ore was laid bare by surface stripping down to a glaciated surface at altitude 700 feet. The property was taken under development in a small way in March 1937. Some 5,000 feet of rock work in all was done in five adits and the mine equipped for efficient operation.

According to the annual report issued by Privateer Mine, Limited, March 10, 1939, the development results stood as follows over a vertical range of 600 feet between the upper level and lower 1,100-foot level:

Level	Length of ore	Width in feet	Average grade
600.....	217.....	0.54.....	4.16 oz. gold
800.....	276.....	0.85.....	4.26 (cut value)
900.....	758.....	1.00.....	3.87
1000.....	815.....	1.07.....	3.28
1100.....	421.....	1.04.....	0.55

The ore reserves developed and partly developed in this work amount to 67,707 tons, assuring a 2-year supply of ore at the present rate of milling. In 98 days of the latter part of 1938, the mill output amounted to \$323,201.41 from 7,234 dry tons of ore. From this tonnage 9,137 ounces gold and 3,150 ounces silver were obtained. The average recovery was 1.26 ounces gold or \$44.10 a ton, which is an average of 97.7 per cent recovery of the mill heads. During the period noted above 26.1 per cent of the mill feed was material accumulated in previously sorting out ore for shipment. In the 75-ton mill, the fines pass over a jig and corduroy blankets before cyaniding. The product of the jig and tables is amalgamated.

The total production from the Privateer mine in 1938, including both sacked ore and milled ores, was \$534,370.91. The production of the mine from May 1937 to the end of February 1939 was \$838,714.41, and of this amount the ore sacked and shipped to Tacoma smelter yielded \$301,760.94.

The southwest contact of the Zeballos batholith crosses the property, and on Spud Creek a blunt wedge of the invaded Bonanza rocks extends half a mile into the batholith. The Privateer mine workings are situated in this wedge. The Bonanza rocks are chiefly dark, bedded tuffs, now altered to hornfels. Interbedded are thin, garnetized beds, which no doubt were originally calcareous. These beds strike north 40 degrees west and dip 79 degrees southwest. The Privateer vein cuts vertically across the structure and encounters varying widths of tongues, fingers, or irregular dykes of quartz diorite, which may have had some influence in restricting the circulation of mineral solutions, directing or confining them to the line of the fissure.

The vein strikes east and to the east terminates at what appears to be a pre-mineral fault, which dips to the west. In Spud Creek a north-westerly striking fault offsets a thin mineral vein, the east or batholith side of the fault having moved a few feet northwest. The fissure followed by the main vein displays some sheeted structure.

The Privateer vein dips steeply to the north, strikes north 57 degrees east in its western part, and farther east assumes an easterly strike and steepens to vertical. The lengths of ore and average widths given for the different levels are an index of the consistent character of the vein. At the surface the vein shows well-defined walls, but has no topographic expression.

The Privateer ore is fairly typical of the ores found in other quartz veins on Spud Creek or Goldvalley Creek. Report No. 746, 1938, of the Ore Dressing and Metallurgical Laboratories of the Department of Mines and Resources, Ottawa, contains results of investigations carried out on 1,560 pounds of ore from the Privateer mine. Sampled, this ore gave: gold, 4.70 ounces; silver, 2.33 ounces; copper, 0.11 per cent; lead, 0.86 per cent; zinc, 1.96 per cent; iron, 8.41 per cent; arsenic, 1.09 per cent; and sulphur 7.50 per cent a ton.

The gangue consists largely of white, translucent vein quartz, locally mottled light grey by impurities. Some hand specimens contain considerable calcite. The white quartz, the mottled grey quartz, the calcite, and the associated sulphide minerals tend to occur along parallel zones, thus imparting to the ore a coarsely banded appearance. Locally, coarsely crystalline quartz surrounds open cavities, and these drusy surfaces may also show certain sulphides.

The metallic minerals present in the ore are, in their order of abundance, pyrite, arsenopyrite, sphalerite, galena, chalcopyrite, pyrrhotite, marcasite, and native gold.

Pyrite is moderately abundant as coarse grains and masses. It is considerably fractured and is veined by sphalerite, galena, chalcopyrite, and native gold. Arsenopyrite occurs as disseminated crystals, often associated with pyrite. The relationships between the pyrite and the arsenopyrite are usually those of contemporaneous deposition, but in rare instances veinlets in pyrite are seen to carry arsenopyrite. Galena and sphalerite also vein arsenopyrite.

Sphalerite and galena are common, occurring as coarse grains in small masses. They are seen together in many places, where their relationships suggest their deposition at the same time, although in places the galena appears to have attacked and enclosed remnants of sphalerite. The latter contains tiny dots and rods of chalcopyrite parallel to its crystallographic directions. Chalcopyrite, in relatively small quantity, occurs, as noted, in sphalerite and as small masses and grains associated with the other sulphides. A little pyrrhotite is present as small masses and grains, usually rimmed by a thin layer of well-crystallized pyrite, a structure suggesting that the pyrrhotite had filled a cavity that previously had been lined with pyrite. There is a slight alteration of the pyrrhotite, usually along cleavage fractures, to marcasite.

Native gold appears to be consistently associated with the sulphides, although much of it occurs in the gangue close to these rather than in the sulphide minerals.

Considerable information regarding the order of deposition of the metallic minerals is furnished by microscopic examination and by the occurrence of certain sulphides among the quartz crystals that line cavities in the massive quartz of the Privateer ore. Pyrite and arsenopyrite appear to have been deposited at about the same time; sphalerite, galena, and chalcopyrite are definitely later, and are also later than the last quartz crystals, which line the cavities, for they occur among them. Much of the native gold was probably deposited rather late in the period of mineralization. It is largely moderately coarse. There is, however, a portion, probably about 1 to 2 per cent, which may prove refractory, and some of this is in dense pyrite and arsenopyrite. As the gold is closely associated with the sulphides, the latter should be a good indicator of values.

### White Star Group

*References:* Ann. Rept., Minister of Mines, B.C., 1935, pp. F 38, 39. Bancroft, M. F.: Geol. Surv., Canada, Mem. 204, pp. 14-15 (1937). Stevenson, J. S.: B.C. Dept. of Mines, 1938; Lode Gold Deposits of Zeballos Area, pp. 13-15.

The White Star group consists of the White Star claim and the Don and Star fractions, all staked by the present owners,<sup>1</sup> John and Andrew Donaldson, of Zeballos. This property was examined for the Geological Survey in 1935 and was then part of the Gold Peak group, situated east and southeast of the Privateer group.

The finding by Alfred Bird in Spud Creek of rich gold quartz float with granitic rock attached led to the staking of claims beyond the

<sup>1</sup> In 1939 the mine was operated by the White Star Mining Company.

Privateer group in October 1933, and the White Star claim was among these. Half a dozen prospectors searched the slopes for 4 months before finding the quartz in place, and when the discovery was made it was on a 35-degree slope at an elevation of 500 or 600 feet above the bed of the creek. The time that was required to make this discovery is in some measure an index of the type of prospecting that is necessary on the mountain slopes of Zeballos district before it is possible to determine that mineral veins are present within even a limited radius.

A record of White Star ore shipments from September 1934 to September 1937 shows 46.3 tons, with smelter returns averaging \$516.38 a ton. The property has produced in 4 years approximately 60 tons<sup>1</sup> from an open-cut and short adit on the Donaldson vein. The ratio of gold to silver in the ore may be judged from a yield of 719.128 ounces gold to 196.26 ounces silver.

Four northeasterly striking veins are exposed on the property. The Donaldson or No. 1 vein has been traced by open-cuts and strippings for about 200 feet. No. 2 vein is 110 feet west of No. 1 and has been traced for 280 feet. No. 3 is 100 feet west of No. 2 and has been traced for 100 feet. The south end of No. 4 vein is 20 feet west of the north end of No. 3 and the vein has been traced for 100 feet. The Donaldson vein has been developed by an adit and the No. 2 vein has been penetrated by a crosscut from the adit.

The veins are in the Zeballos batholith about 1,000 feet from its southwest contact.

Fine-grained feldspar porphyry dykes with the appearance of aplite on the weathered surface occur on the White Star, and one such dyke 6 to 7 feet wide is the foot-wall to the Donaldson vein for 70 feet or more at the surface. The dykes are clearly older than the jointing of the quartz diorite, as a closely spaced joint pattern was imposed on them at the time the blocky jointing took place in the host rock. The pronounced jointing is north 65 degrees east and dips 85 degrees north to vertical; there is also jointing north 15 degrees west and dipping 80 degrees northeast, and also along planes approaching the horizontal.

The veins appear to consist of long, thin, and perhaps discontinuous quartz lenses in narrow shear zones.

Open fissure filling by quartz, pyrite, galena, sphalerite, arsenopyrite, and native gold has occurred along the shear zones; frequently crystalline gold appears in vugs in the veins on this property.

The Donaldson vein, from which most of the shipping ore has been produced, follows the east side of a 6-foot dyke of dioritic feldspar porphyry for some distance, but diverges from it 70 feet from the upper end of the open-cut and continues down the slope in sheared, rusty grey, quartz diorite to a point below the dump where it splits into narrow quartz stringers; its continuity is proved for 250 feet horizontally and for more than 175 feet in depth. The Donaldson vein ranges in thickness from 3 to more than 6 inches, strikes north 30 degrees east, and is for the most part vertical, with dips not less than 80 degrees southeast.

Vein No. 2 is described by J. S. Stevenson of the Department of Mines, Victoria, B.C., as being "a quartz vein along which the quartz occurs as

<sup>1</sup> By the end of 1939, 360 tons had been shipped.

disconnected lenses in sheared granodiorite. The shear averages 6 inches in width, in which, although in one place the quartz-lens is 6 inches wide, the average width is 1 inch. Pyrite and arsenopyrite accompany the quartz. Near the top of the (119-foot) stripping the vein branches into two stringers, from the northerly strand of which  $2\frac{1}{2}$  tons of ore is reported to have been shipped in 1935."

This same vein intercepted 110 feet from the surface in a crosscut from the Donaldson adit at altitude 1,088 feet is showing up excellent heavy sulphides 6 to 8 inches in width with assays up to 10.15 ounces gold a ton. Such possibilities were suggested in the manner in which the Donaldson vein opened up, showing pay-streaks of soft sulphides in the open-cut of 1935.

