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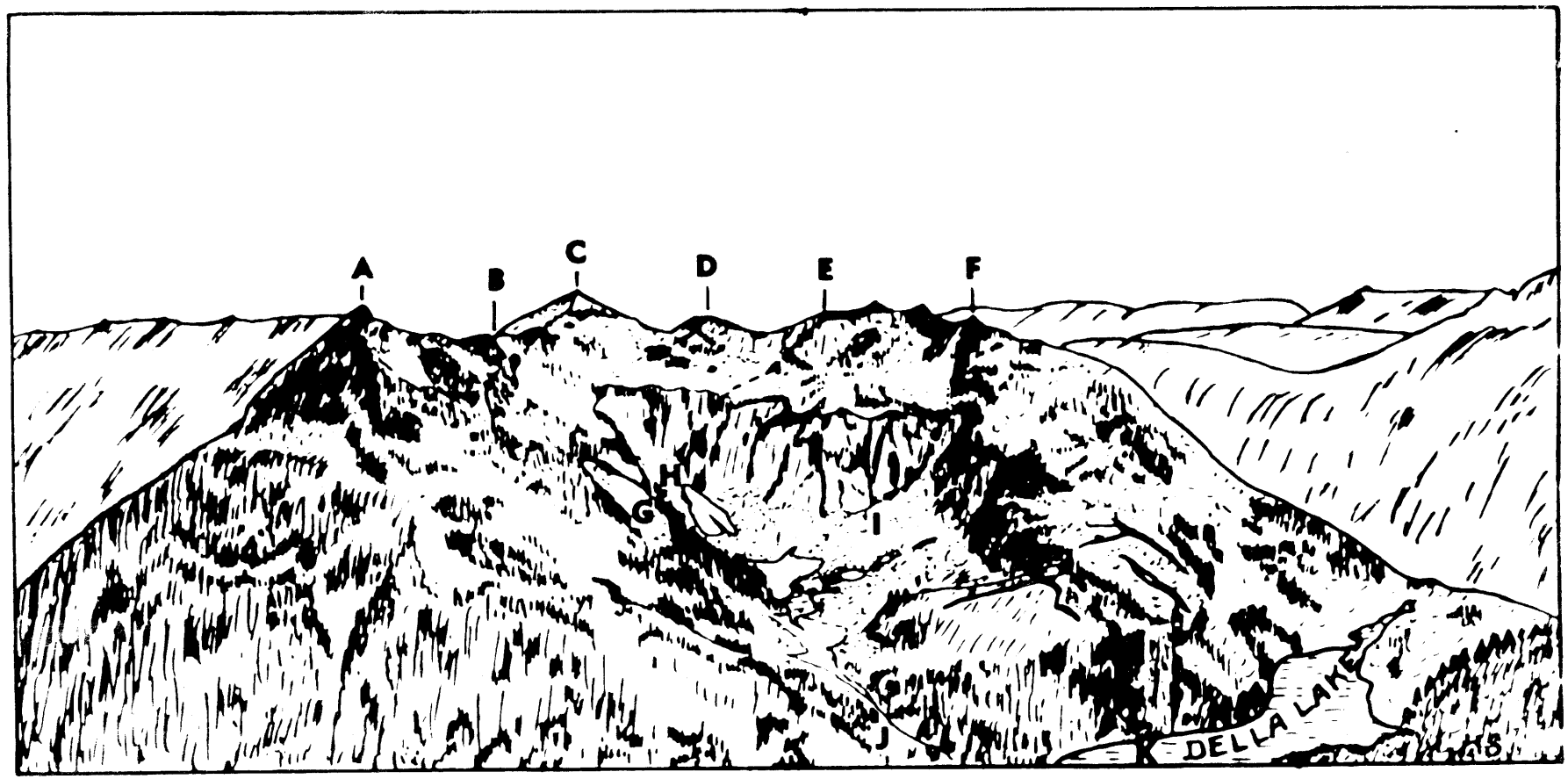
PTARMIGAN (NO. 12-Fig. 1)
BIG I (NO. 13-Fig. 1)

Four Crown-granted claims known as the Ptarmigan group, and adjoining them to the south-east, four Crown-granted claims known as the Big I, or sometimes as the Big Interior group, cover ground which includes the highest peak of Big Interior Mountain and the north-western part of a deep cirque south-east of the peak. The claims are in part in the Alberni and in part in the Clayoquot Mining Divisions. The main peak is approximately 8 1/2 miles north-westerly from the head of Great Central Lake and 11 1/2 miles north-easterly from the head of Bedwell Sound. The claims: Big I No. 6, Lot 1231; Big I No. 7, Lot 1232; Great Central No. 6, Lot 1233; and Great Central No. 5, Lot 1234; Crown-granted in 1913, have been called the Ptarmigan group and are owned by Ptarmigan Mines, Limited, an English company with a representative in Vancouver. The claims: Big I No. 1, Lot 1640; Big I No. 2, Lot 1641; Big I No. 3, Lot 1642; and Big I No. 4, Lot 1644; Crown-granted in 1926, have been called Big I group and are registered as owned by Joseph A. Drinkwater and Michael Tebo of Alberni.

