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GLACIER GULCH GROUP

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The Glacier Gulch group of 8 mineral claims is owned by S.F. Campbell, Grover Loveless, and Wesley Banta, prospectors of Smithers B.C. Hudson Bay mountain (Alt. 8700 feet) flanks the west side of Bulkley River valley and the base of the mountain trinds north 27 degrees west for a stretch of 15 miles at altitude 2,000 feet.

Glacier gulch lies within the confines of the east slope of the mountain four miles northwest of Smithers and 2 miles south of Toboggan creek valley. The gulch is at the foot of Kathlyn glacier, whose waters plunge over Kathlyn falls 500 feet high, to unite in Glacier creek. A motor road enters the gulch following the south bank of Glacier creek passing cabins on the property at altitude 2,440 and terminates at the foot of a small aerial tram. The property is 6 miles by road from Smithers(Alt. 1624) and a little over 2 miles from Lake Kathlyn station on the Canadian National railway.

Glacier gulch is a remarkable topographic feature over a mile in length combining the characteristics of a glacial trough and a water gap, cutting through (low down) obliquely across the east slope of the mpuntain. Most of the streams on this slope flow directly northeast down to the base of the mountain and Glacier creek, which takes its rise at the foot of Kathlyn glacier altitude 3,300 feet, parallels other streams onto the piedmont slope and finally becomes a tributary to Toboggan creek to the north. Glacier creek is a swift flowing stream 3 miles long.

A profile section taken from Bulkley valley through Glacier gulch
Shows that both sides of
Glacier gulch are abrupt and precititous yet the east flank of the trough constitutes a pronounced gap below altitude 6,000 along the 25 degree angle slope of Hudson Bay mountain. The maximum width of Glacier Gulch valley measured horizontally from the eastern crestline (alt. 3250) to the northwest wall is a mile; the floor of the valley has been greatly reduced in width by encroaching talus slopes, especially those forming on the north and west side of the gulch, since that is the highest and longest slope. A vertical cliff 500 feet high marks the head of the Glacier Gulch and the site of Kathlyn falls.

The mineral claims of the Glacier Gulch group take in much precipitous ground on both sides of the gulch; prospecting the north slope was inprogress in 1926 and discoveries on the south slope in 1929 have resulted in some development and gold ore shipments.

The steep sides of Glacier gulch for some distence are covered with talus debris and it is not surprising that most of mineral showings found by the prospectors thus far have been located several hundred feet above the floor of the gulch. The gulch has a forbidding appearance when its steep slopes are considered. However, its position geographically and geologically is unique.

DEPOSITS AS DEVELOPED

The deposits on the property consists of fissure veins, irregular shear zone replacements and blotches of ore veinlets through fractured thin bedded tuffs and sediments. The mineralization includes heavy sulphides, silver-lead-zinc ores, confined to fissure veins and veinlets and gold-tetradymite and molybdenite in veinlets and replacements, the latter found thus far only on the south slope. Development work on a small scale has hinged around three deposits; the initial discovery on the north slope and the 1929 and 1934 discoveries on the south side of the gulch

Development work has taken the form of surface stripping and small scale underground exploration. The principal development on the north slope is an inclined shaft started when the property was under option to F.H. Taylor in 1928 and sunk 23 feet with further work done on it after that, the owners sacking 15 tons of ore from this development.

The property was under option in 1934 to R.W. Wilson and the development on the south slope centered around the two mineral showings. The outstanding bit of work on the gold-bismuth telluride deposit is a shallow quarry following the replacement zone for 100 feet into a rock wall with maximum height of 40 feet (cut away) above altitude 3225. Short tunnels driven to determine the limits of the ore body total about 150 feet of rock work. From one tunnel driven at altitude 3195 just down from the southeast end of the quarry a raise was put up 30 feet to the floor of the quarry.

The second deposit on the southern slope to receive attention in 1934 lies 500 to 600 to the northeast of the quarry noted above, and is a persistent fissure vein, carrying silver-lead-zinc ore. A tunnel side, at altitude 2880 feet, near the top of a bluff overlooking the cabins on Glacier gulch, was made and the vein has been cut into, at 5 different points up to altitude 3250 feet.