### Golden Peak No. 4 Claim

Golden Peak No. 4 claim was staked by Joe Doyle in 1934. It is situated toward the top of the Spud Valley Ridge above the White Star group and is reached by trail from the Spud Valley bridge. The claim adjoins Privateer No. 7 claim and lies between altitudes 1,500 and 2,100 feet above sea-level on the northwest facing slope of Spud Valley.

The deposits on the property are gold-quartz-sulphide veins. Late in 1937 the property was under exploration by Western Holdings Company of Vancouver. In July 1938 Dentonia Gold Mines, Limited, took over development of the property, and early in 1939 the management and development of Golden Peak No. 4 claim was placed with Privateer Mine, Limited. The Western Holding Company had driven an adit 140 feet northeastward from near the southwest boundary, and in addition did some open-cutting and surface stripping that had proved continuity of one vein-shear for 300 feet. Dentonia Gold Mines, Limited, commenced work on an east-west vein on the Goldvalley slope, putting in two or more open-cuts. By the middle of January 1939 it was reported that underground development was in progress on the two veins mentioned above, with 91 feet of drifting having been done on the east-west vein and 46 feet of drifting at a new level on the northeast vein.

The Golden Peak No. 4 claim is underlain by quartz diorite of the Zeballos batholith. It covers the high part of a spur leading off from the main ridge toward the Privateer mine. The presence of volcanic remnants of the Bonanza group of rocks on the Blackbird claim, which lies directly northeast of Golden Peak No. 4, suggests that the quartz diorite of the Golden Peak No. 4 claim is well up toward the original top of the batholith. The quartz diorite is abundantly jointed and fissured. Both veins on which work had been done up to September 1938 gave promise of yielding ore in quartz and sulphide bands over narrow widths. The minerals seen in the ore include pyrite, arsenopyrite, zinc blende, galena, and visible gold.

The lower adit on Golden Peak No. 4 is 355 feet northeasterly from the White Star cabin, and is a drift following a mineralized shear for 140 feet. The strike of the shear is north 40 degrees east and the dip 77 degrees southeast. At the portal there are well-defined walls  $4\frac{1}{2}$  feet apart, showing crushed rock, and quartz in widths from 2 to 4 inches. The quartz contains sulphides, which give it a banded appearance. Pyrite, arsenopyrite, galena, and visible gold were noted. At 50 feet in from the portal the foot-wall

shows pronounced jointing, which strikes north 80 degrees east and dips north 74 degrees. At the face of the adit joints strike east, dip north 67 degrees, and have well-defined walls, lined with gouge. In places quartz stringers carrying much pyrite occur on both walls. The adit level is at altitude 1,490 feet. Surface stripping on the vein starts at altitude 1,600 feet and 105 feet from the portal of the tunnel. This first trench is 30 feet on the shear, showing little but rusty, crushed rock. A second trench, at altitude 1,700 feet and 80 feet horizontally from the first cut, shows a 2-inch stringer of quartz carrying pyrite in rusty, crushed rock. A third trench shows similar material and a 5-inch stringer of quartz and pyrite. It is reported that surface assays along this shear averaged \$10 in gold a ton across widths of 5 to 6 inches.

The Northern Miner of January 26, 1939, contains a statement in regard to drifting on a northeast vein from adit No. 4 (a new adit), 1,800 feet from the Spud Valley road. At 46 feet from the portal, the vein carried 7.2 ounces gold a ton across a width of 5 inches. At 19 feet from the portal a sample across 3 inches returned 19.9 ounces and 5 feet beyond that point a sample across 9 inches returned 5.4 ounces gold a ton.

The east-west vein previously referred to had been traced by two open-cuts from the Blackbird claim boundary back for 40 feet at the time the writer was on the property. It showed much gouge and crushed rock in widths of 7 inches to 4 feet, but gold assays were low. Evidently a drift was started later from one of these open-cuts and then it was decided to come at the vein by a 60-foot crosscut from the Spud Valley side of the claim. A 60-foot adit crosscut was driven at a point 500 feet west of the first open-cut, giving backs of 175 to 200 feet on this east-west vein. The east-west vein by the middle of January 1939 had been drifted on both ways from the crosscut. In all, a length of 91 feet had been opened up, averaging 1.5 to 2 ounces gold a ton across an average width of 10 to 12 inches.

The east-west vein is now regarded as the chief vein of the property and a new adit is planned to cut it 200 feet below the 60-foot adit level.

### Golden Peak Group

*Reference:* Stevenson, J. S.: B.C. Dept. of Mines, 1938; Lode Gold Deposits of Zeballos Area, pp. 15-16.

The Golden Peak group, consisting of six claims and a fraction, staked by Alfred Bird and the late Albert Bloom in 1933, is bonded to Zeballos Gold Peak Mines, Limited (N.P.L.), of New Westminster, with Thomas Carr in charge of the property. The mineral claims include the Red Star, Green Star, Blue Star, Golden Peak, Bloom Fraction, Golden Peak No. 2, and Golden Peak No. 3. These claims extend across country from the northeast facing slope of Spud Creek over the ridge to Goldvalley Creek, and lie between the White Star group on the north and the Goldfields group on the south.

The camp is at about altitude 1,200 feet on the southwest facing slope of Spud Creek and is reached by one-half mile of trail from the Spud Creek bridge at altitude 710 feet or by a second trail out to the road at the upper part of the property.

The deposits on the property are gold-quartz-sulphide veins. One adit 531 feet in length and two short adits, along with open-cuts and stripping, constitute the development work to date. In all, 735 feet of adit has been driven and over 400 tons of ore produced.

The southwest contact of the Zeballos batholith crosses these claims, and most of the ground lies within the area of granitic rocks. Volcanic rocks and sediments of the Bonanza group cut by dykes from the batholith underlie the Green Star and Red Star claims, which are on the southwest side of Spud Valley and as yet have been little prospected.

The gold-quartz-sulphide veins thus far found on the property occur in quartz diorite of the Zeballos batholith, following fissures and shear zones some of which have been traced across the crest of the ridge lying between Spud and Goldvalley Creeks. In all, six different leads have been discovered, showing more or less crushed country rock and bands of mineralized quartz, carrying pyrite, arsenopyrite, galena, and zinc blende. The ore occurs in shoots, one of which was 70 feet long and averaged \$32 to the ton across narrow widths.

On Golden Peak No. 3 claim a vein called the Brown Bomber was recently discovered near the southeast boundary of the claim at altitude 1,625 feet and five open-cuts made on it in tracing it up the slope for 100 feet. The vein strikes north 57 degrees east and dips 80 degrees north. It shows rusty vein material, gouge, and a 2-inch quartz stringer carrying finely divided pyrite and zinc blende. Three other veins occur on this claim 400 feet northward from the camp (altitude 1,200 feet), on a trail leading to the upper workings and the Bloom fraction.

The first vein on the trail is at altitude 1,425 feet and is named No. 1 vein. It strikes north 32 degrees east and dips steeply southeast. This vein shear is 2 inches wide, filled with gouge, lenticular quartz, and heavy sulphides ranging from 1 to 2 inches in width. An adit has been driven on the vein for 127 feet. Above this tunnel, 25 feet higher on No. 1 vein, is an open-cut 37 feet long, 25 feet high, and 7 feet wide at the base and 10 feet wide at the top. An assay from a foot length of vein in this cut returned: gold, 14.4 ounces; silver, 5 ounces a ton. A 6-inch aplite dyke strikes with the break, but dips 70 degrees northwest. A 2- to 10-inch crush zone occurs on the northwest side of the open-cut, filled with gouge and leached granodiorite and narrow bands of quartz.

No. 2 vein is 180 feet farther along the trail from No. 1 vein. At No. 2 there is a small open-cut and stripping. It is a narrow, sheeted zone striking north 32 degrees east with dip of 85 degrees southeast. It consists of three quartz stringers  $\frac{1}{4}$  inch to  $8\frac{1}{2}$  inches thick, in pyritized granodiorite. An assay across a 10-inch width gave: gold, 0.8 ounce; silver, 0.6 ounce a ton. At 50 feet farther along the trail is a similar cut and stripping 43 inches wide; strike north 35 degrees east and dip 82 degrees south. A small inclusion of volcanic rocks appears in the granodiorite of this sheeted zone at the open-cut. The sheeted zone has been followed for 150 feet on the surface.

No. 3 vein lies 190 feet along the trail from No. 2 vein, and its adit portal is at altitude 1,531 feet. No. 3 vein has been opened up by a drift adit 531 feet in length and the vein shear ranges in width from 6 to 26 inches, mineralized with pyrite and arsenopyrite associated with quartz,



crushed rock, and gouge. The ore shoots are from 2 to 70 feet long and from 1 to 3 inches wide. A high-grade, vertical vein consisting of 1 to 2 inches of heavy pyrite and quartz and striking north 10 degrees east was encountered 120 feet from the portal. An assay from this vein gave: gold, 5.9 ounces; silver, 2.5 ounces a ton. At 180 feet from the portal of the adit grooves in the hanging-wall suggest that the northwest side of the fissure had moved to the northeast. At the face of the adit is a sheeted zone with jointing in vertical bands 6 to 12 inches wide and gouge in the fractures.

Vein No. 4 is on the Blue Star claim and lies 400 feet northwest of No. 3 vein. It is a strong shear that has been traced by open-cut and natural outcrop for 1,400 feet, and as exposed at the surface shows considerable gouge and crushed, rusty rock impregnated with pyrite. The first working on this vein is at altitude 1,025 feet and just 500 feet from the Spud Valley motor road. There an adit 77 feet in length has been driven bordering a crush zone 6 to 18 inches in width. Stripping and open-cut on No. 4 shear at altitude 1,325 feet show a thin, flat, quartz vein coming in on the south side of the shear. The shear has been traced in natural outcrop north 23 degrees east across the crest of Spud Valley Ridge on the Golden Peak claim; the ridge rises above altitude 2,200 feet.

On this property there is good evidence of deep fracturing over a belt 900 feet wide in the granodiorite, and the chances appear favourable that some worth-while ore shoots will be found.

There is considerable ground on the Gold Peak group yet to be prospected. The Green Star and Red Star claims on the southwest side of Spud Creek are in the volcanic rocks. On the Green Star 300 feet from the southwest boundary line and at altitude 1,040 feet, there is a small outcrop, where calcareous, greenish tuff is replaced by brown garnet, chalcopyrite, and pyrrhotite. The strike of the formation is north 25 degrees west and the dip 60 degrees southwest. The mineralization is exposed in natural outcrop over a width of 5 to 10 feet.

