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GEOLOGICAL SURVEY

MEMOIR 214

GEOLOGY AND MINERAL DEPOSITS OF
FREEGOLD MOUNTAIN, CARMACKS
DISTRICT, YUKON

BY

J. R. Johnston

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OTTAWA
J. O. PATENAUDE, I.S.O.
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1937

Price, 10 cents

No. 2446

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Illustration

Map 450A. Freegold Mountain area, Yukon TerritoryIn pocket

Geology and Mineral Deposits of Freegold Mountain, Carmacks District, Yukon

INTRODUCTION

Freegold Mountain area has attracted attention in recent years following the discovery there of gold-bearing quartz veins. The mountain lies within a belt of intrusive rocks that occupies the Dawson range of southwestern Yukon. The locality is 28 miles northwest of Carmacks post office. Carmacks is 200 miles down Lewes river from Whitehorse, Yukon.

During the summer of 1936 the writer made a detailed examination of the geology and prospect openings on the mountain. A map was made, on a scale of 1,000 feet to 1 inch, of an area enclosing the main prospects. D. M. McKinnon, J. R. Clark, and J. L. Phelps ably assisted in the field.

Various accounts of the geology, mineral occurrences, and prospecting developments at Freegold mountain have been given by H. S. Bostock in reports for the period 1931 to 1935.¹ The surrounding region is described in Memoir 189.² The writer, in the following report, has used the data in these publications.

Gold-bearing magnetite was discovered on Freegold mountain in 1930 by P. F. Guder, who staked the first claim on this showing. Although this deposit, owing to its contact metamorphic character, apparently restricted size, and limited development, proved unattractive to engineers who later examined it, the spectacular values obtained from early samples created wide interest in the mountain which resulted in a stampede in the spring of 1931. Few of the many claims staked at the time were systematically prospected. During subsequent years, however, a few individuals persisted in their search for gold lodes in the vicinity, and revived interest by discovering a number of gold-pyrite quartz veins on the southwest slope of the mountain. These veins have since constituted the most promising showings within the area.

At the present time travel into Freegold mountain is by trail from Carmacks. The Whitehorse-Dawson road is followed for 11 miles north of Carmacks to a point near Crossing creek. The trail then follows the north side of Crossing Creek valley and crosses a divide to Seymour creek at the base of the mountain, the total distance from the road being 26 miles. In 1934 the N. A. Timmins Corporation widened and rerouted the Crossing Creek trail in places and put in a number of bridges. These improvements allow tractor and sleigh haulage in winter, and pack-horse freighting in summer. Airplanes have been landed on a lake at the head of Seymour creek. This point is near the trail and approximately 6 miles from the mountain.

The area, owing to its proximity to Dawson range, has a considerably higher rainfall during summer months than the plateau region to the east.

¹ Bostock, H. S.: Geol. Surv., Canada, Sum. Rept. 1931, pt. A, pp. 7 to 13; Sum. Rept. 1932, pt. A II, pp. 8 to 14; Sum. Rept. 1933, pt. A, pp. 5 to 8; Mem. 178, pp. 8 and 9; and Mem. 193, pp. 9 to 12.

² Bostock, H. S.: "Carmacks District"; Geol. Surv., Canada, Mem. 189.

Run-off is rapid, however, due to the steep slopes and to the frozen condition of the subsoil, and water is, therefore, scarce on the higher parts of the mountain. The many attempts to utilize water in surface prospecting have, as a rule, been unsuccessful. An adequate supply of water for milling purposes exists in Seymour creek which flows along the west base of the mountain. Snowfall in winter is reported to be moderate, but as the area is mantled with snow during all but four months of the year, the season for surface prospecting is short. With adequate camp facilities, however, mining could be conducted throughout the year.

Timber-line is at approximately 4,200 feet above sea-level on the south side of Freegold mountain and 3,700 feet on the north side. Good stands of timber, suitable for camp buildings, mine timbers, and firewood, are available on the slopes of Seymour creek and in many of the valley bottoms surrounding the area.

It is improbable that sufficient hydroelectric power for mining could be obtained locally owing to the small size of the streams and to the fact that they freeze in winter. For an extensive operation such power might be obtained in larger, more distant streams. It has also been suggested that the coal deposits at Carmacks might be utilized.

GENERAL CHARACTER OF THE MOUNTAIN

Freegold mountain is a northwest-trending ridge lying to the east of, and forming an outlying part of Dawson range, one of the interior mountain groups that rise above the level of the Yukon plateau. The summit of the mountain is 4,772 feet above sea-level. The mountain is separated from the main range by the valley of Seymour creek, and from the plateau country to the east by Stoddart creek.

The topography is the result of erosion without glacial modification, the topographic forms being characteristic of the unglaciated region within which the mountain lies. Stream gulches are "V"-shaped in cross-section and steepen rapidly in profile towards the crest of the mountain, from which they radiate. Northeast-southwest profiles across the Freegold ridge are symmetrical in shape. The mountain sides rise steeply out of Seymour and Stoddart creeks, flatten to gentle intermediate slopes, and steepen again on the uppermost surfaces. The latter, like the intermediate slopes, are long and smooth in profile, their continuity being broken only by occasional castellated outcrops. The intermediate slopes, lying between elevations of 3,500 and 4,300 feet above sea-level, are believed to be part of the mature erosion surface of the Yukon plateau. The summit of the mountain, standing several hundred feet above this surface, probably owes its higher elevation to the presence of numerous finely textured, erosion-resistant dyke rocks.

The valley walls of Seymour and Stoddart creeks are precipitous and a marked topographic unconformity exists between the normal slopes of the mountain and these lower valley slopes. In cross-section the valleys appear as deep troughs in the centre of more widely flaring "V"-shaped depressions.

Rock outcrops are usually scarce. Within the area examined less than 6 per cent of the bedrock surface is exposed. The rest of the area is covered

by a layer of varying thickness, composed of angular rock fragments and soil. Both components are residuals of erosion and are of local or near-local origin. Where transportation by running water has been adequate to remove the finer debris, such as on the more prominent features of relief and on southward-facing slopes (where the thawing action of the sun is most pronounced), well-defined areas of coarse detritus occur. These aggregate approximately half the surface of the map-area. The relatively flat upper surfaces of the mountain are covered by a complex agglomeration of such fragmental material. Individual lithological types, however, are fairly well confined to distinct patches and little scattering appears to have taken place. Furthermore, trenching has proved rock float to lie close to its point of origin. In mapping it was assumed, therefore, that variations in lithology of this coarse detritus represent like variations in the underlying bedrock. On the steeper south-facing slopes, where more appreciable movement of the detritus has occurred, estimates of the point of origin of the fragments were made by comparison with the movement of talus which had obviously come from nearby outcrops. Blank areas on the map are those in which the finer products of decomposition have accumulated and predominate. These areas are on north-facing slopes and at the heads of stream gulches and completely mask the underlying bedrock.