A cirque in the heart of Big Interior Mountain is enclosed by a series of high peaks and connecting ridges except where it opens into the hanging-valley occupied by Della Lake, described in the note on the Della. The cirque and the rugged ridges and peaks enclosing it are shown on Plate II, a panorama composed of three photographs looking in northerly directions from the top of Mount Nine Peaks, elevation 5975 feet. On the drawing, (Fig. 4), based on the panorama, a number of reference points are indicated by letters. These letters with the names given in the following paragraph will be used throughout the report.

The term cirque will be restricted to the inner steep-walled part and the outer section connecting it with the valley of Della Lake. The slopes extending from the tops of the steep walls to the peaks and the crests of the surrounding ridges will be called the rim of the cirque. From the main peak "C" a great ridge extends southerly to a second peak, the south peak "A", and thence south-easterly to a pass between Della Lake and a



A. South Peak—elevation 5,900 feet.
B. Southern margin of limestone, on south spur.
C. Main Peak, Triangulation station—elevation 6,107 feet.
D. Knob of limestone.
E. Eastern margin of limestone on ridge.
F. Fracture on western side of peak.
G. Draw.
H. Top of snow mass in north-west corner of cirque.
I. Eastern end of quartz-diorite.
J. Outlet of cirque.
K. Fracture at Della Lake—elevation 3,525 feet approximately.

Fig. 4. Looking northerly into cirque, Big Interior Mountain, copied from panoramic photograph Plate II.

branch of You Creek. This ridge will be called the south spur. From the main peak a ridge extends north-easterly for about a quarter of a mile to a knob "D" and thence easterly for half a mile to "F" the most easterly of several jagged peaks. From "F" a ridge extends southerly sloping down to bluffs which tower more than 500 feet above the shore of Della Lake. Continuing south-westerly with axis paralleling the lake, a spur slopes down to "J", the entrance to the cirque. A snow mass at "H", in the inner corner of the cirque, and a draw "G", of which the head is in the rim on the south spur, will serve as further points for reference. Some other points marked with letters will be defined in the geological descriptions.

The floor of the inner cirque is between 3700 and 3800 feet in elevation. Some snow masses, about as in Plate II, remained in August 1940 and the several shallow lakes were exposed. Pictures published in the Annual Reports, Minister of Mines, British Columbia, probably taken in August 1906, show a very much greater accumulation of snow, which was then referred to as a glacier. From the floor talus slopes rise several hundreds of feet to steep cliffs which wall the inner cirque. An embayment at "H" in the north-western corner has walls which are less steep. Extending southerly from the embayment on the western side of the cirque steep cliffs of quartz-diorite and limestone rise as much as 700 feet above the talus. High rusty bluffs extend south-easterly from the embayment to an escarpment which forms the eastern wall of the inner cirque. The inner cirque has a maximum width of almost half a mile. The width narrows toward the south-east and the stream from the cirque flows through a shallow narrow canyon at "J" into the valley of Della Lake. The distance from the cliffs at the head of the cirque to Della Lake is about three quarters of a mile.

Above the precipitous walls of the cirque the rim rises steeply to the crest and to the several peaks of which the south peak "A" has an altitude of approximately 5900 feet, the main peak "C", of 6107 feet and a peak about three quarters of a mile to the east has an altitude of about 6000 feet. The outer slopes of Big Interior Mountain are steep on all sides. The main peak stands more than 5000 feet higher than the floor of Bedwell River Valley at the mouth of You Creek, less than 2 miles to the south-west. From the same peak, north-westerly to a point on upper Bedwell River, the drop is more than 4200 feet in about 1 1/4 miles. The highest peak between "E" and "F", (Fig. 4), is about 3400 feet higher than the floor of Drinkwater Creek Valley, three quarters of a mile to the east. A glacier of which the head is in the saddle between "C" and "D", (Fig. 4), extends northerly to

the head of one of the sources of Bedwell River. There is also a small glacier in a northerly-facing cirque, in the south peak, "A".