GENERAL GEOLOGY

Two groups of rock formations feature in the geological set up of Glacier gulch. In the water gap part of the gulch to the east are quartzites and argillites of the Skeena formation. These beds have yielded fossils of Lower Cretaceous age from shales associated with coal beds in this vicinity. Somewhat less than a quarter of a mile west of the Kathlyn coal property the Skeena formation gives place to older formations, and the contact is not clearly exposed, yet there are marked lithological and structural changes to be seen in the rocks as exposed on the north side of the gulch. The Skeena formation locally displays a thickne

ss of upwards of 1,000 feet of tilted beds

striking north 46 and dipping 60 degrees northeast. It apparently makes contactin angular unconformity with members of the Hazelton group of rocks or at least a series of beds that in Glacier gulch have thus far provided no fossil evidence.

West of the Skeena formation in Glacier gulch are chiefly thin bedded to massive argillaceous tuffs, light grey to black in color. The beds strike north 20 degrees west and dip 10 degrees west near the contact of the Skeena formation where it crosses the northeast extension of the Glacier Gulch group of claims. The claims extend southwesterly from the northern slope of the gulch away from the Skeena contact.

The structure of the beds underlying the Glacier Gulch group of claims is clearly shown in the glacial trough, near the head of the gulch. The ledge that gives rise to Kathlyn falls has been cut out of the south west limb of a minor anticline, the beds dipping gently to the southwest and the anticline nosing enough , to give a gentle pitch to the southeast. The axis of the anticline runs directly northwest at rightangles to the course of Glacier gulch and the ledge is 500 feet high as if its face had been sheared off along a northwesterly joint plane. The general structure of the beds is flat-lying with minor undulations, a syncline following the anticline noted above northeastward; the Skeena beds laid down in unconformity on the east limb of this structure. There is evidence that local shearing has taken place along northeast-southwest lines in the vicinity of the gold-bismuth telluride deposit of the southeast slope of the gulch, with abundant development of the slickenside rock surfaces cutting northeasterly across the axis of the same anticline noted in front of Kathlyn falls.

The Hazelton group of rocks on the east side of Hudson Bay Mountain have been intruded by basic and acidic dykes. Coarse granular diorite and granodiorite in cross-cutting sheet-like bodies of varying thickness are in evidence from Toboggan creek southeasterly. The most common type of dyke associated with the silver-lead-zinc ores of the eastern slope of the mountain isahard dense porphyry with light colored feldspar phenocrysts in a darker, bluish-

grey to purplish green matrix. This andesite porphyry grades into a bleached, greyish rock having the appearance of a fine-grained r rhyolite.

This andesite porphyry outcrops of the Glacier gulch group of claims along south facing cliffs near the gold bismuth telluride d deposits and to the southwest along the slope. The strike of a cliff marking the west contact of such dyke was noted as north 73 degrees and dip 50 west.

A local shear zone followed this dyke wall and seemed to persist north 73 degrees east in the direction of the quarry. It was impossible to tell the exact thickness of the dyke, (upwards of 10 feet at least) with overgrowth of vegetation covering the outcrop of the south. Quartz veinlets in the dyke and adjoining tuff carried specks of steel gray tetradymite showing that the dyke was in place and earlier than the mineralization,a sample taken from the sheared contact assayed:-

Gold, a trace;

Silver, a trace.

On the north side of Glacier gulch the rocks of the Hazelton group and of the Skeena formation show abundant evidence of iron staining. The former group shows a maze of curved and branching fractures emphasized in the gully pattern cut in the rocks on the high west slope while the Skeena formation to the east is blocky and rectangular joints in contrast. It would appear that the Hazelton group of formation had been abundantly fractured along northwest lines, with fractures dipping to the south and west. The extisence of such fractures at the time of mineralization appears certain, and proof of it rests with the nature of mineral deposits found in these rocks. The fissures participated in the same kind of metallization as the local north to northeasterly striking shears which have been p proven to contain sizeable ore bodies on Hudson Bay Mountain. It is yet to be demonstrated whether there are here any northwesterly trending fractures that can show anything but small, scattered, blotchy, stringerlike,, pockety, thin and sparse ore fillings and replacements.