GEOLOGY

The rocks of Freegold mountain may be divided into three groups, which differ widely in age. Starting with the oldest these are: (1) metamorphic rocks, (2) stocks, (3) dykes. The metamorphic rocks include gneisses and quartzites that extend in a belt across the northeastern side of the mountain. These are part of the Yukon group and are believed to be of Precambrian age. Granitic stocks of Upper Jurassic or later age make up much of the remainder of the mountain. These granitic rocks comprise two groups: a group of syenite porphyry and related rocks; and a group of granodiorite, granite, and related rocks. The former group is the older. A wide variety of basic and acidic dykes occur intruding all the other consolidated formations. They probably vary in age from the later stage of granitic intrusion to some period in the Tertiary. In general the acidic dykes are younger than those of basic composition.

Table of Formations

Late Tertiary to Recent	Alluvium
Tertiary	Quartz-feldspar porphyry, feldspar porphyry, rhyolite, felsite
	Andesite porphyry, diorite porphyry, monzonite porphyry, granophyre
Upper Jurassic or later	Granodiorite, granite, albite granite, granodiorite porphyry
	Syenite porphyry, granite porphyry, quartz monzonite, hornblendite
Probably Precambrian	Yukon group: gneiss, quartzite, mica schist, graphite schist

YUKON GROUP

Metamorphic rocks of the Yukon group outcrop on the north side of Freegold mountain and extend southeast in a crescentic belt across Schist creek to Emmon hill. These are recrystallized, schistose and gneissic rocks of sedimentary and intrusive origin. They occur in elongate bodies that are inclusions and pendants in the granitic and syenitic intrusives of the area.

Gneisses are the common metamorphic rocks and with them are interbanded quartzites and micaceous schists. Gneisses on Emmon hill occur across a width of nearly one mile. They are strongly foliated, grey to greenish, medium- to fine-grained rocks composed of quartz, feldspar, hornblende, and biotite. The constituent minerals vary in amount across the strike of the gneissic foliation, giving the rocks a decidedly banded appearance. This appearance is emphasized by the presence of numerous sill-like layers, varying from fractions of an inch to several inches in thickness, of fine-grained, light-coloured, granitic and aplitic material. A small body of gneiss that occurs near the summit of Freegold mountain is dark green and composed of hornblende, quartz, and plagioclase feldspar. Most of the rock is foliated, but the gneiss grades in places into a rock with the texture of a normal, fine-grained diorite. Gneisses that outcrop on the divide between Liberty and Cabin creeks, and contain the original magnetite discovery on the mountain, are for the most part finer grained than those of Emmon hill. Two types occur: a dark green variety that has the composition of a hornblende diorite, and a grey variety containing tremolite and having the composition of quartz monzonite. Both types are strongly foliated and are cut by dyklets of aplite and pegmatite which, as a rule, are parallel to the gneissic foliation. Veinlets of epidote occur in both rocks, but are most common in the darker gneiss.

Quartzites occur near the magnetite deposits and extend northwest in a band, which widens to 200 or 300 feet on the ridge between Cabin and Guder creeks. These rocks are light to dark grey, and cherty to granular in texture. They are thinly bedded and contain layers of black, micaceous and graphitic schist from a few inches to fractions of an inch in thickness. A little crystalline limestone is interbedded with the quartzites, particularly in the vicinity of the magnetite deposits where it has been largely altered to calcic silicates such as garnet, epidote, and actinolite. Bands of quartzite several feet wide, and identical with that described above, occur in places in the gneiss of Emmon hill. On a hill about one mile east of the summit of Freegold mountain exposures of impure quartz-muscovite schist are interbanded with hornblende gneiss, but the latter rock predominates.

Although local irregularities in structure are common in the metamorphic rocks, the structures generally follow a persistent crescentic trend across the area. At the south end of Emmon hill banding and foliation in the gneisses strike north-south and dip steeply east. On the north side of Freegold mountain the structures strike northwest, and dip steeply to the northeast. Between these extremes the rocks exhibit north-northwest strikes, with steep dips to the east or northeast. Bedding, as seen in the quartzites, is closely parallel to the foliation of the gneisses and schists.

The gneisses, schists, and quartzites are intruded by all the other rocks of the map-area. They are part of a larger belt that extends from

the head of Seymour creek northwest to, and beyond, Big creek, and have been mapped as part of the Yukon group, believed to be of Precambrian age.¹

SYENITE AND ALLIED TYPES

Intrusive rocks of moderately alkaline composition border all but the northwest end of the stock of granodiorite exposed on the Seymour Creek side of Freegold mountain. The predominant type is coarse-grained, porphyritic, hornblende syenite. Associated with it are hornblendite and quartz monzonite, which are believed to be differentiates of the same magma as the syenite.

In the typical syenite porphyry perfectly formed pink orthoclase phenocrysts, varying from $\frac{3}{4}$ inch to $2\frac{1}{2}$ inches in length, occur in a coarsely crystalline groundmass of feldspar, hornblende, and quartz. The average rock is estimated to contain 50 per cent orthoclase, approximately half of which forms the phenocrysts, 20 per cent oligoclase, 5 to 10 per cent quartz, and 25 to 20 per cent hornblende and accessories. The accessory minerals are apatite, titanite, diopside, and magnetite. At the mouth of Forrest gulch, around the upper part of Seymour creek, and at the head of Schist creek, are areas in which the hornblende is less abundant and quartz is prominent in the groundmass. This phase is a hornblende granite porphyry. In general the syenite is rich in quartz near its contacts with the younger granite and granodiorite.

Exposures of the syenite porphyry usually show phenocrysts in an alinement that trends northwest. Paralleling this alinement is a vague banding in the rock due to alternate abundance and paucity of phenocrysts. Wide streaks and patches, in which the orthoclase phenocrysts are small in size or absent, are a marked feature of the syenite bordering Seymour creek. This phase has the composition of quartz monzonite and contains approximately equal parts of orthoclase, plagioclase, hornblende, and quartz.

Along the east side of Freegold Mountain ridge and across its northern end the syenite porphyry intrudes gneisses and quartzites of the Yukon group. Close to these contacts the intrusive grades into hornblendite. A large body of hornblendite is exposed in cliffs opposite the mouth of Foster creek and smaller patches occur elsewhere in the syenite along Seymour Creek valley. A small body intrudes gneiss near the top of Emmon hill. The typical hornblendite is coarsely crystalline and composed of green hornblende with minor amounts of all the other minerals of the syenite porphyry. Magnetite and diopside are prominent accessories.