### **Farris Group (Mount Zeballos)**

The Farris group consists of six claims owned by Zeballos Mount Mines, Limited. It is located on the southwest side of Spud Valley 5½ miles from Zeballos, and is reached by motor road.

The claims extend from the bottom of Spud Valley up the steep, north-east facing slope from altitude 900 feet and over the top of the ridge at altitude 3,100 feet.

The deposit on the Farris group is a high-grade gold-quartz-sulphide vein, which was found in 1937 in excavating a rock slide just inside the boundary of the Spud Valley property. The quartz vein shear has been traced on the property for a distance of about 1,000 feet by a few trenches made along the strike up the heavily timbered slope. Adit drifts had been made on two levels, totalling 590 feet of underground work, by the middle of September 1938. The claims are underlain by sediments, and brittle tuffs of the Bonanza group, altered and shattered by the Zeballos batholith, the southwestern contact of which follows close to Spud Creek. Grey to green feldspar porphyry dykes cut the bedded volcanic rocks on the prop-

erty at altitude 2,830 feet. The dykes strike northeast and the bedded formation strikes north 40 degrees west and dips 50 degrees southwest.

The altered, brittle tuffs of the Bonanza group vary in colour from mottled green to white or to greyish brown. With the exception of the whitest phase, they are all porphyritic in hand specimen, the feldspar being quite conspicuous. Under the microscope rocks from the upper adit consist of albite phenocrysts set in a fine-grained groundmass of albite and quartz. The indefinitely banded, white, quartzitic-looking rock of the upper adit consists chiefly of a mosaic of fine-grained albite with a little quartz. The rock is apparently a tuff interbedded with porphyritic rocks.

The vein cutting through these rocks strikes north 50 degrees east and is vertical or dips steeply to the north. Underground, the vein maintains a width of 5 to 7 inches and has free walls.

The ore seen underground consists chiefly of masses of pyrite and a little quartz. In places the vein filling consists of grey quartz with finely divided arsenopyrite and some calcite. Some masses of sulphide in the vein varied in width up to 20 inches.

At the time the property was visited in August 1938, the lower adit at altitude 1,600 feet had been advanced 310 feet from the portal. The portal of the upper adit is 346 feet horizontally beyond, and 225 feet higher than, the portal to the lower adit. Assays from the vein in the lower adit indicated some very high-grade ore, and the adit had not yet come under the rich ore shoot that extended along the upper adit for 130 feet from the portal. The upper adit on August 31, 1938, had a length of 280 feet, and at the face the vein was 6 inches wide and assayed across this width \$16.10 a ton.

In 1938 this vein was outstanding among those in the volcanic rocks west of Spud Creek.<sup>1</sup>

### Goldfield Group

*References:* Stevenson, J. S.: B.C. Dept. of Mines, Ann. Rept. 1935, pp. 39, 40; also Lode Gold Deposits of Zeballos Area 1938. Bancroft, M. F.: Geol. Surv., Canada, Mem. 204, 1937, p. 16.

The Goldfield group consists of ten Crown-granted mineral claims and fractions containing 284 acres, with one small fraction held by location. The Goldfield claim was staked by Sam Knutsen in June 1935 and the other claims at later dates. The property is owned by Spud Valley Gold Mines. This group of claims extends northeastward from the valley of Spud Creek across the ridge and into Goldvalley Creek. The main camp and mill are 6½ miles by motor road from Zeballos. The bottom of Spud Valley, at the camp, is above altitude 1,000 feet. The valley slopes are steep and timbered.

The deposits consist of gold-quartz-sulphide veins in granodiorite. The property has undergone rapid development. It was the first property in Zeballos district to be well financed and prospected in a business-like way, Mr. Trites securing control of it in July 1936. Commodious camps, to accommodate sixty men, have been constructed, in addition to the 50-ton amalgamation-flotation mill; the latter was completed in 1938.<sup>2</sup> Up to January 1, 1939, about 3,450 feet of drifting, crosscutting, and raising had

<sup>1</sup> A 35- to 50-ton mill was built in 1939.

<sup>2</sup> In 1939, 20,950 tons of ore was mined.

been done. The company's estimate of ore blocked out by February 1, was given as 44,882 tons, worth just under \$1,250,000. This figure only included ore to a point 100 feet below the No. 4 level on the original Goldfield vein.

The claims take in a section across the southwest contact of the Zeballos batholith and extend southeastward into the granodiorite area. Feldspar porphyry dykes and dark andesite dykes cut the granodiorite. The granodiorite is strongly jointed and fissured. The most conspicuous joints in the granodiorite trend north 78 east and dip 80 degrees north. The joint planes in many places show a veneer of pyrite crystals, where the rock is freshly quarried. Cherty, mottled green to grey tuffs of the Bonanza group occur on the claims, which reach southwest across Spud Creek. These rocks strike northwest and dip 50 degrees southwest.

The Goldfield vein and two or more parallel veins are fault fissure fillings, showing up on the crest of the Spud and Goldvalley divide as gullied out shear zones 2 to 3 feet wide between well-defined granodiorite walls. The fissure filling consists of quartz lenses, gouge, bands of sulphide, cross over stringers, branch veins, and granulated granodiorite with sulphides. The quartz gangue is vuggy. The minerals consist of pyrite, a little sphalerite, and free gold. The tenor of the ore is exceptionally high across narrow widths, and there are sheeted zones where gold values are disseminated and ore widths can only be determined by assay. The grade of ore is reported to average about \$30 a ton across a mining width of 3 feet.

By September 1938, three adits had been driven on the Goldfield vein. The upper adit or No. 1 has a length of 365 feet, 300 feet of which is on the vein. This adit runs through to the Goldvalley slope 120 feet below the surface outcrop of the vein at the crest of the ridge. Adit No. 2 is driven from the Goldvalley slope 120 feet below the level of No. 1. No. 2 adit is a drift 405 feet long. No. 4 adit is 300 feet below the level of No. 2, is 1,121 feet long, and follows the vein for 798 feet. Adit No. 8, 560 feet below No. 4, has been driven 577 feet, but has not yet reached the vein. The total vertical range from the surface to the No. 8 level is 1,100 feet.

The assays on No. 4 level would average somewhat lower in gold content than what was obtained in the No. 1 and No. 2 adits, yet the vein maintains its width and is structurally similar on all three levels, holding a course of north 55 degrees east and dip 85 degrees northwest throughout. The jointing and fracturing of the granodiorite is quite as pronounced in tunnel 8 as at the higher levels of the mine.

The main quartz seam of the Goldfield vein in many places shows widths of 6 inches to 1 foot and over. Important widths of ore are provided in numerous branch fissures and sheeted fractures. Sheeting is particularly well developed in No. 2 adit between points 60 and 120 feet in from the portal, where it occurs across the full width of the back as joints spaced 2 and 6 inches apart, some with a thin film of gouge and some with  $\frac{1}{8}$  to  $\frac{1}{2}$  inch filling of quartz. A four and one-half foot channel across this sheeted zone assayed: gold, 8.30 ounces; silver, 2.5 ounces a ton.

A start is being made to open up a second vein lying south 23 degrees west and 150 feet from the portal of No. 2 adit on the Goldvalley slope. This

vein strikes north 75 degrees east and dips 88 degrees south. It shows thin lenses of mineralized quartz and shattered granodiorite over a width of 12 inches. Northeasterly striking shears to the north and to the south of the Goldfield vein occur, but the main effort has been confined to the Goldfield vein.

### "M" Group

The M group consists of M-1 to M-6, staked by Britannia Mining and Smelting Company, Limited, in 1936. It lies to the south of the Goldfield group on Spud Creek and is reached by a short trail off the end of the Spud Valley road. The camp is at altitude 1,300 feet.

The deposits on the property are gold-quartz-sulphide veins. Open-cutting and surface stripping were in progress along veins between altitude 1,500 and 2,500 feet, up the east side of Spud Valley, in 1938. The crest of Spud Valley Ridge rises to 2,900 feet on the southeastern part of the property.

The property is crossed by the southwest contact of the Zeballos batholith. The batholith is intrusive into green volcanics of the Bonanza group. The contact strikes north 70 degrees west and dips 65 degrees southwest. The invaded rocks strike northwest and dip southwest from the contact.

The gold-quartz-sulphide veins on the property cut grey quartz diorite of the Zeballos batholith. Six, narrow, rudely parallel veins and mineralized shears have been found in a belt 1,000 feet wide. The narrow veins are not conspicuous; they consist of white, vuggy quartz carrying pyrite, arsenopyrite, and some visible gold. In general they strike northeasterly and dip steeply to the north. The veins are persistent and contain 2 inches of quartz to 18 inches of mineralized material, gouge, and crushed granodiorite.

The veins on the property, named in order from north to south, are: Wall vein, Cliff vein, Long vein (750 feet in length), Lattice vein, Free Gold vein, and Goot vein.

The Goot vein has a remnant of volcanics on the foot-wall. It strikes north 62 degrees east and dips 77 degrees north. The hanging-wall is granodiorite. The vein contains breccia fragments rimmed by quartz and pyrite; it is distinctly too fragile material to have remained intact if there had been movement along the vein after deposition of the quartz and sulphides. In one place it shows 7 inches of mineralized material. At altitude 1,800 feet an adit site has been faced up, preparatory to drifting on this vein.

### Scorpio Group

The Scorpio group consists of six fractional claims located along the Zeballos River channel northeast of the Macquinna group and owned by John Roy Ildstad, Thomas William Ildstad, *et al.* The property is reached from the Zeballos motor road and is 4 miles from Zeballos.

The deposits on the property consist of sulphide replacements in tuffs of the Bonanza group, and have been prospected by open-cuts and surface strippings.

The claims are underlain by the Zeballos granodiorite and roof remnants of the Bonanza formation that outcrop in bluffs south of the river. On the north side of the river recent alluvial and glacial deposits cover much of the bedrock.

The deposits are in bedded, calcareous tuffs, which strike east and stand vertical. They consist of masses of pyrrhotite carrying a little chalcopyrite and a little molybdenite. Both acidic and basic dykes occur in the vicinity and the ore is associated with them in several scattered showings. The largest deposit is exposed in a rock cut near the river trail on the Scorpio claim and is 20 feet long and 4 feet wide.