The general geology is indicated on (Fig. 1). Trending south-westerly the contact of the Bedwell River batholith crosses the crest in the saddle between the main peak "C", and a knob of limestone "D", and crosses the crest of the south spur not far south of "C". The main batholith is not exposed elsewhere within the area encircled by the crests surrounding the cirque; but a mass of quartz-diorite, three eighths of a mile from north to south, is exposed between "I" and "H" in the northern wall of the cirque; a second and smaller mass is exposed in the bluffs, westerly from "H", in the north-western corner of the cirque; and a third mass about the size of the second is exposed in the bluffs about 1100 feet to the south. Dykes of quartz-diorite up to 50 feet wide are exposed on the spur on the south-eastern side of the cirque, and numerous smaller dykes of quartz-diorite and of feldspar-porphyry are found in and around the cirque. Dykes of feldspar-porphyry, including a facies rich in hornblende, cut the quartz-diorite.

Limestone outcrops on the crests of the ridge north-easterly and southerly from "C" and extends almost to the foot of steep cliffs between the two smaller masses of quartz-diorite, on the western side of the cirque. On the south spur limestone and overlying thin bedded siliceous and argillaceous sediments are intruded by basalt, doubtless related to the overlying lavas which form the south peak "A", and are important in Mount Nine Peaks to the south and Mount Septimus to the east. The limestone is believed to belong to the same horizon as other faulted masses found in this part of the area. Fossils collected from two limestone masses north-east of upper Drinkwater Creek have been identified and placed in the Permian.

The rocks stratigraphically below the limestone are mapped as a "Palaeozoic and Mesozoic complex". They include fine-grained cherty volcanics and impure tuffs older than the limestone, small bodies of intrusive basalt, and at the eastern side of the cirque a large mass of basaltic rock in intrusive relationship, as well as numerous granitic intrusives. Much of the large mass of basaltic rock consists of rounded cobbles in a matrix of very similar material which grades from fine-grained to a moderately coarse granular texture. This rock passes gradationally to one of more uniformly gabbroic appearance and is believed, like the basalt intruding the sediments on the south spur, to be related to the Lower Mesozoic volcanics.

Much faulting has occurred in this part of the area as indicated clearly where there are limestone masses to serve as markers. Probably there has been movement along some fractures which are indicated by scarps and other topographic features. A fracture cuts through the spur on the eastern side of the cirque and is clearly exposed from "K" on the shore of Della Lake, for almost 1 mile northerly to the peak "F". This fracture strikes west of north, dips steeply westward and for some distance controls the scarp at the eastern side of the cirque. Other fractures control parts of the south-western wall of the cirque.

A good deal of limestone is recrystallized but most of it is unmineralized. At some points, notably near the main peak, garnet, epidote, amphibole, and other silicates replace basalt and limestone. Some of the resulting silicate rock contains a little magnetite. Sulphides are found at a number of points in the silicate rock and, close to contacts with limestone, in the basalt which has been less completely metamorphosed. The sulphides include chalcopyrite, pyrrhotite, and at a few points, molybdenite. In the talus on the upper slopes near the main peak some banded material containing a good deal of malachite is found. Patches green with malachite are to be seen at a number of points. The andesite and fine-grained sediments older than the limestone contain disseminated sulphides and some magnetite at several points. On the rim and in the cirque sulphide mineralization was found in the basalt and in the older volcanic rocks more commonly than in the limestone.

Some of the granitic dykes contain chalcopyrite and pyrrhotite in tiny fractures. Fine grains of pyrite, pyrrhotite and some chalcopyrite are disseminated in some of the granitic rock, particularly near the contacts. Great rusty bluffs at the northern side of the cirque consist of quartz-diorite containing disseminated sulphides. Rusty bluffs on the peaks facing Drinkwater Creek consist of fine-grained rocks of Palaeozoic age, cut by granitic dykes. Grains of pyrite are disseminated through the dykes and the older rocks.

Local concentrations of copper-bearing mineralization and larger masses containing scattered grains of chalcopyrite, in or close to the ground covered by the Crown-granted claims, will be described later in more detail. A little chalcopyrite and some molybdenite were found near a dyke in the escarpment on the eastern side of the cirque. Elsewhere on Big Interior Mountain the writer found little evidence of copper-bearing mineralization.