As they are mineralogically alike and in most places show gradational contacts with one another, the syenite phases, the quartz monzonite, and the hornblendite are all believed to be derivatives of a common magma. The hornblendite body near Foster creek is intruded by syenite porphyry and quartz monzonite. This intrusion and the marginal position of the hornblendite body relative to the other alkaline phases indicate that the hornblendite was probably the first differentiate to crystallize. The syenite porphyry and quartz monzonite appear to be contemporaneous types. Sharp boundaries occur between the two. These limits, however, are defined only by the presence of numerous phenocrysts in the former type and their

¹ Bostock, H. S.: Geod. Surv., Canada, Mem. 189, pp. 14 to 19.

absence in the latter; the monzonite appearing to be continuous with, and identical with, the groundmass of the syenite.

Shearing is locally pronounced in the syenite porphyry and related intrusives. Outcrops on Grizzly gulch, at the north end of Freegold Mountain ridge, and in places along the south side of Seymour creek consist of crushed aggregates of feldspar phenocrysts in a groundmass of sericite and chlorite, the whole traversed by veinlets of epidote. At the head of Liberty gulch, syenite containing numerous inclusions of andesitic volcanic material is altered to a mass of chlorite, feldspar, and epidote.

The syenite and related types intrude rocks of the Yukon group and are intruded by the granodiorite and related types. The syenite and granodiorite groups, together with other intrusive types in Carmacks district, are believed to be Upper Jurassic or later in age.¹

GRANODIORITE AND RELATED INTRUSIVES

The body of granodiorite and granite that occupies much of the west side of Freegold mountain is referred to here as the Seymour Creek stock. This intrusive mass is approximately one mile wide and extends northwest along Seymour creek from the vicinity of Grizzly gulch to the mouth of Bow creek. Similar rocks lie in a narrow northwest-trending belt that crosses the head of Liberty creek. The gneisses of Emmon hill are intruded by granodiorite of a batholith that occupies most of the country east to Lewes river.

The predominating type of the Seymour Creek stock is grey, medium- to coarse-grained granodiorite composed of oligoclase-andesine, quartz, orthoclase, hornblende, and biotite, with accessory sphene, magnetite, and apatite. The rock tends to be porphyritic with occasional pink or white feldspar phenocrysts. Granite outcrops at the head of Porcupine gulch and in places along the lower slopes of Seymour creek. The granite is pinkish grey and composed of quartz, oligoclase, orthoclase, and biotite. Although the granite and granodiorite are distinct types, no intrusive contact was seen between the two.

The elongate intrusive body at the head of Liberty creek varies markedly in composition. In its central and widest part the intrusive is a greenish white albite granite composed of 57 per cent albite, 28 per cent quartz, 3 per cent orthoclase, and 12 per cent chlorite, epidote, calcite, sericite, apatite, magnetite, and zircon. The presence of occasional large albite crystals gives the granite a somewhat porphyritic texture. The narrow northwest and southeast extremities of the intrusive mass, and its southwestern border, are composed of greyish white granodiorite porphyry. This peripheral phase is coarse-grained, with corroded spheres of quartz and euhedral crystals of zoned oligoclase-andesine set in a groundmass of smaller plagioclase crystals, intergrown quartz, and orthoclase, biotite, hornblende, and accessory minerals. The biotite and hornblende are largely altered to chlorite and epidote. Close to its contact with syenite porphyry at the head of Liberty gulch the granodiorite porphyry becomes light grey and much finer grained.

¹ Bostock, H. S.: Geol. Surv., Canada, Mem. 189, p. 39.

Granodiorite on the east side of Emmon hill is similar in composition to that of Seymour Creek stock. Near its contact with the gneisses it is strongly foliated and contains a high percentage of biotite. This foliated phase resembles the intruded gneisses. The granodiorite, however, is coarser in texture and lacks the banding that is so characteristic of the gneisses.

The granodiorite and related types, as well as the syenite porphyries, belong to a group of granitic intrusives that are widely distributed in Carmacks district. Although the various types of the group show intrusive relationships with each other they all are thought to have originated during an extended period of batholithic invasion, which took place in Upper Jurassic and later time.¹

DYKES

A conspicuous feature of the geology of the area is the presence of many and varied dykes. Most of these occur near or within the Seymour Creek stock of granodiorite and they trend approximately parallel to the borders of the stock. The dykes are divided into a group of andesite and related types and a group of quartz-feldspar porphyry and related types. In the main the former group is older than the latter.

Andesite and Related Dykes

These include dykes of andesite, monzonite, and granophyre. The andesite types occur predominantly along the summit of Freegold Mountain ridge and on Emmon hill. Small, dark green andesite dykes were seen in various places elsewhere, but these are not abundant and are too small to be shown on the map. The monzonite and granophyre types occur along Seymour Creek valley where they intrude granodiorite and syenite porphyry.

The typical andesites are dark green or grey in colour and mottled with irregular, white to pink plagioclase phenocrysts in an aphanitic groundmass. Dioritic phases occur in which the groundmass is finely crystalline and composed of feldspar, hornblende, biotite, and quartz. The monzonites are mottled like the andesites, but can be distinguished from the latter by their reddish colour. They consist of orthoclase and oligoclase phenocrysts in a fine-grained to cryptocrystalline groundmass of feldspar, quartz, chlorite, calcite, and epidote. The granophyres are composed of occasional vague quartz and feldspar phenocrysts in an aphanitic groundmass. Under the microscope the latter is seen to be a mass of spherules of intergrown quartz and feldspar. In outward appearance the granophyre dykes closely resemble phases of the quartz-feldspar porphyries. They are distinctly reddish in colour, however, and are similar mineralogically to the monzonite dykes. They have, therefore, been mapped in the same group as the latter.

Andesite dykes on the summit of Freegold mountain intrude syenite porphyry and the gneisses of the Yukon group. They strike northwest and appear to dip southwest. The andesite dykes of Emmon hill tend to follow the structure of the gneisses in which they occur, striking north-south and dipping steeply east. It is noticeable that in both cases the dykes dip towards bodies of granodiorite and a possibility exists that they may be,

¹ Bostock, H. S.: Geol. Surv., Canada, Mem. 189, p. 39.

in part, near-surface phases of the granodiorite. The monzonite and granophyre dykes of Seymour Creek valley intrude both syenite porphyry and granodiorite. They invariably strike northwest and dip at angles of from 60 to 70 degrees to the southwest.