### **B. and Wet Fraction Groups**

The B. and Wet Fraction groups staked in 1936 are owned by Britannia Mining and Smelting Company, Limited. They consist of B-1, B-3, B-4, B-5, B-6, and B-2 fraction and "W" fraction on Goldvalley Creek, B-7, "T", and Wet Fraction in Zeballos Valley, the Wet Fraction being held under option.

The claims extend up the valley of Goldvalley Creek, a distance of  $1\frac{1}{2}$  miles, and in Zeballos Valley the group has a width of 4,875 feet.

The deposits on the property consist of a group of parallel, mineralized, quartz veins belonging to the productive gold-bearing vein system of the area. The development work on these veins includes combined open-cutting and surface stripping. It represents the most thorough attempt yet made in surface exploration within the district to uncover and trace a group of veins over a rugged surface.

The B. and Wet Fraction groups have an interesting geological position in relation to the Zeballos batholith for the topography closely conforms to the upper surface of the batholith. Glaciation has exposed a major trough trending northeast across the main body of the batholith in Zeballos Valley. Roof remnants of the Bonanza group outcrop across the granodiorite area in Zeballos Valley for some distance and up the sides of the trough of Goldvalley Creek, which also marks an original furrow along the contact extending south and southeast. The valley and bounding ridges rise toward the high points on the batholithic roof.

Jointing and fracturing are prominent in both the intrusive granodiorite and intruded volcanics on the B. group of claims. Along the rocky channel of Goldvalley Creek, on the west side of the creek, one shear striking north 60 degrees west was observed where a bed of cherty tuff was displaced vertically 30 feet; the south block of the fault had moved up in relation to the north side. The shear zone was 3 feet wide with a dip of 60 degrees to the southwest. This was the only reverse fault seen in the field that afforded a definite check on the amount of vertical movement.

On the west side of the property a very pronounced shear zone occurs in the granodiorite on Monckton Creek at a point below the foot-log crossing of the Central Zeballos trail to their upper camp. This shear zone is 30 feet wide, strikes north 7 degrees west, and dips 85 degrees east. This northerly striking shear crosses Monckton Creek at altitude 1,050 feet. The crushed granodiorite in this zone is rusty and impregnated with pyrite.

A light grey feldspar porphyry dyke 15 feet wide, which strikes north 45 degrees east, cuts the darker granodiorite in the channel of Goldvalley Creek below altitude 570 feet. The surface of the granodiorite is seamed with dykelets, up to 2 inches in width, of acidic material. These dykelets are faulted and presumably were intruded at an early stage in the cooling of the batholithic body. A flinty, rhyolite dyke 4 feet wide cuts through the granodiorite and can be seen on both sides of the creek.

The mineralized veins on the property cut through all the bedrock formations. Thirteen veins in all had been uncovered by August 1938, some widely scattered and others grouped fairly close together. They show varying widths of quartz, mineralized country rock, gouge, and sulphides. The prevailing strike of these veins is northeast and their dip to the southeast.

Surface work has been done on the following veins, named in the order in which they occur on the property from north to south.

1. River vein, strike north 45 degrees east, dip 60 degrees southeast; width 5 inches; quartz, calcite and sulphides, pyrite.
2. Garbo Trail vein, strike north 73 degrees east, dip 80 degrees southeast.
3. East to west vein.
4. Contact vein, strike north 55 degrees east, dip 75 degrees southeast; width 4 inches; pyrite, chalcopryrite, and oxidized quartz.
5. Wet Fraction vein, strike north 43 degrees east, dip 65 degrees southeast.
6. End vein, strike north 45 degrees east, dip 68 degrees southeast.
7. Easter vein, strike north 45 degrees east, dip 70 degrees southeast; mineralized, vuggy quartz.
8. Wet Gulch vein, strike north 54 degrees east, dip 62 degrees southeast; pyrite and chalcopryrite.
9. Footwall vein, strike north 60 degrees east, dip 70 degrees southeast; width 3 inches.
10. Gouge vein, strike north 60 degrees east, dip 70 degrees southeast.
11. Draw vein, strike north 45 degrees east, dip 56 degrees southeast; width 5 to 8 inches; pyrite, arsenopyrite, galena, zinc blende.
12. Straight vein, strike north 55 degrees east, dip 66 degrees southeast.
13. Camp vein, strike east, dip 60 degrees south; width 2 inches; gouge.

The End vein has been traced on the surface for 1,200 feet and the other veins for shorter distances. It is about 1,800 feet from the Contact vein to the Straight vein as they are exposed at the surface, that is, nine veins occur in a belt of that width. However, in the first 750 feet southeast from the Contact vein no less than seven of the northeast veins are included. The surface showings along these veins are typical of the gold sulphide veins of the district, and it is probable that some of them will prove of economic importance once they are opened up underground. Most of these veins are in the granodiorite, or if not will reach it at shallow depth.

### Lone Star Group

*Reference:* Stevenson, J. S.: B.C. Dept. of Mines, 1938; Lode Gold Deposits of Zeballos Area, pp. 20, 21.

The Lone Star claim, staked by Alex. MacDonald in 1934, and the adjoining J and E, K, and Axe fractions, all in Goldvalley Creek, make up the Lone Star group. The property has been brought into production and encouraging results obtained on it by Rey Oro Mines, Limited, under the management of Edward G. Brown. The camp and mill are on Goldvalley Creek above altitude 1,300 feet and less than a mile from the confluence

of the creek and Zeballos River. A good trail for pack-horses connects the property with the Spud Valley motor road.

The deposits on the property consist of gold-quartz-sulphide veins. The property is in the initial stages of being prospected, yet it has the distinction of having put up a 15-ton mill, which in August 1938 turned out the first gold brick in Zeballos district. The chief development has been in connection with a vein known as No. 4, which proved up some very high-grade ore. The adit on No. 4 vein in July 1938 had been advanced 325 feet, and in this distance the fault fissure held its course so that it was possible to stand at the face and look out to daylight at the portal. Work on a raise toward the surface was in progress from this tunnel and had been carried 50 feet upward. A crosscut had been started also toward the east to connect up with other veins, exposed on the surface. In all 490 feet of underground exploration had been done and the work was continuing. Over 100 tons of ore had been sacked ahead of milling operations.

The mill heads on the first 14 tons of ore treated ran between 7.51 and 7.81 ounces gold a ton.

The Lone Star group is underlain by rocks of the Zeballos batholith that have been cut by feldspar porphyry, aplite, and dark andesite dykes. The topography coincides closely with the original upper part of the batholith, Goldvalley being a minor trough whose bottom plunges to the northwest. This places the Lone Star ground well up in the mineralized zone of the batholith where the massif is strongly jointed and deeply fissured.

The gold-quartz-sulphide veins occur in grey quartz diorite of the Zeballos batholith and also cut the dykes intruded into it. A dozen veins or mineralized shears have been discovered on the property. These veins are inconspicuous, and on the timbered slopes call for intensive prospecting or else they would be overlooked. In general the veins contain massive to vuggy, banded quartz associated with heavy pyrite, galena, arsenopyrite, and some visible gold. Some of the sulphide bands have been crushed to grey streaks 2 to 3 inches in width, and from such ore assays as high as 80 ounces in gold to the ton have been obtained although the material shows no visible gold. The granodiorite adjacent to all the mineralized veins is altered for half an inch or more.

On the west side of the property a newly discovered vein-shear on the J and E fraction was receiving attention when the writer was on the property in August 1938. This new vein was found 100 feet below the boundary between the J and E fraction and Golden Peak claim adjoining on the west. Two open-cuts had been made on it at altitudes 1,600 and 1,650 feet. These open-cuts showed a mineralized shear  $2\frac{1}{2}$  to 5 feet wide, striking north 60 degrees east and dipping 85 degrees north. It contained gouge, crushed material, quartz stringers, and a little pyrite and galena. There was a width of 13 inches of rusty sheared material in the upper cut with 3 inches on the foot-wall of quartz and heavy sulphides. This vein on the J and E fraction is situated on the west-facing slope to Goldvalley Creek.

No. 1 showing is an oxidized shear at altitude 1,315 feet, 60 feet south-east of the foot-log across the creek. It has been stripped for 10 feet along the junction of two joints, one of which strikes north 45 degrees east and dips 80 degrees southeast, the other north 33 degrees east and nearly vertical, in the granodiorite; where they join the rock is fractured for a width of one

foot and the shear strikes north 57 degrees east and dips 84 degrees south-east. A half inch band of sulphides occurs near the edge of this open-cut on the east side of Goldvalley Creek. A dark, fine-grained, vertical andesite dyke 2 inches wide and striking north 45 degrees east cuts the foot-wall side of the shear.

No. 2 is a shear 20 feet southeasterly from No. 1. A stripping exposes several quartz stringers cutting across a 3-foot, northeasterly striking, dark andesite dyke. The stringers are less than half an inch in width and carry pyrite, arsenopyrite, and galena. No. 2 strikes north 82 degrees east and dips 70 degrees north.

No. 3, at altitude 1,325 feet, is 210 feet in a direction south 28 degrees east from No. 1 and on the northeast side of Goldvalley Creek. It is a vertical, sheeted zone, striking north 50 degrees east. The zone is 18 inches wide and carries a little arsenopyrite. At altitude 1,355 feet an adit 46 feet long on this sheeted zone shows 6 inches of mineralized gouge in a shear striking north 38 degrees east and dipping 70 degrees northwest.

No. 4, at altitude 1,335 feet and 30 feet in a direction south 65 degrees east from No. 3, is a fault fissure with high-grade vein filling. No. 4 strikes north 46 degrees east and dips 85 degrees southeast. The chief development work by Rey Oro Mines, Limited, has been in connection with No. 4 vein. An adit with portal on the northeast side of Goldvalley Creek, by August 1938 had been advanced 360 feet northeast on the vein. The company's assay plan for vein No. 4 shows an ore shoot 180 feet in length with average width of 7 inches of vein filling, having an average tenor of 4.247 ounces gold a ton or an average value of \$29.73 over a mining width of 30 inches. Along the 180-foot ore shoot, quartz banded with sulphides occupies the full 7-inch width in places, whereas solid sulphide bands of pyrite, galena, and zinc blende come in making up half the width for several feet in parts of the vein. Some of the sulphide bands show slickensiding, whereas other parts of the vein are free from any sign of movement. The quartz is vuggy to massive. A sample taken along 2 feet of a  $\frac{1}{2}$ -inch quartz sulphide veinlet 20 feet outside the portal assayed: gold, 14.40 ounces; silver, 5.6 ounces a ton.