History

The Annual Report, Minister of Mines, British Columbia, for various years from 1903 to 1933 refer to the Ptarmigan and Big I. The Annual Report, Minister of Mines, 1906 is based on an examination made in August of that year by H. Carmichael and the Annual Report, Minister of Mines, 1916 is based on an examination made in October of that year by W. M. Brewer. The other reports contain the current news of the properties and some of them reproduce information contained in 1906 and 1916.

From the reports it appears that the first claims were located about 1899 by J. A. Drinkwater and D. Nichols, and that at different times other staking was done nearby. Of the various claims staked the eight mentioned in the first paragraph of this report are probably the only ones held for long. Apparently little actual work was done on the ground, although a rather costly campaign of road construction was begun by Ptarmigan Mines, Ltd, and a serious effort was made to take a diamond-drill to the Big I group.

In the Annual Report, Minister of Mines, British Columbia, 1906, Carmichael mentions a 31-foot adit; this appears to be the only reference to any working on either property seen by an officer of the Department. The adit is in the north-western corner of the cirque toward the north-western boundary of the Big I group. Carmichael does not mention any workings farther to the north-west on the ground later acquired by Ptarmigan Mines, Limited; and it is probable that in 1906 there were no workings on this ground. In the Annual Report, Minister of Mines, 1916, Brewer says that in October he was unable to visit the 31-foot adit on the Big I property because the rock was slippery from frost. He says also that for the same reason he was unable to examine three short adits driven on the Ptarmigan property after Carmichael's examination. The present writer found the 31-foot adit; and on the Ptarmigan property found a 15-foot rock-cut from the end of which an adit had been driven 3 feet; but found no other workings within the area covered by Crown-granted claims.

The 1912 and 1913 Annual Reports, Minister of Mines, British Columbia, record that Ptarmigan Mines, Limited, had taken up claims and in 1913 obtained Crown-grants of the claims listed as Ptarmigan group in the first paragraph of this report. The 1913 Report mentions a "tunnel entry of 10 feet" on the property of Ptarmigan Mines, Limited, and the expenditure of $47,000, principally on road construction. The 1914 Annual Report, Minister of Mines, British Columbia, says that the company suspended work because of the outbreak of war.

Apparently Ptarmigan Mines, Limited, intended to build a wagon-road up Bedwell River, to a point from which an aerial tramway would be built to the claims near the summit of Big Interior Mountain. The exact location of the proposed tramway is not mentioned in the reports. It seems probable that the site proposed for the lower terminal of the tramway must have been at least as far up the river as the mouth of Yew Creek, and possibly farther; that is at least 11 miles by road from the head of Bedwell Sound and possibly 12 or 13 miles.

It is reported that when work was suspended in the autumn of 1914, supplies and equipment, including cables for the proposed tramway, were left at the head of Bedwell Sound. Road construction, involving the building of many bridges, had reached the 7-mile post. This was a difficult and costly project requiring the building of many bridges and of much corduroyed road. Powder left at the head of the sound had later to be destroyed. The Annual Report, Minister of Mines, British Columbia, 1919, reports that the company engineer inspected the material, and the road, and found that they had deteriorated greatly. The company does not seem to have attempted further work on the project. In 1939 the wooden bridges and the corduroyed parts of the road had deteriorated so much that they were no longer useful even for pack-horses.

The Annual Reports mention examinations of the Big I property, made by engineers representing one or more mining companies; but there is no statement of any specific work done at the property after the 31-foot adit, which was driven before Carmichael's examination in 1906. In 1916, Brewer says that early in October of that year a diamond-drill was taken in and that a light aerial tramway had been built for taking supplies up the mountain from the river camp on Drinkwater Creek. The tramway, still standing in 1940, extends from the bottom of Drinkwater Creek Valley to the top of the escarpment just north-west of Della Falls. The writer saw a quantity of equipment including pumps, parts of a diamond-drill, pipes and tools still lying near the foot of the tramway. Possibly this equipment was never taken any nearer the Big I property. An electric generator, the remains of which are in an old cabin on the north-eastern side of Drinkwater Creek, and copper transmission wire now used for hand-holds along the Della Falls trail, were probably taken in at the same time as the diamond-drill.

Access

The head of the cirque can be reached from the top of the Della Falls trail by a route along either side of Della Lake, vestiges of a trail remain through timber on the north-western side of the lake. The distance is about 1 1/2 miles by either route. At a few points it is possible to climb well up the cliffs from the cirque, and it may be possible to reach the rim above the cliffs this way. A safer and much easier course to follow, leads south-westerly from the southerly corner of Della Lake to the summit of the pass, a distance of about a quarter of a mile in a straight line, thence the south spur can be followed northerly. Most of the mineralization exposed on the upper slopes is close to the main peak of Big Interior Mountain, about 1 mile west of north from the pass.