Quartz-feldspar Porphyry and Related Dykes

Dykes of this group occur everywhere in the map-area, but are most abundant on top of Freegold Mountain ridge and in the granodiorite of Seymour Creek stock. They are usually well defined either by outcrops or by conspicuous rows of broken fragments of the dyke rock. Two unusually large areas, one between the heads of Cabin and Porcupine gulches, the other northeast of the head of Rambler gulch, were found to be almost wholly covered by broken fragments of quartz-feldspar porphyry. These areas are believed to be underlain by dykes that dip southwest at low angles closely conforming to the hill-side slopes they occupy.

The dykes of the group are all much alike in appearance due to a marked uniformity in colour and texture. They are white to light cream coloured, fine to densely textured, and conspicuously free of dark-coloured minerals. The main type is porphyritic with phenocrysts of quartz, or of quartz and feldspar, in a microcrystalline groundmass of quartz and feldspar. Many of the latter minerals are in the form of micrographic intergrowths and contain small grains of magnetite and tiny shreds of chlorite. A second common type is felsite, which consists almost entirely of cryptocrystalline quartz and feldspar. A variety of rhyolite occurs that is cherty and banded with alternating quartz-rich and feldspar-rich layers. A few small feldspar porphyry dykes were seen in which pink to orange coloured feldspar phenocrysts occur in a dark, felsitic groundmass. This type was invariably found to be oxidized.

A large dyke, locally known as the "Whale vein," crosses Major creek, and Forrest, Fairclough, Rambler, and Grizzly gulches. It is composed largely of quartz-feldspar porphyry, but has also been a channel for successive deposition of vein-quartz. Much of the dyke is now a breccia composed of angular fragments of quartz-feldspar porphyry cemented by quartz. As shown on the map the dyke branches at its extremities; the upper branches appear to dip steeply northeast into the mountain, the lower branches may dip to the southwest.

The quartz-feldspar porphyry and related dykes on the summit of the mountain characteristically split and coalesce along their courses, thus including large masses of the intruded rocks. Many variations in structure probably occur, but most of the surface traces of these dykes appear to indicate a general dip to the southwest. Two parallel dykes that cross the upper part of Major creek dip at 50 to 60 degrees to the northeast.

With few exceptions all phases of the quartz-feldspar porphyry group are believed to be closely associated in age. In many places different types occur as parts of the same dyke. Some of the dark feldspar porphyry dykes intrude other types. The quartz-feldspar porphyry and related dykes may be, in part, complementary to, and contemporaneous in age with, the andesite group. In general, however, they intrude members of the latter group and are, therefore, younger.

Nothing definite is known of the age of the dyke rocks as a whole. As mentioned previously some of the andesite types may be extensions of the granodiorite intrusives and, therefore, of approximately the same age as the granodiorites. Other andesite dykes, however, plainly intrude the granodiorites. The same is true of the quartz-feldspar porphyry group. The fine-grained texture and spherulitic structure of many of the quartz-feldspar porphyries and the granophyres suggest that these types solidified near the surface. Elsewhere in Yukon acid intrusives, corresponding to the quartz-feldspar porphyry dykes of Freegold mountain, have been thought to be of Tertiary age.¹

STRUCTURE

The metamorphic rocks of Freegold mountain exhibit structures that are typical of the rocks of the Yukon group elsewhere in Carmacks district. Bedding and foliation in these quartzites and gneisses follow the regional trend, striking northwest and dipping steeply northeast.² On the east and north sides of the mountain some structural control appears to have been exerted by the metamorphic rocks on the syenite porphyry that intrudes them. The smaller bodies of syenite porphyry in these places are sill-like in form and dip northeast in concordance with the metamorphic rocks.

All other primary structures of the area are those of intrusive rocks in contact with one another. The main structure is that of Seymour Creek stock. This body is an intrusive of granodiorite into syenite porphyry. It is elongated in a northwesterly direction and the traces of its lateral contacts (on the northeast and southwest) strongly suggest that the stock is a sheet-like body dipping steeply southwest. The albite granite mass at the head of Liberty creek is also elongated northwesterly. Here, again, variations in the body's contacts suggest a dip to the southwest and the mass may be an apophysis of Seymour Creek stock.

Structures secondary to the main intrusives are fractures, faults, and joints. The dykes follow a fracture system that is well defined in the main, but embodies numerous local irregularities. As noted in their description the general trend of dykes is northwest and most of them dip steeply southwest. A few dykes on the summit of the mountain and on Seymour Creek slope trend northeast and dip vertically. Dykes on Emmon hill, and in places on the east and north sides of Freegold mountain, tend to follow the structures of the gneisses and quartzites they intrude and might more properly be called sills. No faults of large displacement were observed in the area, but such may be present. Certain irregularities in contacts may be due to faults, but this could not be verified owing to lack of outcrops. Minor faults and numerous joints occur in most of the rock exposures. It was not found possible, however, to correlate those as features of definite systems.

¹ Bostock, H. S.: Geol. Surv., Canada, Mem. 189, p. 44.

² Bostock, H. S.: Geol. Surv., Canada, Mem. 189, p. 7.

MINERAL DEPOSITS

The mineral deposits of Freegold Mountain area consist of magnetite bodies and quartz veins. The former group, and many of the latter, are of interest because of their gold content.

MAGNETITE DEPOSITS

The magnetite deposits are at the northwest end and on the east side of Freegold mountain. A number of trenches and pits reveal deposits in place and magnetite float indicates their presence elsewhere over a large area. The best exposure is the original discovery on the Augusta claim and a considerable part of the following information is based on examinations of this single deposit.

The magnetite bodies occur within quartzites and schists of the Yukon group close or adjacent to contacts with the granitic rocks. Excavations made on the deposits reveal little to indicate their shape or dimensions. In general, however, they are believed to be irregularly lenticular in form and to conform in structure with the metamorphic rocks. Like the latter, they probably strike northwest to west, and dip steeply northeast or north.

The principal mineral is magnetite and with this are smaller amounts of hematite, pyrite, chalcopyrite, quartz, actinolite, garnet, epidote, calcite, limonite, and gold.

Magnetite occurs in massive crystalline aggregates, as irregularly dispersed octahedra in the other minerals, and in bands of $\frac{1}{16}$ - to $\frac{1}{2}$ -inch width alternating with narrow layers of quartz.

The hematite is specular and micaceous. It is most common in the wall-rock where it is seen as flaky crystals and veinlets in the silicates. Hematite in the ore appears to have partly replaced magnetite.

Pyrite and chalcopyrite are not abundant, but occur as small crystals in quartz and in minute fractures in the magnetite.

The quartz is crystalline and glassy and in many places shows comb structure and vugs. It occurs interstitially between masses of magnetite and as fracture fillings in the magnetite. Under the microscope the larger patches of quartz are seen to be fractured and traversed by a network of tiny veinlets of a second generation of quartz stained with limonite.