MINERAL DEPOSITS

The three mineral deposits on the Glacier gulch claims occur in and are in cross-cutting relation to various members of the Hazelton group and its intrusives. There are two types of deposits: (1) fractures mineralized with sphalerite, galena, freibergite, pyrite, pyrrhotite, and gangue minerals quartz and siderite; carrying good values in silver and some gold, taking the form of a well defined fissure vein only in one deposit on the property and (2) replacements associated with fractures and shear zones; replacement and shear containing free gold associated with bismuth telluride, molybdenite, Pyrite, silver-cobalt sulphides and nodular masses of arsenopyrite; replacement trending northeast. Gangue minerals consist of quartz and aggregates of a purplish to a brownish grey garnet in a chalky textured silica-alumina-carbonate rock.

The country rock has experienced intense hydrothermal alteration adjacent to the mineralized fractures, producing light silicified borders in dark argillites and talcose white sections through the greenish dacitic tuffs. Evidence of high temperatures locally is seen in the Skeena formation; coal beds in this vicinity changed to anthracite with some pyrrhotite nodules in the associated shales.

NORTH SLOPE DEPOSIT

THE initial discovery on the property, a gold-silver-lead-zinc deposit at altitude 2,690 feet on the north side of the Glacier creek, is one quarter mile from the Lake Kathlyn coal property. It was the one deposit receiving attention on the claims prior to 1929. The north side of the gulch is very steep and largely inaccessible rising to altitude 6,00 feet, abruptly along the mountain spur, that lies between glacier and Toboggan creeks. The mineral showing is 500 feet above Glacier creek in the Hazelton formation near its contact with the Skeena formation.

The position of the deposit, on so steep a slope, gives little opportunity for surface exploration, and underground development has not gone far enough to yield much information.

The surface, when under development prior to 1928 showed inone place mineralization for 20 feet, maximum width 6 feet; a silicified replacement with mineral showing in joints, bedding planes and cracks.

planes of tuffs, which strike north 20 degrees west with a dip of 10 degrees west.

The underground development is an inclined shaft sunk in the ore zone at a point 480 feet above Glacier creek. At the collar of the shaft 18 inches of solid sulphides occur, narrowing to 16 inches and is continuous narrowing to 9 inches at 23 feet (according to B.C. Minister of Mines Report 1928). The shaft was full of water but S.F. Campbell volunteered the information that it was 35 feet deep and showed 16 inches of zinc blende at the bottom. The shaft yielded 15 tons of ore, which has remained sacked at the workings.

The minerals in this deposit are zinc blende, galena, tetrahedrite, ruby silver, pyrrhotite and pyrite.

The assay certificates shown to the writer(by S.F. Campbell, from this deposit on the north slope) are as follows:

Nov. 25, 1927 Width 6 feet

Gold, 0.26 oz; Silver, 21.9 oz; Lead, 4.1 per cent, Zinc 50.5 per cent, per ton

Gold, 0.38 oz; Silver, 11.8 oz; Lead 2.3 per cent Zinc, 45.5 per cent per ton

Picked sample:- Gold, 0.32 oz; Silver, 2,190.8 oz; Lead, 47.1 per cent, per ton.

From 18 inches at the collar of shaft: sampled by Douglas Lay.

Gold, 0.04 oz; Silver 179 oz; Copper, 0.3 per cent Lead, 12.6 per cent; Zinc, 15.8 per cent per ton.

From 9 inches 23 feet down the shaft, mostly pyrrhotite: Sampled by Douglas Lay.

Gold, 0.06 oz; Silver, 0.6 oz; Copper, trace.

SILVER-LEAD-ZINC DEPOSIT ON SOUTH SIDE OF GLACIER GULCH

The silver-lead-zinc deposit discovered in 1934 is on the south side of of Glacier creek about 540 feet due east of the initial discovery. It isawell defined fissure striking 20 degrees to 40 degrees east of north and dipping 30 to 60 degrees west. It is of interest that it was discovered in prospecting along the north facing slope out from the gold bismuth-telluride deposit in a direction 68 degrees east from the last open cut on that deposit, the distance being 460 feet to a point on an east facing slope where this silver-lead-zinc vein was found at an altitude

planes and cracks. The ore zone strikes north 64 degrees west cutting across the bedding

3,250. It is well defined in outcrop and traceable for 380 feet in a direction north 20 degrees west across the slope and down to altitude 2,900 feet to the top of a cliff. Open cuts were made near the base of the cliff at altitude 2,620 feet where a 3 inch vein was found, considered to be the downward continuation of the fissure vein, traced to the top of the cliff.