The upper slopes can also be reached conveniently from the Bedwell River side by making use of the trail which leads from a camp-site, about 13 1/2 miles by road and trail from the head of Bedwell Sound, to the Casino workings. The camp is at about 1400 feet elevation, a short distance south-east of the river. From it the trail climbs, in about 0.8 miles, to a point at 2600 feet elevation, south-east of the camp. The trail forks here; the left hand fork leads to the mine-camp and to the most extensive workings on the Casino property. The right hand fork of the trail is steep, rough, rather circuitous, and may be hard to follow, but it indicates a route up the very steep north-western side of the mountain to the open upper slopes. This branch of the trail reaches a point, at about 3900 feet elevation, on the western side of a northerly-flowing creek, about 1 1/4 miles from the river-camp. One of the Casino veins is exposed at intervals along the eastern side of this creek. The ridge on the western side can be followed southerly to a small lake at about 4400 feet elevation, and 1 3/4 miles from the river-camp by this route. The lake is a little more than half a mile south-westerly from the main peak. North-easterly from the lake there are high bluffs of quartz-diorite and of limestone. By circling to the south, the crest of the south spur, a short distance south of the peak, can be reached with little difficulty. The writer and his assistant climbed from the river-camp to the little lake in just over two hours. It is possible to go from the little lake to the crest of the main ridge near the best showing in not more than an hour and a half.

Examination in 1940

With two assistants the writer devoted a large part of the 1940 field season to geological mapping and examination

of mineral deposits on Big Interior Mountain, and on Mount Nine Peaks, immediately south of it. By far the greater part of the effort was devoted to Big Interior Mountain. This work included mapping with a plane-table, for which a system of triangulation stations was laid out, and additional information was recorded in photographs taken from several camera stations. Traverses were run on which positions were determined by pacing and compass bearings, and by rough triangulation.

Most of the time the Sherwood base-camp on upper Drinkwater Creek was used as the base. Later, the western parts of the mountains were attacked from the Bedwell River side, using the old You mine-camp and the Casino river-camp as bases. Excluding time spent travelling between the outside and bases, and time spent at the Sherwood base-camp, 32 days in July, August and September were devoted to this work. During this time there were many rainy days and much fog. For plane-table mapping fair visibility and freedom from actual rain were required. Other work was frequently done in the rain. Climatic conditions of this kind are usual in this area.

The rugged and often precipitous slopes of Big Interior Mountain are hazardous when visibility is poor. Large parts of the upper slopes were still snow-covered in mid-August. Talus covers the bed-rock in considerable area on the rim and in the cirque. The difficulty of access, rugged nature of the country and unfavorable climatic conditions, greatly increase the difficulty of examining mineral deposits in this part of the area. Rust-stained rock exposures cover large sections and some copper mineralization is indicated in a very large volume of rock. To sample such a volume of material would be a large task, and to take the samples out for assay would be another.

The principal copper-bearing mineral found in these deposits is chalcopyrite. The pure mineral contains 34.5 per cent copper and has a specific gravity from 4.1 to 4.3. If we take the specific gravity of the average rock as about 2.7, it is apparent that chalcopyrite must make up about 2 per cent of the volume of such rock, in order for the rock to contain 1 per cent copper by weight. Chalcopyrite is a rather conspicuous mineral, and is usually seen readily if present even in small amounts. Therefore the writer feels that careful observation will give a fair indication of whether or not chalcopyrite mineralization approaches commercial grade. The writer took samples representing any material which contained chalcopyrite including material obviously poor in that mineral. These "indicator" samples were designed to support and make more

definite careful observations of the chalcopyrite content. The assays of these samples are given in the following more detailed notes.

Erosion is proceeding rapidly, snow lasts more than half the year, and therefore most material exposed at the surface shows little evidence of secondary alteration. Chalcopyrite, pyrrhotite and pyrite, found in the cliffs, in pieces of talus and in other exposures, show little evidence of alteration. On the other hand malachite, doubtless derived from chalcopyrite, is found at a number of points; and some pieces of talus, near the crest of the "South Spur" northerly from "B", consist of banded material obviously deposited by surface waters, and contain a good deal of malachite. It may be that, from shattered rock where erosion is less rapid, chalcopyrite has been leached out almost entirely, leaving perhaps a little malachite. Masses of shattered silicate rock, consisting largely of garnet, found northerly from "B" on the crest of the "South Spur", and south-easterly from "B" along the contact between limestone and basalt, contain a little malachite at the surface and might be found to contain sulphides a few feet below the surface.