Occasional small patches of actinolite, garnet, and epidote occur in the ore, but these silicates form a much larger proportion of the wall-rock where they are typically developed as crystals surrounded by quartz and calcite. The garnet is a yellow-brown variety and may be andradite. The epidote is typically green. The actinolite is green, acicular, and occurs in sheaf-like clusters.

Limonite is distributed abundantly through the quartz and magnetite as fracture and cavity fillings.

The writer was unfortunate in his attempt to obtain specimens of the magnetite showing gold. The occurrence of gold in these deposits has been described by H. S. Bostock¹ as follows: "The gold occurs here and there as small patches visible to the unaided eye. The patches are scattered through the limonite and under the microscope numerous minute particles

¹ Bostock, H. S.: Geol. Surv., Canada, Sum. Rept. 1931, pt. A, p. 12.

can be seen around larger ones. Gold was noted adjacent to magnetite but never in it. Tiny wires and films of gold also occur between quartz crystals in the vugs."

The association of magnetite with the silicates actinolite, garnet, and epidote indicates that the bulk of the deposits are of contact metamorphic origin. These minerals are believed to have been deposited selectively in impure calcareous bands of the quartzites, by replacement. At a slightly later period the character of the mineralizing agents changed somewhat, with consequent introduction of quartz, pyrite, chalcopyrite, and gold. The direct cause of the contact metamorphism has not been ascertained. A variety of intrusive rocks exist in the vicinity of the deposits, but no contacts between the magnetite and intrusives are exposed. The deep-seated intrusive nearest to the magnetite on the Augusta claim is a body of syenite porphyry. It has been suggested that the mineralization may have originated from this phase of the granitic rocks.¹

Rich values in gold were found in samples of magnetite when these deposits were discovered. Later work has revealed a number of bodies of magnetite, but these are small and gold values have been disappointing in the deeper openings. These excavations do not penetrate completely below the zone of oxidation, so that the tenor of primary magnetite below this zone is unknown. The structure and composition of the deposits are such as to permit a near surface concentration of residual gold. The magnetite itself appears to be impervious to chemical decomposition. Fresh magnetite can be chipped from surface exposures and large, rounded boulders of magnetite have been found far down the mountain sides as foreign elements in decomposed surficial material of local origin. In the process of erosion, however, the magnetite deposits have suffered equally with surrounding rocks; blocks of magnetite have been broken up by frost action and removed by gravity with little decomposition. In the case of the minerals filling fractures in the magnetite, the silicates, sulphides, and hematite have all been oxidized in place. It seems probable that under such conditions gold, which is a component of these fracture fillings, would tend to collect in residual form along with the limonite in fractures below the surface layer of broken materials.

QUARTZ VEINS

Quartz veins occur as fissure fillings, many of which follow shear zones, mainly within and near bodies of granodiorite and granite; as fillings in brecciated dykes of quartz-feldspar porphyry; and as gash veins in the metamorphic rocks of the Yukon group. Mineralogically the veins include barren types and those that contain sulphides and gold. Most of the gold-bearing types are fissure-fillings with quartz and sulphides, and occur: (1) in gneiss, quartzite, and granodiorite at the north end of Freegold Mountain ridge, and (2) in granodiorite of Seymour Creek stock.

(1) *Gold-quartz Veins at the North End of Freegold Mountain Ridge*

A number of quartz veins containing sulphides and gold have been discovered on claims situated around the heads of Liberty, Cabin, and

¹ Bostock, H. S. : *idem*, p. 12.

Guder creeks. Although some of the earlier showings proved to be exceedingly attractive little attempt has been made to follow the leads or to explore and prove the continuity of any one of them. Most of the veins have been exposed only at a single point, so that information concerning them is necessarily meagre.

Veins occur in granodiorite of the intrusive body at the head of Liberty creek, and in gneiss and quartzite of adjoining areas. Commonly the veins lie within or adjacent to dykes of quartz-feldspar porphyry. In general they strike east-west and may dip steeply either to the north or south. Widths vary, but few are greater than 2 feet.

The veins contain pyrite, chalcopyrite, galena, sphalerite, arsenopyrite, and gold in a gangue of quartz, in some cases with calcite and siderite. Some differences in mineral content suggest that several types of vein-deposits may be present. Tourmaline has been identified in the quartz of one deposit. In most of the veins the quartz is finely crystalline and dark blue-grey, with very small, disseminated crystals of sulphide. A few veins have been discovered in which galena is the dominant metallic mineral and occurs with chalcopyrite and pyrite. Pyrite, however, predominates in most of the veins, particularly in those in which the best gold values have been found. The latter are mineralogically similar to the gold-quartz veins in the Seymour Creek stock.

(2) *Gold-quartz Veins of the Seymour Creek Stock*

The portion of the Seymour Creek stock in which veins of this group are best known and have been most intensely prospected lies along the upper parts of Forrest, Fairclough, and Rambler gulches. This area is strewn with fragments of sheared and altered granodiorite and, in exposures, the underlying bedrock is seen to be traversed by a set of intersecting fracture systems and shear zones. In one system veins occur in shear zones that strike 30 to 70 degrees east of north and dip steeply northwest. This system intersects shear zones, fissure veins, and quartz-filled felsitic dykes which trend 10 to 20 degrees west of north and usually dip steeply northeast.

The typical gold-quartz veins, as known at present, follow shear zones in the northeast-trending system. The veins vary from fractions of an inch to 3 feet in width and occur as parallel sheets across widths of 2 to 10 feet or more. As a rule, in any one exposure a single vein is well defined and paralleling this are smaller veins and fractures filled with gouge, limonite, or crushed sulphides.

The wall-rock consists, in the main, of granodiorite, and near the veins and shear zones it is altered to a mass of soft material containing some fractured quartz grains and many fractured and altered feldspar crystals in a cement of kaolin, chlorite, sericite, pyrite, and other alteration products.

Quartz, which forms the predominant vein-filling material, varies in texture from massive to finely crystalline. The former type is milk-white in colour, although occasionally darkened by clusters and rosettes of acicular crystals of tourmaline. The other type is dark blue-grey due to disseminations of fine crystals of sulphides. Some of the quartz is ribboned, with alternate seams of gouge and sulphides, and has occasional cavities

containing inward pointing quartz crystals. Minor amounts of carbonates and chlorite may be seen in the veins, but are more common as stringers in the altered wall-rock.

The main metallic minerals are pyrite, arsenopyrite, sphalerite, galena, chalcopyrite, pyrrhotite, and gold. Pyrite is the most abundant sulphide in the veins and in the altered wall-rock. It is fine grained as a rule, but crystals up to $\frac{3}{4}$ inch in diameter have been seen. Arsenopyrite is common both in the quartz veins and, in places, in the wall-rock. It is usually quite abundant in the thin black seams of sulphides, which along with streaks of gouge give the quartz a ribboned appearance. Chalcopyrite and pyrrhotite are rare; sphalerite and galena occur in minor quantities.