At 280 feet in the adit the vein splits around a granodiorite horse. Recent progress reports indicate that commercial ore is being found beyond the horse. A winze was put down and a new level started 50 feet below the main level. The ore shoot continued and had been followed on the lower level for 160 feet, the grade of ore averaging \$150 a ton in gold across an average width of 5.3 inches.

At the time the property was examined a raise had been put up at 225 feet in from the portal to a height of 50 feet. An assay from the top of the stope across 14 inches returned gold 1.38 ounces a ton, and 5 feet up in the raise an assay across 18 inches gave gold 8.23 ounces a ton. It was estimated that there was a distance of about 50 feet more to go in the raise to reach the surface.

Production from the Rey Oro mill between July and the middle of October 1938 had amounted to \$30,000.

Vein No. 5 is 18 feet above No. 4 on Goldvalley Creek, yet in the crosscut off the main level the distance between the two veins is 50 feet.



It shows mineralized quartz stringers and crushed granodiorite, and is evidently a vein that curves, for on the creek it strikes parallel with No. 4.

No. 6 and No. 7 veins are at altitude 1,420 feet and 260 feet in a direction south 60 degrees east from No. 4. Open-cuts and an adit expose the two veins. No. 6 vein has been drifted on for 82 feet. It is a sheeted zone 2 feet wide cut by curving gouge slips, and so crushed that it is a mass of leached, disintegrated granodiorite associated with quartz lenses and stringers. No. 6 vein strikes north 70 degrees east and dips 60 degrees northwest, and can be traced for 235 feet out from the adit portal. Arsenopyrite and pyrite occur disseminated in small amounts in the walls of joints striking 5 degrees south of east.

No. 7 shear shows up best in a rock cut 18 feet up from the portal of the adit as a shear angling in toward No. 6 vein on its hanging-wall side. No. 7 contains 6 to 8 inches of oxidized quartz, crushed granodiorite, and gouge. The quartz is 2 to 3 inches wide and mineralized with pyrite, arsenopyrite, and visible gold. Assays across this vein gave 6 ounces gold a ton. The vein strikes 5 degrees south of east and dips 60 degrees north. Adjacent to it is a system of joints striking north 4 degrees east and dipping 83 degrees east.

There are other mineralized veins and shears out in front of the portal of the adit on No. 6 bordering a watercourse. One quartz stringer 4 inches wide strikes north 61 degrees east and dips 82 degrees north. A second mineralized fracture strikes north 80 degrees east and dips 81 degrees north. Both these show oxidized vein material, quartz, and pyrite. Off the trail going from the Rey Oro to the Rimy group, there are other mineral showings in a stream channel tributary to Goldvalley Creek. The first showing is at altitude 1,500 feet and 660 feet in a direction south 85 degrees east from the Rey Oro 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 and one-half inch stringers.

At altitude 1,600 feet and 220 feet in a direction north 80 degrees east from the last-mentioned showing is the McDonald cut and stripping along the bed of the same creek. This is a sloping outcrop of granodiorite with 12 to 18 inches of sheeted structure and blue quartz stringers, exposed for a length of 50 feet. The vein-shear strikes north 56 degrees east and dips 68 degrees north. 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, and 6 to 8 inches of quartz abundantly disseminated with pyrite. A sample taken across 12 inches of the mixed material assayed 0.01 ounce gold to the ton and a trace of silver.

The number of mineral fissures, the fine-textured andesite dykes, and the diversely oriented strong jointing on the Lone Star group, all point to the fact that the trough in the upper surface on the granodiorite was a place of pronounced fracturing. Erosion has touched lightly on the upper part of the batholith in Goldvalley Creek. The high-grade gold ores found there should have as good a chance of going to depth as those at any other points where veins occur on the upper surface of the batholith. This granodiorite trough was well up in the zone of fracture, asmiarolitic cavities occur in the granodiorite and the quartz in the veins is cavernous and banded.

### I.X.L. Group

The I.X.L. group consists of two small mineral claims, L.M. and P.M., and the I.X.L. fraction staked by P. M. Monckton in 1937. The property was optioned to Haida Gold Mines, Limited, and was under exploration early in 1938. It is situated northwest of the North Star group and south of the Rimy group, and is reached by trail, from the Rey Oro mine, in a distance of three-fifths of a mile along the southwest facing slope of Goldvalley Creek.

An adit has been driven on the I.X.L. property for over 200 feet, at altitude 1,840 feet. A crosscut adit was driven to get in under a creek channel nearby that plainly follows a fault fissure zone striking north 50 degrees east in the granodiorite. A foot of gouge shows in the face of the crosscut adit. The fault fissure is strong, cutting across joints that strike north 70 degrees east and also across a second set of joints striking north 30 degrees west. The north wall of the fault is smooth, the south wall more irregular. There is little sign of any mineralization in the fissure. When Haida Gold Mines, Limited, began work on these claims it was reported that the fissure on the property lined up with the Goldfield vein, one-half mile to the southwest. However, no fault fissures can be correlated across an unexplored area with certainty and single mineral veins rarely extend over 1,000 feet.

### North Star Group

*Reference:* Stevenson, J. S.: B.C. Dept. of Mines 1938; Lode Gold Deposits of Zeballos Area, West Coast of Vancouver Island, B.C., p. 19.

The North Star group consists of twelve claims and fractions, owned by A. B. Trites. The property is about 2½ miles up Goldvalley Creek from its junction with Zeballos River. A branch trail turns east from the Goldvalley trail at altitude 1,640 feet and leads to the North Star camp, at altitude 2,280 feet near a creek channel on the slope up to Grayback Peak.

The deposits on the property are gold-quartz-sulphide veins and zones of mineralized country rock. The North Star claim was staked by Sam Knutsen in July 1937 and other claims have been added since that time. The property has been developed by open-cuts and by an adit about 350 feet long.

The claims are underlain by quartz diorite of the Zeballos batholith, which is abundantly jointed, fissured, sheared, and cut across by a few dykes and many, narrow, mineralized veins. One dark andesite dyke 12 feet wide was noted on the North Star claim at altitude 2,800 feet, cutting through the granitic rocks.

The topography in the vicinity of the North Star group affords significant structural evidence in regard to the configuration of the upper surface of the batholith. Mount Lukwa (altitude 3,749 feet), at the head of Goldvalley, and Grayback Peak (altitude 3,670 feet) are the highest points in the batholithic area between Zeballos and Nomash Rivers, and as such mark the axis of a cupola ridge striking northward in which fissuring and mineralization occurred after the emplacement of the intrusive mass. The Lukwa-Grayback Ridge was formerly high in the roof relative to other parts of the batholith. This ridge plunges due north, whereas the main axis of the Zeballos batholith trends north 55 degrees west. The east and

west slopes of the Lukwa-Grayback Ridge are jointed and fissured nearly parallel to the axis of the ridge. The North Star property is on the steep west slope of the ridge south of Grayback Peak.

Judging from the development work already done there appears to be structure on the North Star group that favours a fairly large low-grade body. It is a shear zone striking north 12 degrees east and dipping 70 degrees west. Underground work and sampling have demonstrated a width of 120 feet of low-grade ore. Surface indications give promise of a further width of 150 feet. This zone is intersected in places by northeasterly fractures parallel to the productive veins nearby in the district, and in such places ore extends over considerable widths in the shear zone. One zone underground, 20 feet wide, length unknown, was carefully channel sampled and big samples returned \$8 to \$12 a ton in gold.

The mineral deposit in the shear zone consists of disseminated pyrite and arsenopyrite, gouge, lenses of quartz and calcite, and crushed quartz diorite. In places the quartz diorite is interlaced with veins of vuggy white to rusty quartz; the veins varying from 6 inches to 1 inch or less across. Most of these veins in the mineralized zone strike northeasterly and dip to the southeast; a few veins dip to the north, but apparently all formed at the same time. Apparently mineral solutions welled up to occupy all available space in shattered parts of the shear zone.

The adit on the North Star is at altitude 2,520 feet on the south side of a creek draining to Goldvalley Creek and driven to get under open-cuts southeast of the creek. The adit crosses the mineralized zone for 120 feet eastward and exposes many quartz stringers and gouge seams. Three open-cuts, down from the adit and on the north side of the creek, indicate that mineralization persists also for 150 feet to the west.

The lowest open-cut on the north side of the creek, at altitude 2,430 feet, shows pyrite and arsenopyrite and rusty ledge matter. An assay of the rusty gouge from this cut gave: gold, 0.4 ounce a ton; silver, 0.2 ounce a ton. Fifty feet farther up the creek is another cut showing rusty material and sheeted structure and 40 feet northwest from this is a third open-cut at altitude 2,500 feet. The joints strike north 57 degrees east and dip 85 degrees south. All three cuts on the north side of the creek show similar rusty gouge-banding and sheeted structure.

The open-cutting and natural outcrops south from the creek and those above the adit to altitude 2,935 feet show ladder-like vein structure in altered, ferruginous, crushed granodiorite. The first open-cut at altitude 2,560 feet and 45 feet northeast of the portal of the adit, in a width of 14 feet, shows numerous interlaced veins and stringers in oxidized, sheared granodiorite. There are at least a dozen mineralized veins striking northeasterly in the face of this cut. A 54-inch channel sample taken across the face of this cut by J. S. Stevenson in 1937 assayed: gold, 0.80 ounce a ton; silver, 0.6 ounce a ton. A single 6-inch vein in this cut gave a specimen assay of 7 ounces gold to the ton.

Another open-cut at altitude 2,588 feet has a length of 41 feet and shows almost as many quartz veins and stringers associated with rusty material and gouge along a rock face 10 feet high. This cut is 60 feet east of the portal of the adit. Eighty feet east of the portal, at altitude 2,614 feet, is a small rock cut and another at 110 feet, showing quartz stringers

and rusty gouge. To the south of these cuts is a dry gulch, and along it and south of it a great deal of quartz in films and bands up to 30 inches wide cut through the quartz diorite.

Many stall-like gullies mark the surface between the North Star adit and the Haida property line to the northwest. These should be investigated for high-grade gold veins striking northeast. One such gully 500 feet southeast from the Haida line on the Golden Key claim follows a shatter zone 3 feet wide.