Notes on occurrences of mineralization.

The position of the claims in relation to the topography is indicated on (Fig. 1) copied from Map 92 F/5, published by the Department of Lands in 1939, at a scale of 2 inches to 1 mile, and 100 foot contour interval. The topographic features are conspicuous and the triangulation station on the summit of the main peak of Big Interior Mountain consists of a cairn visible for miles. On the ground the writer found only one indication of the claim boundaries, a point witnessing for one claim post. It is therefore impossible to describe all the occurrences of mineralization in relation to the boundaries of the two properties, much less in relation to the boundaries of the individual claims. For this reason the mineral occurrences are described in relation to topographic features indicated on (Fig. 1) and shown in Plate I, specific references are made to letters in (Fig. 4), a sketch based on Plate II. Based on the boundaries as given on Map 92 F/5 it can be said that the occurrences described in the following notes are almost entirely within the ground covered by the eight claims of the Ptarmigan and Big I properties.

Mineralization exposed in the cliffs on the northern side of the cirque, from "I" to "H", is described first. Reference is then made to disseminated mineralization in the corner near "H" and along the western side of the inner cirque. The next

exposures described are in the draw "G", which may be outside the ground covered by the two properties. The mineralization described next is exposed near the south-western margin of the limestone on the upper slopes of the eastern side of the south spur. Mineralization exposed on the inner slopes not far below the main peak is then described, followed by reference to masses of silicates found in the saddle just north-east of the main peak, and at the eastern edge of the glacier just north of the saddle.

Great rusty cliffs, extending for about 2000 feet westerly and north-westerly, form the northern wall of the cirque. For about 1500 feet, from "I" almost to "H", the cliffs consist of rather fine-grained quartz-diorite which contains inclusions of altered rock. At some points slabs of altered andesite or basalt form a veneer on the face of the cliffs, which are about at the southern boundary of the largest mass of quartz-diorite in the cirque. It appeared to the writer that the contact dipped toward the south and that the cirque advancing northerly has not gone far into this mass. The quartz-diorite belongs to a facies rich in biotite and hornblende and contains grains of magnetite recognized under the microscope. In the cliffs this rock contains tiny scattered grains of pyrite, pyrrhotite and some chalcopyrite. In the inclusions and in the slabs of altered rock exposed in the cliffs there is more-concentrated chalcopyrite mineralization. At some inaccessible points on these cliffs there are small areas of green stain, probably malachite. The most noticeable of these is toward the north-western end, where the face of the cliffs bends from a westerly to north-westerly course.

It seems unlikely that the accessible mineralization in these cliffs approached commercial grade. The amount of chalcopyrite to be seen is definitely small, and there is nothing to suggest that primary copper-bearing sulphides have been leached out. There is more sulphide mineralization in and around inclusions and in the slabs on the face of the cliffs but this material is present in small units, the largest seen by the writer might contain a few hundred tons which certainly would not average 2 per cent copper. A large sample consisting of chips knocked off at intervals in 40 feet was taken along the base of the cliffs, in what appeared to be a fairly representative section of the mineralized quartz-diorite. This sample assayed: Gold, nil; silver, nil; copper, trace.

The talus contains a great volume of rock broken from the cliffs and also contains rock carried down from the rim above. Particularly toward the north-western corner below

the cliffs, the talus contains high temperature silicates which may have come from the zone near the main peak where such silicates are found in place. Mineralization richer in copper is also found near the main peak. It seems probable that scattered pieces of material, much richer in chalcopyrite than is the rock in the cliffs, have contributed to the idea that the talus might be regarded as low grade ore. The present writer does not believe that the talus contains enough copper per ton to cover the costs of extracting it even if the operation were on a large scale.

The second and smaller mass of quartz-diorite is exposed on the western side of the north-western corner of the cirque, north-westerly from "H", about due west of the southern boundary of the mass of quartz-diorite mentioned in the preceding paragraphs. Between the two masses of quartz-diorite, the rock consists of fine-grained dark volcanics and possibly some limestone cut by dykes and less regular granitic bodies. The granitic rocks include quartz-diorite and hornblende-feldspar-porphyry. At some points they have absorbed material from the older rocks producing dark hybrid types which are difficult to identify. The older rocks have been materially altered and frequently consist of fine-grained mottled rocks of indeterminate character. Some of these rocks have been bleached and altered hydrothermally. In these rocks there are many joints containing quartz with a maximum width of 1/2-inch. Three systems of intersecting joints were observed, individual joints are separated from the nearest members of the same series by distances of 1 foot to 4 feet. Some of the joints contain a little chalcopyrite. Fine grains of pyrrhotite, pyrite and chalcopyrite are found in minute irregular fractures particularly in the granitic and hybrid rocks. Small aggregates of magnetite were observed at some points in the altered volcanic rocks.