The gold apparently occurs distributed in the quartz and in seams of sulphides. Spectacular specimens of quartz containing particles of gold visible to the eye have been obtained in surface showings and underground in these veins. Such specimens are unusual, however, showing that the gold is locally concentrated into shoots. Aside from these specimens the best assays have been obtained from samples taken across the dark crystalline quartz and across seams of sulphides. Gold has also been obtained in samples of the wall-rock.

The mineral assemblage of the gold-bearing veins suggests that they were formed under moderate to high temperature conditions and should continue to a considerable depth, provided the fissures are maintained. The length of the veins should give some measure of the depth they attain. A vein on the Laforma group has been traced 900 feet by excavations made at fairly regular intervals, and other showings believed to belong to the same vein would give it a total known horizontal length of 1,500 feet. A vein on the Brown-Fairclough group has been traced 1,000 feet, but several wide gaps occur in this distance. The width of the shear zones which the veins follow and the intensity of shearing favour maintenance of these structures to considerable depth.

The northwest-trending fracture system in the Seymour Creek stock area embodies shear zones, fracture fillings of quartz, and narrow dykes of quartz-feldspar porphyry. In many cases the latter are much fractured and the spaces are filled with quartz. The greater part of the quartz in all these openings appears to be barren of sulphides, but some blue-grey quartz containing sulphides occurs, and with this gold has been found although not as yet in commercial quantities.

The relationship between this system and that of the northeast-trending veins is uncertain. No intersections between the shear zones of the two systems were observed. A northeast-trending quartz vein exposed on the surface of the Laforma group, however, is offset in places by a northwest-trending shear zone. Quartz-feldspar porphyry dykes that follow the northwest direction appear to be much more intensely fractured than those that follow the other direction. Mineralogically the two systems are alike except in proportion of minerals; the sulphides and gold apparently predominate in the northeast system. The inference from these observations is that the fracture systems developed contemporaneously, although movement may have been greater and more prolonged in the northwest system, and that conditions for mineralization were more favourable in the northeast system than in the other.

The proximity of the mineralized quartz veins to dykes of the quartz-feldspar porphyry group suggests a genetic or structural relationship between the veins and the dykes. Aside from the gold-bearing veins in the fracture systems described above some pyritic quartz containing low gold values has been found in a large compound dyke of quartz and quartz-feldspar porphyry which extends in an east-west direction across the mass of Seymour Creek stock and lies below the area of known gold-bearing veins. As mentioned previously many of the mineralized veins at the northwest end of Freegold mountain occur adjacent to or within dykes of the quartz-feldspar porphyry group. That this relationship is probably structural rather than genetic is suggested by the facts: that some of the veins occur independently of the dykes; that many of the dykes are fractured and the resulting spaces filled with mineralized or barren quartz; that the dykes themselves are rarely mineralized, and that where such is the case the mineralization occurs in streaks or narrow veinlets that may be offshoots from nearby quartz veins. From this it seems evident that, in many cases, the mineralizing agents followed the same channels as the dykes as well as fissures developed after the intrusion of the dykes. The development of the fracture system commenced before the intrusion of the dykes and continued during the mineralizing period.

DESCRIPTION OF DEPOSITS

Laforma Group

The claims of this group are situated along the middle and upper parts of Forrest gulch on the Seymour Creek slope of Freegold mountain. The property has been described in some detail by H. S. Bostock in Memoir 189. During the winter of 1934-35 a tractor trail was built to the property from the Whitehorse-Dawson road, camp buildings erected, and some underground exploration was done, under option, by the N. A. Timmins Corporation. Additional work was carried on in the winter of 1935-36 by the Yukon Consolidated Gold Corporation, but in the following spring the corporation dropped its option and the property reverted to its owners, W. J. Langham and associates.

The workings include numerous surface openings and a total of over 2,000 feet of underground exploration, much of which has been done on a single vein zone on the Goose claim. This zone is exposed on the surface by trenches spaced at fairly regular intervals along a distance of 900 feet, and other exposures along the same line indicate that it may continue to a length of at least 1,500 feet. Adits have been driven to intersect the vein zone at elevations of 3,940, 3,800, and 3,650 feet.

The lowest of the adits, driven north 35 degrees west, intersects the vein zone at a distance of 150 feet. From this point a drift, known as the "east drift," follows the vein zone northeast for some 800 feet and constitutes the main working on the property. Short crosscuts are driven on both sides of the drift at intervals of about 100 feet. The situation at the southwestern end of the drift has been described as follows: "The drift and crosscuts from it show a shear zone in granodiorite 20 to 30 feet wide, striking north 22 degrees east and dipping vertically to 80 degrees west. The shear zone is followed by veins of quartz, crushed and altered wall-

rock, seams of gouge, and seams of sulphide. On the west or hanging-wall side the shear zone is bordered by a quartz porphyry dyke 5 to 8 feet wide. The most persistent vein of quartz is on the east or foot-wall side. It varies in width from 9 inches to 4 feet, and seams of sulphide and gouge occur where the thickness is greater. In the central part of the shear zone a number of prominent fractures or faults that contain seams of gouge and sulphide occur over a width of approximately 2 feet. On the hanging-wall side of the shear zone adjacent to the dyke other veins of quartz and seams of sulphide are present, and in one place quartz vein material occurs on the west side of the dyke."¹ The description above is based on an examination made when the drift had been driven a distance of 400 feet. Farther to the northeast the shear zone appears to widen, but includes a greater proportion of wall-rock. The foot-wall of the zone continues to be well defined and is closely followed by the drift to a point about 700 feet from the entrance of the working. Beyond this point fracturing and mineralization weaken along the foot-wall and the drift has been driven in the hanging-wall side of the zone. The main feature of the hanging-wall side in this vicinity is a seam of gouge that progressively widens towards the northeast. In west crosscuts at 600 and 700 feet from the entrance of the drift it is 4 feet wide and, from the appearance of the material in a caved west crosscut at the extreme northeastern end of the drift, it is probably considerably wider in this direction.

From the point of intersection of the lowest adit and the shear zone in the "east drift" a crosscut extends west for a distance of 165 feet. The crosscut exposes: the hanging-wall side of the shear zone at 15 feet; narrow fractures containing quartz, gouge, and sulphides at 65, 100, and 130 feet; and a dyke of quartz porphyry at 90 feet from the adit. The fractures are divergent in strike and the largest is $2\frac{1}{2}$ feet in width. The dyke is 4 feet wide, strikes east-west, and dips 45 degrees north. Most of the granodiorite wall-rock between and beyond these structures is unaltered.