### Rimy Group

The Rimy group consists of several claims and fractions named Rimy No. 1 to No. 8, and are under development by Man-O-War Mines, Limited. The group lies on the ridge northeast of Goldvalley Creek and east of the Lone Star group. A pack-horse trail was extended to the property in 1938 from the Rey Oro trail. The camp is at altitude 1,950 feet and  $6\frac{1}{2}$  miles from the town of Zeballos. Some 500 sacks of ore estimated to run about  $2\frac{1}{2}$  ounces gold to the ton were produced in new development on the Rimy vein up to the end of September 1938.

Situated as the Rimy group is in the central part of the granodiorite area, it is interesting to find there as strong jointing and pre-mineral fissuring as in any other part of the batholith. Both feldspar porphyry dykes and late andesite dykes cut northeasterly across the granodiorite on this slope.

The gold-quartz-sulphide vein that is being opened up on Rimy No. 3 claim strikes east and dips 83 degrees south. It is well exposed in a steep cliff above the new adit at altitude 2,480 feet, and occupies an oxidized shattered zone with steep walls 4 feet apart. Some distance down the slope the vein outcrops for 40 feet along a watercourse and is quite inconspicuous like other veins found on the lower slopes in Zeballos district. The quartz vein is 4 to 8 inches wide, contains fine-grained pyrite, galena, and a little zinc blende, and is bordered by gouge and oxidized, broken granodiorite. It has been traced by open-cut for 15 feet above the upper adit and for 200 feet southwest on the slope. The vein has been drifted on at two levels by short adits.

The lower adit is a crosscut at altitude 2,130 feet, driven on the north side of a watercourse. It encountered the vein at 38 feet from the portal and passed beyond it 22 feet; at the face of the crosscut is a 6-foot andesite porphyry dyke in the granodiorite. A 30-foot drift was advanced eastward on the vein at this level. This adit was driven previous to 1938.

The upper adit is a drift on the vein at altitude 2,480 feet. By August 5, 1938, the adit had been advanced 90 feet. Previous to driving the adit, the vein was sampled along a length of 20 feet at the surface; five samples across average widths of 4 inches gave an average of \$142.80 a ton in gold. The assays were 4.60, 1.62, 2.88, .820, and 4.28 ounces gold a ton. This vein showed uniform narrow width and continuity the full length of the drift, and the company assay chart showed high-grade assays throughout.

A high-grade ore shoot averaging approximately 2.5 ounces gold has been developed for a length of 200 feet in the upper adit, and over a vertical range of 290 feet between the lower adit and highest open-cut above the upper adit.

### Bibb Group (Central Zeballos)

*Reference:* Stevenson, J. S.: Lode Gold Deposits of Zeballos Area, 1938; B.C. Dept. of Mines.

The Bibb or Extension group consists of ten claims, staked in February 1935 by P. M. Monckton for the firm of Hawkins and Horie, land surveyors of Vancouver. The property was optioned to Central Zeballos Mines, Limited, in May 1937.<sup>1</sup>

The claims are two abreast extending south from the King Midas group to beyond Monckton Creek, one of the branches of Goldvalley Creek coming in from the east. The trail leading to Goldvalley and the Central Zeballos camp leaves the Spud Valley motor road at a point 4 miles from the town of Zeballos; a 2-mile go-devil trail connects with the property.

The gold-quartz-sulphide vein being developed on this property is a recent discovery made by O. T. Bibb in September 1937. By August 1938, about 750 feet of adit had been driven to develop this vein at two levels. In addition to the gold vein there are two copper deposits on the property. Two separate camps were built on the claims, one at altitude 1,685 feet on Monckton Creek and the main camp at altitude 700 feet near the entrance to the canyon of Bibb Creek. The King Midas group of claims adjoins the property on the north and immediately south of it are the Rey Oro and Rimy groups of claims.

The claims extend across the north contact between the Zeballos batholith and the rocks of the Vancouver group. Limestone of the Quatsino formation occurs in the lower part of the canyon of Bibb Creek and forms bluffs to the west of the main camp. The beds strike northwest and stand nearly vertical. To the southeast limestone inclusions occur in the granodiorite. Dykes of feldspar porphyry and aplite cut through the light-coloured granodiorite, principally along northeasterly or easterly directions. Some of these dykes are 30 feet wide. Jointing and shear planes are prominent, as in other parts of the batholithic area.

The gold-quartz vein on the Central Zeballos follows a strong shear zone cutting through andesitic feldspar porphyry along an aplite dyke. The dyke has been shattered in places and its fragments cemented by quartz and sulphides. The mineralized shear is exposed in open-cuts and trenches on the steep slope above the portal of the adit driven west from Bibb Creek at altitude 1,410 feet. In the creek bottom the shear is on the south side of a 2-foot aplite dyke, a little farther up it is in the central part of the dyke, and at the blacksmith shop it is on the north side. The width of shearing varies on the surface from 1 to 2 feet. The strike of the vein is north 85 degrees east and dip 80 degrees south. At elevation 1,550 feet a stripping 45 feet in length shows quartz, heavy sulphides, and gouge in lenses and bands up to 15 inches wide. Open-cuts have been made at intervals along the strike of the vein for over 700 feet. Attention has been centred on underground development during 1938.

An adit driven west from Bibb Creek at altitude 1,410 feet had been advanced by August 11, 1938, about 180 feet from the portal. Over this distance the vein varied in width from 3 to 42 inches. The face of the adit showed heavy pyrite, arsenopyrite, galena, and sphalerite. The mine

<sup>1</sup> Reno Gold Mining Company took over this mine in 1939 under a lease agreement.

record of assays taken every 5 feet in this adit had shown some high-grade ore, but this face assayed 26·10 ounces gold a ton across a width of 2·8 feet. Two commercial ore shoots are indicated, one 30 feet in length and a second over 50 feet; the first gave 1 ounce gold across widths up to 3 feet and the second 0·61 ounce gold a ton across an average width of 2·9 feet.

At altitude 1,240 feet on the west side of Bibb Creek an adit crosscut encounters the vein 304 feet from the portal. It showed up in the crosscut as a gouge seam beside the aplite dyke. It improved very much in a few rounds, and it has been reported that the ore shoots encountered in the upper adit rake westward and appear in the lower adit. This development marks the deepest mining that has yet been done on a vein near the northern contact of the Zeballos batholith; the crest of the mountain at the point where the vein strikes across it is 425 feet above this lower level.

A shipment of 25 tons of high-grade ore from the Central Zeballos vein in November is reported to have averaged 4·27 ounces gold a ton. Ore suitable for mill feed is being stored underground.

The copper deposits on the Bibb group have remained undeveloped. One occurs in the northeast half of Extension claim No. 5 following a band of limestone northwestward; it shows garnetized areas containing bornite, chalcopyrite, and magnetite. The second copper showing strikes east across the south branch of Bibb Creek on Extension claim No. 10. Both showings can be followed for 1,000 feet and occur in rugged country between altitudes 1,000 and 2,400 feet above sea-level. Assays of 0·05 ounce gold and 7½ per cent copper have been taken across 5-foot widths.

### King Midas Group

*References:* Gunning, H. C.: Geol. Surv., Canada, Sum. Rept. 1932, pt. A II, pp. 38-42.  
Clothier, G. A.: Ann. Rept., Minister of Mines, B.C., 1933, p. 253.

The King Midas group consists of twelve claims and three fractions staked two abreast along the north fork of Zeballos River, from south of the forks northward. It was staked by T. J. Marks in 1926, and the King Midas Mining Company, Limited, was organized in July 1933 to develop the property. It is reached by pack-horse trail from the Spud Valley motor road and is about 9 miles from the town of Zeballos. The north fork of Zeballos River occupies a sharp, V-shaped valley along which the property extends for 9,000 feet.

The deposits on the King Midas are gold-quartz-sulphide veins and chalcopyrite-pyrite replacements. The King Midas is one of those properties where assaying of surface showings has given interesting results for gold from the time the claims were staked. T. J. Marks had assays from narrow veins in 1926 that gave: gold, 24·70 ounces; silver, 14·70 ounces; lead, 2·1 per cent; zinc, 7·4 per cent; and copper 0·2 per cent a ton. The Tagore property down river in 1924 had afforded similar assays but had been abandoned in 1925, the deposit then being regarded as too complex and too small to be commercial. However, interest was maintained in the King Midas, for veins on the surface persisted along the strike for several hundred feet, though they were narrow like the Tagore vein, varying commonly from ½ inch to 6 inches.

Development work undertaken on the King Midas kept up an interest in the district in giving temporary employment to men, some of whom staked claims for themselves and continued to prospect for placer gold and lodes. Most of the work done on the King Midas was done prior to 1935 when everything had to be back-packed over the trail, yet a narrow adit 450 feet long was driven by hand, and open-cuts and trenches were excavated. It was the one property in Zeballos district in 1935 where there was actually a drift following a vein for as much as 100 feet. The ore taken from the vein had been placed in crib-work, but flood conditions on the north fork had worked havoc with the ore-bin and largely removed the ore that had been mined. The owners of the property are carrying only a limited program of development until transportation to the property becomes less of a problem.

The status of the King Midas property has not changed since it was reported on by H. C. Gunning in 1932.

The King Midas property lies to the east and north of the Zeballos batholith and is underlain by altered formations belonging to the Vancouver group. On the east side of the North Fork massive limestone occurs in faulted relation to andesites of the Karmutsen volcanics, which underlie that part of the claims lying to the west of the river. The main fault trends a little west of north along the North Fork and dips vertically or steeply east. A branch fault extends up Fault Creek on the west and beyond Fault Creek a second fault has been observed on the east side of the river striking northeast. Feldspar porphyry dykes cut the Karmutsen volcanics and the Quatsino limestone.

The gold-quartz-sulphide veins cut the Karmutsen volcanics and the Quatsino formation and the dykes intruded into them. The mineralized deposits consist of "stringer-charged" masses of rock, and also of persistent, narrow, gold-bearing quartz veins that have been traced for hundreds of feet at the surface. There are a dozen or more mineral showings on the property but the persistence of three veins has been demonstrated, one south of Fault Creek on the west side of the river and two north on Yauco 6 and 7 claims on the east side of the river. Chalcopyrite, arsenopyrite, pyrite, pyrrhotite, zinc blende, and galena occur in different veins or the same vein.