The writer climbed to a point near "H", at about 4200 feet elevation, near the top of the snow mass on the western side, and then circling to the north-east climbed the bluffs. At about 4625 feet elevation dark quartz-diorite containing pyrite, pyrrhotite and chalcopyrite in minute irregular fractures, was sampled across 5 feet from west to east. It assayed: Gold, trace; silver, 1.0 oz. per ton; copper, trace. The 31-foot adit is a short distance to the east at about 4525 feet elevation, on the eastern side of a small creek which cascades southerly to the head of the snow mass. In front of the portal a dyke of hornblende-feldspar-porphyry, 10 feet wide, strikes north 40 degrees east and dips 85 degrees north-westward. The dyke contains pyrrhotite and chalcopyrite in minute fractures. North-west of the dyke, above the adit

and for some distance west of the creek, the rock is bleached to a light-buff colour. White mica in small flakes appears to be the principal constituent of the rock. Above the adit there are patches stained green with malachite. The adit is driven about north 20 degrees west, in rock that contains some pyrite. On the western wall, 12 feet from the portal, a sample was taken, combining two vertical channels cut from the curve of the roof to the floor. It assayed: Gold, nil; silver, nil; copper, trace. Another sample was cut from the face of the adit It combined two channels cut from the roof to the top of the muck, a distance of 4 1/2 feet; and assayed; Gold, nil; silver, nil; copper trace.

Continuing north-easterly and easterly across several creeks and climbing to about 4800 feet elevation, little sulphide mineralization was seen. Much of the rock traversed consists of quartz-diorite and hornblende-feldspar-porphyry.

On the western side of the north-western corner cliffs of limestone tower above the floor of the cirque. They have a maximum height of about 700 feet, and extend southerly for more than 1000 feet from the small mass of quartz-diorite in the north-western corner to the third mass of quartz-diorite, which is also small, and is exposed in high cliffs. From the foot of the limestone cliffs dark fine-grained volcanic rocks cut by granitic dykes slope steeply to the top of the talus. The limestone high in the cliffs is apparently cavernous, and from openings toward the top streams pour down the face of the cliffs to the narrow strip of volcanic rock at the base. The cliffs are dark grey in colour and are banded suggesting bedding-planes of low dip. Fragments in the talus contain fossils resembling those obtained from other limestone masses in the area but nowhere else in the area did the writer see massive limestone of a thickness comparable with that indicated here. This limestone does not appear to be mineralized. In part of the narrow strip of volcanics below the cliffs there are small cavities from which nests of sulphides have been dissolved by surface waters. A number of hornblende-feldspar-porphyry dykes in this section contain chalcopyrite and pyrrhotite in tiny fractures.

The cliffs continue southerly or south-easterly to about the end of the third mass of quartz-diorite, beyond which a timbered spur projects east of north into the cirque At "E", (Fig. 4), the eastern boundary of the limestone crosses the crest. From this point a plane of weakness extends west of south, dipping westward, and at the top of the escarpment, above "H", marks the boundary of the largest of the three masses of quartz-diorite. This plane projected southerly

crosses the cirque to a bluff which is the continuation of the main wall of the cirque. The bluff, extending upward to the rim, is of limestone and from it the spur extends easterly. The southern limit of the spur is the draw "G". From its head to the bluff the deep steep-walled draw cuts through limestone. Easterly from the bluff the southern slope of the spur is covered with unconsolidated material. The spur appears to be composed chiefly of volcanic rocks.

On the southern side of the draw there are good exposures of fine-grained volcanics and impure argillaceous rocks, generally much altered and cut by many granitic dykes. At about 4200 feet elevation the rock is mottled by alteration. A width of 3 feet with ill-defined boundaries is cut by many joints and is mineralized with pyrrhotite and chalcopyrite. A sample of this material assayed: Gold, trace; silver, trace; copper, 0.1 per cent. At 4350 feet elevation on the northern side of the draw a strong shear is exposed striking north 60 degrees west and dipping 60 degrees north-eastward. The sheared rock across a width of 5 feet is sparingly mineralized with sulphides. To the north above this exposure there is dyke of quartz-diorite which the shear cuts a little farther to the west. In the dyke the shear narrows to 10 inches and contains less mineralization.