About 150 feet above these workings an adit has been driven north 60 degrees west. At a distance of 35 feet the adit connects with a raise driven up from a point in the "east drift" 350 feet from the entrance of the latter. The adit is reported to intersect the shear zone a few feet beyond its connexion with the raise, but at the time of the writer's visit this part of the working had caved.

The uppermost adit enters the mountain along a course north 37 degrees east, and crosses the hanging-wall side of the vein zone at 55 feet. It shows here much altered granodiorite streaked with numerous seams of gouge. The most prominent of these strike north 15 degrees east and dip 80 degrees northwest. The foot-wall side of the zone, opened by an east crosscut, had caved when examined, but 25 feet above the level of the adit a large open-cut shows the foot-wall to be occupied by a width of 6 feet of quartz streaked with seams of gouge and iron oxide.

Pyrite is the main metallic mineral and occurs with other sulphides disseminated through the quartz and in streaks in the quartz and sheared wall-rock. A large number of samples have been taken for assay from many parts of the vein quartz and sheared wall-rock in the vein zones.

¹ Bostock, H. S.: Geol. Surv., Canada, Mem. 189, pp. 54-55 (1936).

Many of the samples from surface exposures gave assays of over an ounce a ton in gold. The underground work proves the persistence of the structures exposed on the surface to the depths explored and confirms the persistence of gold below the zone of oxidation.

The Alpha claim of the Laforma group adjoins the Goose claim on the south. Following the discovery of rich gold-bearing quartz float on the claim a northwest-trending vein was exposed by a trench, now caved. An adit has been driven for a distance of 247 feet with this vein as its objective. The adit is at elevation 3,516 feet and follows a course 24 degrees east of north. Through most of its length the tunnel is in blue-grey quartz porphyry. A number of north-south striking shears and seams of gouge occur in this and the quartz porphyry is streaked in places with narrow veinlets of quartz, but no well-defined quartz vein is exposed.

Brown-Fairclough Group

This group, comprising six claims situated below timber-line in the vicinity of Rambler and Fairclough gulches, is held by Messrs. A. Brown, G. Fairclough, and associates, of Selkirk. A description of the property is given in the Mining Industry of Yukon Report for 1936.¹

The claims are heavily covered with soil and slide-rock, but most of the area is believed to be underlain by granodiorite of the Seymour Creek stock and this is bordered to the south by a mass of syenite porphyry. A large, irregular dyke of quartz-feldspar porphyry extends east-west across the centre of the property. The prospect openings are north of this dyke. Bits of rock float and a few small exposures indicate the presence of smaller porphyry dykes among the workings, but the disposition of these could not be ascertained.

The workings, consisting of trenches and open-cuts 3 to 8 feet deep, reveal veins of quartz in sheared granodiorite. Much of the wall-rock is altered to a material composed of quartz grains in a groundmass of kaolinized feldspar and chlorite. The main direction of shearing is northeast and this direction is followed by seams of gouge and limonite and by most of the vein quartz.

On the Wild Rose claim a succession of trenches are spaced at irregular intervals along a northeast-trending line 1,000 feet long. Vein quartz is revealed in six of the trenches, including those at the extremities of the line. The vein exposures are somewhat divergent in strike, but all strike in northeasterly directions, dip 60 to 80 degrees northwest, and probably belong to a single vein zone. Widths of quartz vary from a few inches to 3 feet. The largest opening, which is at the northeast end of the line of trenches, reveals three irregular quartz veins separated by walls of altered granodiorite. The total width of quartz and altered wall-rock is at least 15 feet, but considerably less than half of this is quartz.

A second northeast-trending row of three trenches lies 100 feet east of the Wild Rose workings. The trenches are spaced 30 feet from each other. The northeast trench shows no vein matter. The southwest trench exposes a vein 12 inches wide which dips and strikes parallel to the Wild Rose veins and is bordered on its hanging-wall side by 24 feet of sheared granodiorite

¹ Bostock, H. S.: Geol. Surv., Canada, Mem. 209.

and iron-stained clay. In the middle trench a 12-inch vein strikes north and dips at 70 degrees to the east. A narrow intersecting vein here appears to parallel the vein in the lower trench.

The veins are stained and streaked with limonite which also stains much of the wall-rock and occurs in seams of gouge. Occasional bits of freshly broken quartz show unoxidized metallic minerals consisting mainly of pyrite with lesser amounts of arsenopyrite, chalcopyrite, and other sulphides. Visible gold occurs in small quantities in some of the oxidized vein matter and good assays in gold have been obtained in the quartz and, to a lesser extent, in the adjoining sheared granodiorite of both vein zones.

Rambler Claim

This claim, held by the owners of the Laforma group, is situated on top of Freegold Mountain ridge near the head of Rambler gulch. The country rock is granodiorite of the Seymour Creek stock. A small open-cut exposes a vein of quartz 12 inches wide in somewhat altered granodiorite. The vein strikes north 25 degrees east and dips 75 degrees northwest. A shallow shaft has been sunk at a distance of 500 feet from this point and between the two workings are two shallow pits. The shaft and pits were found to be caved. Quartz on the dumps and in the exposed vein is blue-grey and mineralized with iron pyrite. Native gold is reported to have been found in the quartz float that led to the discovery of the showings. A number of smaller veins of similar type have been found on this and the adjoining Nabob claim.

Red Fox Claim

This claim, held by P. F. Guder, is situated at the head of Guder creek and adjoins the Gold Star claim on the northwest. The underlying rock is gneiss and quartzite intruded on the west by granodiorite. A vein containing galena was found on the claim in 1931. It was not seen by the writer, but has been described by H. S. Bostock:

"The vein is exposed in two cuts approximately 30 feet apart on the steep side of the draw. It strikes approximately east and dips nearly vertically. It is 6 to 8 inches wide and composed of lumps of sheared galena between which limonite and gouge occur, the exposures being well up in the zone of weathering. The wall-rock is quartzite. Small amounts of chalcopyrite and sphalerite occur in the galena."¹

Guder Property

A number of claims at the northwest end of Freegold mountain are held by P. F. Guder of Carmacks. The claims lie across the head of Cabin creek and include the Liberty, Augusta, Margarete, Gold Star, and others. Much of this area is underlain by metamorphic rocks and these are intruded on the west by granodiorite and granite of the Seymour Creek stock.