No. 1 vein, as crosscut by No. 1 adit and exposed by surface cuts, is typical of the narrow fissure type of deposit. The normal vein is a few inches wide and splits locally into parallel stringers, but has been traced along the steep slope south of Fault Creek for 260 feet. It is a quartz vein with considerable zinc blende, arsenopyrite, pyrite, chalcopyrite, and a little galena. It carries high gold values, apparently associated with the zinc blende. A vein parallel to it has been found 800 feet up Fault Creek. These veins strike parallel to the north fork fault, or north 6 degrees west, and are vertical or dip steeply east.

No. 1 adit is about 450 feet south of Fault Creek on the west side of the north fork and 10 feet above the river. This adit has been driven from a 20-foot rock cut 60 feet to cut No. 1 vein, 90 feet below the best exposed part of the vein. The crosscut was extended beyond the vein for 40 feet. A winze is sunk 16 feet on the vein where crossed by the adit. At the winze the vein consists of parallel stringers; there are five distinct



veins at the winze, the widest is 5 inches on the floor of the adit and the others average about 3 inches in width. The veins are from 12 to 15 inches apart, the country rock between them is seamed with tiny veinlets, and the wall-rock is impregnated with sulphides. The wall-rock is a silicified volcanic rock, probably andesite. The principal minerals in the veins are sphalerite, arsenopyrite, pyrrhotite, and pyrite in a quartz gangue. Some of the veins are frozen to their walls; others break clean and have no gouge. Assays from the winze are high in gold.

Drifts have been made on No. 1 vein from the winze south 62 feet and north 125 feet. The east 5-inch vein continues strong in the north drift for some distance when it turns into the west wall. The south drift is in ore for about 30 feet when it runs into broken ground.

No. 2 adit is parallel to No. 1 and 140 feet to the south; its length is 155 feet. It cuts small quartz stringers between 116 and 130 feet from the portal. At the face it shows strong jointing, which strikes north 82 degrees east and dips north 80 degrees, in grey feldspar porphyry.

Open-cuts have been made north of Fault Creek at a point 150 feet or more above and west of the creek. There a vein 6 to 10 inches wide exposed to a height of 12 feet in a rock cut strikes due north and is vertical. It contains pyrite, sphalerite, arsenopyrite, and a little galena in quartz. It is identical in appearance with veins seen in the granodiorite batholithic area to the south, where grey banded quartz coloured by finely divided arsenopyrite is frequently seen.

On the east side of the river there are two persistent veins, one known as the Contact vein and the other as the Trail vein. These veins are roughly parallel and 250 feet apart at the northern end of the property, but converge southward. Trail vein has been traced along the strike for 1,800 feet and the Contact vein, lying to the west of it, has been traced for 850 feet or more. The veins are frozen to the wall-rock, show widths of 3 to 6 inches, branch into stringers, and contain pyrite and rusty quartz. An adit 30 feet in length was recently driven on the Trail vein. At the north boundary of the King Midas property and beyond this adit the vein has been traced on the surface for about 250 feet, on the property of the North Zeballos Exploration Company.

### **Goldspring Group**

The Goldspring group includes several claims recently staked by Sam Knutsen in the valley of Fault Creek, adjoining and west of the King Midas group. It is reached by a short, steep trail connecting with the pack-horse trail at the King Midas cabin.

In August 1938 a camp was established at altitude 1,060 feet on the south side of Fault Creek with a view to prospecting a 6-inch vein of quartz exposed in natural outcrop in one of the steep gulches, on the south side of the creek above altitude 1,370 feet.

The north-facing slope to Fault Creek is underlain by much fractured and sheared andesites (Karmutsen volcanics) intruded by grey to green, feldspar porphyry dykes. A fault trending east-southeast and dipping steeply north follows the bed of Fault Creek. A little over  $\frac{1}{2}$  mile up the creek the fault is visible and has offset the westerly dipping contact between Quatsino limestone and Karmutsen volcanics about 2,000 feet to the west



on the south side of the fault. There are mineralized quartz stringers in the bed of Fault Creek on either side of the fault, which is exposed in front of the camp. The vein in the gulch to the south is definitely in the foot-wall of this major fault.

The mineral deposits consist of the quartz sulphide stringers in the bed of Fault Creek and the vein on the mountain slope above the camp.

The largest stringer in the bed of Fault Creek at the camp can be traced for 25 feet; it is 4 inches wide, strikes north 57 degrees west, and dips 46 degrees north. It is in sheared andesite and on the hanging-wall side of the major fault near a dyke of feldspar porphyry on the north. The stringers in the creek bed carry pyrite, pyrrhotite, and chalcopyrite in white quartz.

The chief vein on the property strikes north to south and dips 58 degrees east. It can be traced in outcrop for upwards of 1,000 feet along and adjacent to a watercourse on the mountain side from altitude 1,370 feet. A branch vein takes off the main vein at altitude 1,525 feet and strikes south 10 degrees west and dips 80 degrees east. The vein carries sparkling clusters of light-coloured pyrite in white quartz streaked through with films of chlorite. Visible specks of gold appear in some of the oxidized parts of the vein; the vein pinches and swells and has an average width of 6 inches.

### **Nomash River (Southeast Fork of Zeballos River)**

Nomash River Valley for its full length of 8 miles was completely staked in 1937, and most of this ahead of any serious effort to prospect. The principal groups of claims are as follows: Nomash River group, twenty-nine claims; Monitor group, eight claims and a fraction; Golden Horn group, nine claims; Climax group, six claims; Wilson group, six claims; and Zeballos Dome, sixteen claims.

Northeasterly striking granodiorite dykes are common on the north slope of Nomash Valley cutting the Quatsino limestone, and, farther up the slope, the rocks of the Karmutsen group. The northern contact of the Zeballos batholith cuts southeast across Nomash River about 4 miles from the forks. The granitic rocks are much jointed and fissured and the intruded formations are also shattered, altered, and extensively mineralized in places.

There is little to add to the description of the deposits along the Southeast Fork (Nomash River) as seen by H. C. Gunning in 1932.

### **Nomash River Group**

The Nomash River group consists of twenty-nine mineral claims, located east of the Monitor group on Nomash River and extending southeast across the Zeballos batholith and into the Little Zeballos drainage basin. The Canadian Exploration Company, Limited, owning these claims had N. W. Henry representing the company in Zeballos in 1938.

The property is of interest because of its geological setting and the fact that it was one of the first places where prospectors found mineral veins in the granodiorite of the Zeballos batholith. H. C. Gunning's account of what he saw on the property in 1932 is quoted below:

"About 4 miles up the southeast fork from the main forks of Zeballos River the Quatsino limestone and Karmutsen volcanics are cut off on the

south and west by the Zeballos batholith. This body, near the contact, consists of black speckled grey granodiorite and quartz diorite of medium grain with scattered inclusions of the older rocks. The first outcrops of the granodiorite in the creek bed are cut by numerous, small, irregular, and lenticular veins of white to watery, coarsely crystalline and cavernous quartz and some of the veins carry an appreciable quantity of pyrite, pyrrhotite, and chalcopyrite and an occasional speck of zinc blende. The two largest veins observed were from 6 to 10 inches wide, but merged at one place to a thickness of about 16 inches. The granodiorite is quite fresh alongside the veins which in no place exhibit any great continuity. Mr. Bird, one of the discoverers, states the gold values were too low to encourage development. The showings deserve mention because they serve to emphasize the fact that the granitic intrusives of the district do contain appreciable mineralization; consequently they should not be passed over too carelessly by prospectors."

### Monitor Group

The Monitor group consists of eight unsurveyed claims and a fraction, owned by John Creagh and staked in November 1937. The property lies  $1\frac{1}{2}$  miles northeast of Mount Lukwa on the Nomash River watershed. A new pack-horse trail has been extended to Creagh's lean-to on the south bank of Nomash River at altitude 660 feet and about 3 miles from the forks of Zeballos River. A foot-trail leads to cabin and workings on the northeast facing slope of Nomash Valley at altitude 1,675 feet. In October 1938 the property was bonded to Conrad Wolfe of Spokane and associates.

The mineral deposits on the property consist of gold-quartz-sulphide veins in the granodiorite and replacement copper sulphide deposits in limestone. Recent development work consists of a rock cut and two short adits in the granodiorite.

The claims extend along and across the northeast contact of the Zeballos batholith with the Quatsino limestone. The granodiorite on the property is strongly jointed; one joint system in particular stands out, it strikes north 4 degrees east and dips 74 degrees west. This joint system makes junction with others striking northeasterly. The jointing of the granodiorite is quite as pronounced in the vicinity of the Monitor group as it is anywhere in the upper part of the Zeballos batholith.

A mineralized shear strikes north 87 degrees east through the granodiorite at altitude 1,560 feet, crossing a bare ridge lying between the two forks of a short creek tributary to Nomash River and east of Curly Creek. The shear zone is conspicuous in natural outcrop for 100 feet or more, and displays  $\frac{1}{2}$ - to 2-inch stringers and lenses of quartz up to 2 feet wide, mineralized with pyrite, arsenopyrite, and zinc blende. Only a start has been made to determine the nature and extent of the deposit. The ore resembles that found on the Golden Horn property to the west. A rock cut and adit 25 to 30 feet in length has been driven at altitude 1,560 feet, and a second adit faced up at the foot of a bluff 100 feet or more below the upper one. The face of the upper adit shows 2 inches of gouge, crushed quartz, and country rock.

### Golden Horn Group

The Golden Horn group consists of nine claims, staked by Harry Smith and associates in 1937, on the south side of Nomash Valley on Curly Creek. The property was under development in 1938 by Pioneer Gold Mining Company, Limited. The Golden Horn group is reached by a new pack-horse trail leaving the main trail along the Nomash at altitude 410 feet and proceeding up Curly Creek to the main camp at altitude 1,460 feet.

The mineral deposit is a narrow gold-quartz-sulphide vein and associated stringer lodes in the jointed granodiorite on the west side of Curly Creek. The development work consists of small open-cuts at intervals between altitudes 1,875 and 2,240 feet. There are twenty small rock cuts along the strike of the fissure in a horizontal distance of over 920 feet. The country rock is dark grey granodiorite cut by feldspar porphyry and thin, dark, diorite dykes.

The favourable structure is a strong shear in the granodiorite, which trends east from the Goldvalley Creek slope. On the Nomash Valley slope it strikes north 85 degrees east and dips 80 to 86 degrees north.

The fact that the Golden Horn vein-shear strikes east and dips steeply north and has characteristic stringer lodes coming into it on the hanging-wall side is of interest, for other veins in the Zeballos batholith farther south, notably the Privateer vein, show corresponding structural features.