The tracing of this vein obliquely down its dip is facilitated by the topography as the vein outcrops on the face of a ledge which as the slope steepens becomes the west side of a steep ravine where it is possible to get at the vein and note its character.

The vein is continuous and well exposed along the ravine, varying in width from 8 to 12 inches. It has been cut into at several places, notably at four points between altitudes 3,240 and 3,140 feet. A short adit started at altitude 3,050 feet shows a narrowing of the vein from 9 inches to 1 inch in 20 feet. The second tunnel on the deposit is a drift 80 feet long at altitude 2,800 feet. The vein strikes south 22 degrees west in the first fifty feet and then curves to strike south 40 degrees west in the remaining 30 feet to the face where it has a width of 7 inches and dips 52 degrees west. The dip of the vein at altitude 3,240 is 20 degrees at altitude 3,205 is 30 degrees, at altitude 3,140 is 40 degrees and at the short adit 55 degrees west, thus showing a general tendency for the dip to steepen coming down the mountain.

The vein cuts across massive, green and grey volcanics containing some thin bedded also massive black argillites which strike northwest and dip gently west. The rocks show considerable bleaching and silicification bordering the fissure vein, it is particularly noticeable in the fresh rock surfaces at the portal of the main tunnel, where there are mineralized across fractures in black argillites on the footwall side of vein and the argillites display light coloured silicified bands up to 8 inches thick.

For so narrow a vein it shows general y good mineralization, zinc-blende, galena, pyrite, arsenopyrite and pyrrhotite in a quartz, siderite gangue. At the portal of main adit there is a distinct banding, a solid 2 inch band of zinc-blende followed by schistose steel grey galena and siderite for 5 inches. then country rock silicified and impregnated with arsenopyrite. Zinc blende 7 inches wide occurs at the face of the tunnel. In the 3 inch vein at the base of the cliff there is a mix up of pyrite, pyrrhotite, and less zinc-blende and galena in a siderite gangue.

An assay from the vein at 30 feet in the tunnel (Sample taken by Douglas Lay, Aug. 4, 1934) shows:-

Gold 0.04 oz.
Silver 13 oz.
Lead 10.3 per cent
Zinc 20.7 per cent per ton.

The structural relation of this deposit to the gold-bismuth telluride deposit should be noted. Projection the silver-lead-zinc vein along its course south 40 degrees west from the face of the main adit would bring it in a distance of 540 feet below the gold-bismuth replacement ore body. The fact that the fissure vein can be followed 380 over a vertical range of 300 feet above the main adit on the mountain side up the dip of the vein is the chief argument to support the idea of a still greater lateral continuity along its strike. If such is the case then the gold-bismuth deposit occurs in the hanging wall side of the silver-lead-zinc vein and vertically not far above it.

GOLD-BISMUTH TELLURIDE DEPOSIT

THE gold - bismuth telluride deposit discovered in 1929 is located on a steep north facing slope, to the south of Glacier gulch and lies 500 to 600 feet southwest of the silver-lead-zinc fissure vein deposit described above as occurring on this slope.

The deposits consist of several showings carrying tetradymite associated with gold and silver values, in shear zones

and stringer lode replacements. Several small open cuts and natural exposures extend southwest and northeast from the main showing at the quarry, giving evidence of scattered mineralization along the slope for upwards of 300 feet, the several open cuts seen by the writer are confined to a stretch of 320 feet if the place where three car loads of ore quarried out is included.

The quarry opening up the principal replacement body so far discovered is a shallow affair (maximum width 20 feet) with an irregular floor at altitude 3,225 feet with a step up of 20 feet toward its northeast end. The lower level being 60 feet long and the upper level 40 feet. The maximum height of the quarry face on the lower level is 40 feet and short shallow open cuts have been made on the hillside at altitude 3,265 just off the southeast end of the quarry. A raise comes up through the floor of the quarry near the southeast end. A tunnel has been driven into the south face of the quarry 20 feet over from the raise following a quartz vein 2 feet wide which strike north 75 degrees east and dips 23 degrees south At the face 30 feet south from the quarry the vein shows a tendency to narrow to a foot wide near the floor of the tunnel. At a point 10 feet in from the portal a 30 foot branch tunnel follows the quartz vein along its strike and the vein becomes less well defined. This vein is well mineralized where the drift was put in on it. It raises the problem of how much importance were fissures rising from the southeast as feeders to the replacement ore body.