The first discovery of lode gold at Freegold mountain was made by Mr. Guder in a body of magnetite on the Augusta claim. This deposit is a replacement of a limy layer in quartzite and schist. The magnetite body is elongated in a northwesterly direction and exposed by trenches at intervals

¹ Bostock, H. S.: Geol. Surv., Canada, Sum. Rept. 1931, pt. A, p. 13.

of 50 to 100 feet for a distance of some 300 feet. The width of the magnetite is uncertain; in the southwesterly trench the body is at least 5 feet wide and 200 feet northwest of this magnetite is exposed across the full length of a trench 15 feet long. In the longest trench a pit, caved when examined, has been sunk to a depth of 20 feet, entirely in magnetite.

When the deposit was discovered free gold was found in the oxidized ore and assays as high as several ounces a ton were obtained from this material. Further work revealed somewhat lower gold values in the less oxidized magnetite. A number of other bodies of magnetite have been discovered on other claims of this group and on the adjoining Morning and Badger claims, but none of these deposits has been explored.

In addition to the magnetite deposit a quartz vein has been discovered on the Augusta claim near its west boundary. The vein had been exposed by a trench for a length of 16 feet, but as the working was caved it was not possible to determine its structure or width. Mineralized matter on the dump consists of quartz containing pyrite, chalcopyrite, arsenopyrite, sphalerite, calcite, siderite, limonite, and copper carbonates.

On the Margarete claim, following the discovery of mineralized metamorphic rock by trenching, a shaft, since caved, was sunk to a depth of 20 feet and, in a drift extending $14\frac{1}{2}$ feet south of this, a vein 2 feet wide was exposed. The vein strikes east and dips steeply north. On the hanging-wall side the vein is walled by feldspathic schist, on the foot-wall side by a dyke of quartz porphyry. Both types of wall-rock are mineralized, like the vein, with pyrite, chalcopyrite, and arsenopyrite. The quartz exposed on the dump is very heavily mineralized and assays in gold from it have been as high as 60.2 ounces a ton. A long southwest-trending trench has been cut in the hill-side, 350 feet northwest of the shaft. The trench cuts across the contact of the metamorphic rocks and the granodiorite of Seymour Creek stock and has exposed several narrow quartz veins. One of these may be a continuation of the Margarete vein.

On the Gold Star claim a shallow shaft, also caved, has been sunk to explore an east-west striking vein similar to the Margarete vein. The shaft is close to the contact between granodiorite and quartzite and a drift is reported to have been driven to this contact. The dump above the shaft contains much quartz porphyry mineralized with pyrite, but little vein quartz was seen.

The Peerless claim adjoins the Gold Star on the west. On this a small shaft, now caved, has been sunk to expose a vein of blue-grey quartz mineralized with tourmaline and sulphides. The vein is in quartz porphyry which, in the form of a large dyke, intrudes granodiorite.

Morrison Property

Claims held by A. Morrison and a group of Whitehorse men are situated on the northeast side of Freegold mountain in the forks of Liberty creek. The main geological feature in this area is an elongate, northwest-trending body of albite granite which intrudes metamorphic rocks and syenite porphyry. The granite grades into granodiorite along its southwest contact and most of the prospect openings are in this contact phase. The

main workings are two shafts referred to as the east and west shafts. These were not accessible when visited by the writer but have been described by Bostock:

"The west shaft was 8 feet deep and showed a vein 12 to 16 inches wide striking north 80 degrees west and dipping very steeply south. The wall-rock is an altered granitic rock. The vein matter is quartz containing finely crystalline pyrite, but most of the sulphide originally present in the vein appears to have been leached out. Some limonite and some copper stain are also present. A small fault fracture along the vein contains gouge from which gold is said to have been panned. Fifty feet to the south of the west shaft is a parallel vein of blue-grey, fine-grained quartz and pyrite. The east shaft is approximately 300 yards east of the west shaft. At the time of the writer's visit the east shaft was filled with water. It is said to show a vein 7 feet 10 inches wide, striking approximately east. The vein matter on the dump is blue-grey quartz with pyrite."¹

American Yukon Gold Company's Property

This company holds a group of nine claims situated on the higher parts of Emmon hill approximately 2 miles southeast of the summit of Freegold mountain. The top and western side of the hill are underlain by banded gneisses which strike north to north 20 degrees west and dip steeply east or northeast. Bands of black or greyish quartzite, several feet wide, occur in places and are elongated parallel to the gneissic foliation. On the east side of the hill the gneisses are intruded by granodiorite.

Prospect openings, consisting of trenches and a timbered shaft, are grouped about a point 1,000 feet north of the summit of Emmon hill. The first discovery here was a vein of coarse stibnite, barite, quartz, and carbonate. The writer did not see this material in place. A partly caved trench exposes grey granular quartzite mineralized with pyrite and stained with iron and manganese oxide. Surface float indicates that the quartzite extends northwest in a band, bounded on both sides by gneiss, for a distance of about 1,000 feet. The width and dip of this band could not be determined.

The shaft, a few feet east of the quartzite exposed in the trench, has been sunk to a depth of 92 feet. Crosscuts to intersect the quartzite have been driven at depths of 40 and 92 feet and are reported by the owners to be 27 and 50 feet in length, respectively. Ice, which covered the walls of the crosscuts at the time of the writer's visit, prevented their examination. A large part of the dump above the shaft consists of quartzite and it is evident that a considerable part of the workings are in this rock. The quartzite is grey to bluish in colour and granular in texture, some of it being heavily mineralized with pyrite. Some vein quartz was also noticed on the dump.

Assays as high as \$60 a ton in gold are reported to have been obtained at a depth of 15 feet in the shaft. The owners report most consistent values at depths of 60 and 65 feet where assays varied from \$26 to \$31 a ton.

The mineralization and geological occurrence of this deposit indicate that it may be a pyritic replacement and of a type distinct from other gold-bearing deposits known on Freegold mountain. Insufficient information is available, however, for correct classification.

¹ Bostock, H. S.: Geol. Surv., Canada, Mem. 193, p. 10 (1936).

Whale Claim

This claim is one of a group held by Messrs. J. H. Carpenter and W. Forbes and is situated on the south slope of Freegold mountain just east of Grizzly gulch. The country rock is syenite porphyry intruded by numerous dark andesite dykes. The most conspicuous geological feature is a dyke varying in width from 30 to 40 feet and known as the "Whale vein." This dyke strikes east and may be an extension of a similar dyke that crosses the granodiorite of the Seymour Creek stock farther west. Its dip is not known. The dyke is composed of white quartz-feldspar porphyry, but has also been a channel for successive depositions of vein quartz, and consequently contains much vein quartz. Near its eastern exposure a large open-cut has been blasted across the dyke, showing it to be composed of blocks and fragments of quartz-feldspar porphyry cemented by quartz. Some of the quartz is milky white and chalcedonic, some crystalline and glassy. A little blue-grey quartz containing finely divided sulphides occurs and low assays in gold have been obtained from this.

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