Mineralized stringers striking north 65 degrees east and dipping steeply southwest appear on the hanging-wall side of the main fissure, and fifteen or more of these stringers were noted. The width of the main shear varies from a well-defined, silicified crack to 14 inches of vein filling, consisting of quartz and gouge. In places the shear shows 2 to 3 inches of vein matter rich in pyrite, finely divided arsenopyrite, and zinc blende, together with small, glassy, quartz crystals and some calcite. Some excellent specimens have been obtained from this property, showing flake gold in calcite vugs. Some of the ore from the Golden Horn has a striking resemblance to that found in narrow veins just north of Fault Creek, on the King Midas property.

### Climax Group

The Climax group consists of six claims owned by the Climax Syndicate. This property is situated on the south side of Nomash Valley, less than 2 miles from the North Fork of the Zeballos. Delphine Mines, Limited, of Vancouver, carried on intensive prospecting on this property during the early part of 1938, from a camp at altitude 500 feet.

Thus far only bunchy deposits of chalcopyrite and garnet have been found, though considerable surface trenching and four short adits were driven with no conclusive results. Quatsino limestone occupies the lower slopes of the valley and the claims extend up and across the north contact of the Zeballos batholith.

One small open-cut at altitude 1,400 feet in garnetized limestone showed a 4-inch vein striking north 10 degrees west and dipping 76 degrees west. The vein carries spheroidal masses, one inch or more in diameter, consisting of allemontite (antimony arsenide).

### Wilson Group

The Wilson group, consisting of six claims, is owned by the Wilson Group Syndicate. The claims are underlain by the Quatsino limestone and are down valley from the Climax group and east of the Central Zeballos group on the Nomash slope.

### Zeballos Dome Group

*Reference:* Gunning, H. C.: Geol. Surv., Canada, Sum. Rept. 1932, pt. A II, p. 44.

The Zeballos Dome group consists of sixteen claims on the north side of Nomash River, staked by Alfred G. P. James of Zeballos in December 1937 and later sold to A. V. Seymour. The property lies across the river from the Golden Horn group.

A new cabin has been erected on the property at altitude 1,350 feet in a steep ravine. The trail to the cabin leaves Nomash River at altitude 410 feet at a point  $2\frac{1}{4}$  miles above the junction of the Nomash and the North Fork of Zeballos River. The cabin is about  $\frac{1}{4}$  mile from Nomash River on a short tributary stream.

The property represents a restaking of the Major group, the deposits of which were described by H. C. Gunning in 1932 before any development work had been done. In 1938 an effort was being made to trace and sample two veins exposed in the creek bed, one at altitude 1,600 feet and the other at altitude 2,250 feet. The deposits consist of contact replacements and quartz veins.

The claims extend across the contact of the Quatsino formation and underlying Karmutsen volcanics. These formations are cut by feldspar porphyry dykes and mineralized shears. The contact of the Quatsino limestone with Karmutsen volcanics is poorly exposed, "but can be seen in one place to be mineralized for a width of 5 feet or more with garnet epidote, magnetite, pyrite and a little chalcopyrite". Below the contact the basic volcanics are much sheared and in part converted to serpentine and chlorite schist along a narrow zone striking north 18 degrees west and dipping 60 degrees northeast. For a width of as much as 80 feet east of the shear the altered rocks are sparingly mineralized with pyrite, quartz, and a little chalcopyrite. The volcanics are intruded by a large dyke of greyish green feldspar porphyry, which appears to be from 20 to 40 feet wide and trends north 10 degrees west. "The dyke is strongly fractured and jointed and contains many small and large veins of white to watery, coarsely crystalline quartz, the strongest development of which appears to lie along the east side of the dyke. Much of the quartz is quite barren, but some contains a small quantity of pyrite and chalcopyrite, particularly where the quartz surrounds angular inclusions of altered dyke rock. The maximum width of fairly pure quartz observed was about 5 feet." Selected specimens taken from an open-cut, between the branches of the creek, along this vein gave assays up to \$18 in gold a ton. Where this vein crosses the creek at altitude 1,600 feet it has been explored by rock cut and adit for 25 feet and from this point northward the vein has been traced by natural outcrop and a few surface cuts for 500 feet. Where exposed in the rock cut at the adit the vein is 2 feet wide and has 9 to 14 inches of greenish, chloritic gouge on the hanging-wall side. The quartz is white showing few oxidized sulphide

stains. At altitude 1,650 feet north of the adit the vein has been laid bare for 12 feet along its strike and shows 8 to 14 inches of rusty quartz carrying pyrite and chalcopyrite and the characteristic chloritic gouge on its hanging-wall side. The feldspar porphyry of the foot-wall has been fractured and in the adit shows stringers that have assayed \$2.85 to \$5.60 in gold to the ton. The second vein, opened up at altitude 2,250 feet, up from the south branch of the creek, strikes north 25 degrees east and dips 85 degrees west. It shows chalcopyrite, bornite, and pyrite in quartz carrying fragments of greenish volcanics, and has an average width of less than one foot. The vein is free on the foot-wall side. On the hanging-wall side several quartz stringers come in, striking north 80 degrees east and dipping toward the vein. This second vein has been traced in natural outcrop for 100 feet up the mountain from altitude 2,250 feet and for 200 feet down the slope toward the south branch of the creek.

### Friend Group

The Friend group consists of eight claims and fractions of claims extending from the mouth of Little Zeballos River northward for about 2 miles. The property in 1938 was under exploration by Pioneer Gold Mining Company, Limited.

A dozen or more mineralized veins have been found on the Friend group. The veins are narrow and few of them can be traced far in natural outcrop. Some 200 feet of adit has been driven to explore two veins outcropping across gorges high on the main west fork of a creek lying east of Beano Creek.

The claims are underlain by flows of basalt and felsite porphyry, bedded dacite tuffs, and conglomerate, belonging to the lower part of the Bonanza group. These rocks have been intruded by small stocks of diorite and later acidic dykes.

The first adit on the Friend group is at altitude 1,060 feet on the west side of the creek near the head of a gorge and waterfall. The country rock, consisting of brittle dacite tuffs, is cut by a master shear striking due north. A branch fissure off this northerly shear strikes south 54 degrees west and dips 64 degrees northwest. A 1-inch quartz vein carrying pyrite, arsenopyrite, and visible gold occurs in this fissure and has been drifted on to the southwest for 75 feet. The quartz assayed on the average 4 ounces in gold a ton. Calcite and quartz outcrop in the main northerly shear at its junction with the fissures.

Farther up the creek, at altitude 1,600 feet, there is also a northerly shear that cuts across a wide, greenish grey, feldspar porphyry dyke around which there has been considerable cross fracturing. The main shear strikes north 5 degrees east; it is vertical and contains crushed rock. An adit is being advanced into the mineral zone bordering the hanging-wall side of the feldspar porphyry dyke that outcrops on the east side of the creek. The strike of the dyke is north 85 degrees east and dip 60 degrees north. A limited amount of quartz, pyrrhotite, sphalerite, pyrite, and dyke breccia were showing up in the adit face, which had only been advanced a few feet. The pyrrhotite is of the same bronzy appearance as that seen in quartz on the Beano vein of the adjoining property.

Cross fissuring seen at the portal of the adit strikes north 30 degrees east and dips 60 degrees to the southeast across a 10-foot width in brittle dacite tuff. The slope is precipitous and inaccessible for some distance above the adit portal. These transverse fissures appear to be independent branches of northerly shears. In the lower showing on the creek, at altitude 1,060 feet, the mineral deposit is confined to the west side of a northerly shear whereas at the upper adit mineralization comes in fissures on the east side of a similar shear.

### Beano Group

The Beano group consists of fifteen claims and a fraction under option by Bayonne Consolidated Mines, Limited.

It is located on Beano Creek, a tributary of Little Zeballos River, just south of the Farris-Zeballos group. The topography bordering the Spud Valley-Little Zeballos divide is exceedingly rugged.

The deposits on the property consist of masses or lenses of auriferous pyrrhotite. The property was staked late in 1937. The Inspiration Mining and Development Company of Montreal had a small crew doing near surface prospecting on the property during the summer of 1938. A ladder, some 88 feet in length, had to be built in order to get down into a narrow, steep canyon where the best surface showings occur.

The Beano claims are underlain by bedded tuffs and flows of the Bonanza group. Included in the bedded series is a limestone member partly exposed on the foot-wall side of the fissured zone in which the ore-bodies occur near a body of diorite of the Coast Range intrusives.

At altitude 2,470 feet an open-cut 22 feet long had been made to the south of and near the brink of a canyon. This is on the upper showing on the property, which consists of pyrrhotite and some chalcopyrite impregnating and replacing an altered flow rock, striking north 30 degrees east and dipping 46 degrees southwest. This material is not ore; gold values are too low.

Less than 100 feet to the east from the above showing massive pyrrhotite covers a considerable area on the north sloping wall of the canyon. There are several large bands and patches left high on the canyon wall. Here are found two distinct types of pyrrhotite: (1) a massive, bronzy sulphide such as is seen in various veins in the district associated with quartz; and (2) pyrrhotite that has replaced limestone.

In the bottom of the canyon there appears to be a vein, 15 inches to 3 feet in width, containing white crystalline quartz much shattered and associated with lenses of the bronzy pyrrhotite. The vein strikes north 65 degrees west and dips 77 degrees north. The hanging-wall is dense, dark diorite; the foot-wall is grey limestone.

The limestone appears to have been fissured *en échelon* for pyrrhotite replacement bands occur in that way along it.

The development work on this impressive surface showing was done with the purpose of finding out possible tonnage in sight. Two short adits were driven across the ore-body and the best looking band of ore proved to be 6 feet wide. According to A. W. Freakes, who had charge of the work, there was between 5,000 and 6,000 tons of pyrrhotite on the wall of the canyon. Some of the bronzy pyrrhotite is definitely high-grade gold ore.

**Other Mineral Claims**

East of the Friend group lies a block of claims known as the Cliff, Luckies, Golden, Dorothy H., and Bird groups, owned by Mrs. Dorothy M. Wilson of Vancouver. North of these is the Royal group of twelve claims under exploration by Consolidated Mining and Smelting Company, Limited, adjoining the Nomash group of twenty-nine claims, held by Canadian Exploration Company, Limited. All these claims and others in the Little Zeballos River section are recent stakings, for the most part awaiting exploration.