The second level of the quarry embracing a stretch of 40 feet is in the same white altered andesitic tuffs and the floor is 20 feet wide. Small open cuts 120 north east of the quarry show very limited sections containing quartz veinlets and auriferous tetradymite. The same thing features to the southwest of the quarry with no definite width clearly shown, but enough to suggest that local shearing along a strike north 73 degrees east exists and andesite porphyry

dykes or sheets come into the geology of this precipitous slope at this end of the property and were fractured and mineralized with quartz stringers which carry tetradymite. A sample taken by the writer gave:- Gold, a trace; silver, a trace; from a contact shear following the north side of an andesite porphyry dyke at the edge of the ravine, west of the present workings.

The one tunnel down the slope that penetrates the replacement deposits opened up in the quarry was driven during the winter of 1931 -32 at altitude 3,196. The tunnel follows a silicified band striking due south across the volcanic tuffs; at 48 feet in a dark andesite dyke or basic volcanic appears at face of tunnel, and without cutting into this rock a northeast course is followed for 12 feet coming in to the replacement ore body; at this point a raise connects the tunnel level with the quarry floor 30 feet above it. A second tunnel 50 feet west from the portal of the tunnel noted above and down the slopeat altitude 3,135 feet has been driven into the bedded volcanics following a southwest course for 46 feet and stops 30 or more feet short of its objective of testing out at the depth conditions noted in the first adit. A third tunnel 70 feet to the north of the tunnel described as driven into thequarry face has been advanced 15 feet south. The only information available from these tunnels is that they emphasize the crumpled structure and thin bedded character of the volcanics.

The Andesite tuffs strike north 20 degrees west and dip 50 degrees southwest. It would appear that the anticline seen on the north side of the gorge below Kathlyn falls persisted southeastward and the gold bismuth telluride deposit is on its southwest limb possibly not far from the axis of the fold. Slickensided surfaces suggest that there has been local shearing across this structure permitting access to mineral solutions which altered sections of the andesite tuffs to a chalky white mineral into which was also introduced

native gold, tetradymite, molybdenite, silver-cobalt sulphides and bunchy coarse aggregates of quartz chrystals, also segregations of arsenopyrite, which come out in nodular form.

The widths of the white alteration zones vary from a few inches, showing but little bismuth to a width of 7½ feet showing good mineralization in the quarry just above the raise. When the property was examined by Douglas Lay, resident engineer in June 1930 there were eight different places showing bismuth mineralization within a vertical range of 160 feet and a horizontal range of 500 feet. The little development work since outside the 100 foot length at the quarry affords but a meagre amount of information.

Chemical analysis of the white replacement material gives;-

Silica, 54.5 per cent
Alumina, 26.5 per cent
Ferric oxide, 0.3 per cent
Calcium carbonate, 10.7 per cent;

the remainder being composed of bismuth minerals. On the material shipped to the smelter with bismuth treated under the lead schedule, credit was given for the silica content, which in the three shipments ranged from 56 to 58.7 per cnet. Other elements noted in Trail Smelter analyses being:-

Lime, 4.08 to 4.5 per cent
Sulphur, 0.2 to 0.5 per cent
Iron, 0.5 to 1 per cent
Gold, 1.4675 to 3.0985 oz.
Silver, 0.1 to 1 oz per ton.

The following assays indicate the width of mineralized material found in the replacement deposit, where three carloads of ore were quarried out and shipped. The best representative sample obtained by the resident engineer, Douglas Lay in 1930 was across 7½ feet, which assayed:-

Gold, 0.43 oz
Silver, 0.10 oz
Bismuth, 2.2 per cent.

A sample taken across 15 feet at another point in the quarry

gave:-

Gold, 0.18 oz

Silver, 0.22 oz to the ton.

A sample across 26 inches gave:-

Gold, 0.34 oz

Silver, 0.1 oz

Bismuth, 8 per cent

Selected specimen assays show a much wider range in gold values in the tetradymite deposits; one assay of 20.92 and another of 19. 14 ounces in gold. in 1930 Douglas Lay got the following results from a specimen assay:-

Gold, 13.2 oz

Silver, 1.8 oz

Bismuth, 5.2 per cent, per ton.

This and other sample assays indicat a wide variation in the gold gold ratio to the unit of bismuth. The writer was shown several specimens of the ore containing visible gold also some unusually large tabular hexagonal crystals of tetradymite, 1 to 2 inches across and 1/8 of an inch or more in thickness, which had been obtained from the quarry.

The large crystals of tetradymite found in the quarry are associated with coarse massive aggregates of a purplish to brownish grey garnet and milk white quartz. The garnet contains spangles of tetradymite. In general the tetradymite is so finely divided as to produce only greyish areas and grey bands through the otherwise white altered rock. There is a limited amount of finely divided molybdenite also in the rock at the quarry and spots of cobalt bloom were noted near the top of the quarry rock face.

A further point of interest in connection with the mineralogy of the deposit at the quarry is an assay made by widdowson of Nelson, which gave:-

Gold, 6.79 oz;

Silver, 3.7 oz;

Platinum, 0.29 oz, per ton.

Northeast of the quarry gold values persist in open

cuts into similarly altered rock and Mr. Campbell obtained over a width of 3½ feet on the west side of the largest cut:-

Gold, 0.34 oz, per ton.

From 4 feet in center of cut:-

Gold, 0.12 oz, per ton

From selected sample:-

Gold, 2.9 oz per ton.

Below the southwest end of the quarry in the drift where the tunnel turns northeast leading to the raise assays were as follows:- at the turn over a width of 1½ feet, gold, 0.09 oz, per ton, and 5 feet northeast of the turn a sample across a width of 2½ feet gave:-

Gold, 1.48 oz per ton.

These assays at 30 feet below the quarry level are given because it is only from that it can be determined that gold values are present.

Three carloads of ore aggregating 108 tons shipped from th the gold-bismuth telluride deposit returned a total of 199.309 ounces of gold and 56.16 ounces of silver. The first shipment of 28 tons went froward in December 1933 and the tenor of the ore was:-

Gold, 3.0985 oz

Silver, 0.55 Oz per ton.

The third shipment, 39 tons in October 1935 yielded:-

Gold, 1.5255 oz.

Silver, 1.0 oz, per ton.

A good deal of material was taken out of the quarry in addition to what was considered of shipping grade. There is no way of telling what ore remains in the ground in this vicinity, considering the nature of the deposit. Only further development and careful assaying can throw light on this matter.

Pure tetradymite, $Bi_2 (Te.S)_3$ or Bi TeS, is very soft flexible in laminae, perfect basal cleavage, foliated, steel-grey colour and bright metalic lustre. It will mark paper like graphite. Its specific gravity is 7.2 to 7.6 and it contains 51.9 per cent of bismuth. Tetradymite is not

common enough to be an ore of bismuth; a bismuth deposit to be rich enough to mine should contain 3 per dent bismuth and very few deposits do contain that amount. The production of bismuth in general is as a by-product, the metal is derived mainly from lode ores of gold, silver and copper.

Proof that tellurieds may sometime crystallize at high temperatures is wellestablished. Tellurides are not known as products of igneous consolidation. A pyrometasomatic deposit of the gold-arsenopyrite type occurs at Hedley, B.C., where impure limestones are converted into contact-metamorphic minerals with arsenopyrite in the vicinity of gabbro and diorite sheets, which, undoubtedly, produced the metalization. The ore minerals are, in order of abundance, arsenopyrite, pyrrhotite, chalcopyrite, pyrite, sphaleerite, tetradymite and molybdenite. In the upper levels free gold occurred associated with tetradymite, while at greater depth the gold is intimately bound up with the arsenopyrite and is not amenable to amalgamation. There is very little silver; traces of platimum (as sperrylite?) and nickel are present.

The position of the gold-bismuth telluride replacements of Glacier gulch has already been noted in relation to the silver-lead-zinc, fissure vein which outcrops approximately the same altitude 540 feet to the northeast. The fissure vein definitely strikes south 40 degrees west in the tunnel at altitude 2,880. These two glacier gulch deposits considered together contain all of the ore minerals noted in the Hedley deposit. The fact that tetradymite occurs in the upper levels in the Hedley deposit supports local structural evidence that the two deposits on the south slope of Glacier gulch may be part of one mineralized zone.

Mineralogical variations laterally and vertically are to be expected if the igneous bodies outcropping to the southwest of the quarry are the source or come from the same source as the mineral solutions. The development of coarse garnet aggregates betoken high temperatures at the quarry and no garnet was seen in the open cuts northeast from the quarry.