Westerly up the draw at about 4525 feet elevation, 250 feet from the point where the shear was found, a fracture strikes north-easterly and dips about 80 degrees northwestward. This is at the bluff of limestone previously mentioned. From the fracture to the head of the draw the northern wall is limestone. The elevation of the top of the bluff is approximately 4850 feet. In the bottom of the draw a shear strikes about due west and dips 45 degrees northward. There is a dyke of quartz-diorite immediately below the shear, and on the southern side of the draw, below the dyke, fine-grained volcanics extend for 25 feet west of the north-easterly striking fracture. Westerly from this point the south wall of the draw also is of limestone. In the volcanic rock on the south side, the fracture contains a dyke of hornblende-feldspar-porphyry. Close to this dyke, at creek level, there is an irregular mass of pyrrhotite 3 feet wide. It is not exposed north of the creek, is not traceable far to the south, and appears to die out upward. The pyrrhotite is cut by veinlets from the thickness of a pencil line to 1/16-inch. They are spaced 1/2-inch or more apart and contain chalcopyrite and some quartz. A sample across the width of 3 feet assayed: Gold, trace; silver, trace; copper, 0.4 per cent.

The draw "G" cuts well into the rim of the cirque. Southerly from the draw the limestone is broken and intruded by basalt. From a point a short distance west of the head of the draw the contact of the main limestone mass, with overlying basalt, follows an irregular course north-westerly to "B" on the crest of the south spur. The course of the contact is marked by a depression with volcanic rocks to the south-west and limestone to the north-east. The depression was partly filled with snow on August 14th, 1940. The contact roughly follows the limestone beds, strike about north 50 degrees west, dip 50 to 60 degrees south-westward, but the basalt is intrusive into the limestone at many points. Cherty and argillaceous beds at the top of the limestone horizon have been largely destroyed as have some of the upper beds of limestone. Much of the limestone is recrystallized, but along most of the contact there is little other evidence of metamorphism.

Following the contact north-westerly sulphide mineralization was found, at 5300 feet elevation, about halfway between the head of the draw "G" and the crest at "B". For about 40 feet north-westerly along the contact and 15 to 20 feet south-westerly rock, which projected through the snow, contains sulphides in irregular masses from an inch to 20 inches wide. This rock, largely fine-grained and basic, contains some garnet and possibly some fragments of limestone. The masses containing sulphides consist of chalcopyrite, garnet, some quartz, and unreplaced rock. Possibly 20 per cent of the area consisted of such material. A selected sample of this sulphide-rich material assayed: Gold, 0.14 oz. per ton; silver, 3.0 oz. per ton; copper, 11.1 per cent. The limestone just north-east of the contact dips 75 degrees westward. A little malachite stain at the margins of cherty nodules was the only evidence of mineralization in the limestone.

Between this point and the crest of the south spur occasional exposures of garnet and epidote were found near the contact but there was little to indicate sulphide mineralization. On the western slope, about 400 feet west of south from the crest of the south spur, the writer found some garnet and a little malachite stain in a small area near the contact. This was the only copper-bearing mineralization found by the writer on the western side of the south spur.

The contact of the limestone with basalt to the south crosses the crest of the south spur at "B", elevation about 5700 feet, and about 1600 feet southerly from the triangulation station on the top of the main peak. Northerly along

the crest the limestone is intruded by basalt and by granitic dykes. Between 350 and 375 feet along the crest the rock consists largely of garnet and shows a moderate amount of malachite stain. Thence northerly for another 350 feet the rock on the crest is basalt which extends for 100 feet or so down the slope to the west, but on the eastern side of the spur limestone is just below the crest. On the eastern side, a short distance below the crest and about 700 feet from the southern margin of the limestone, an adit has been driven for 3 feet from the end of a 15-foot rock-cut. Just past this point the main contact of the batholith crosses the crest. From the contact northerly the crest of the spur is quartz-diorite, as is the main peak about 900 feet to the north. On the western slope the contact runs westerly for some distance, but on the eastern slope of the spur, limestone continues a short distance below the crest for 400 feet northerly. From this point the crest rises steeply to the top of the main peak, about 500 feet farther to the north and nearly 300 feet higher. The side facing south-easterly into the cirque is very steep down to a small snow mass 300 to 400 feet below the peak. Immediately above the snow for 100 to 200 feet there are almost vertical cliffs. On this steep surface the contact is exposed extending north-easterly to the saddle between "C" and "D". The quartz-diorite in the ridge and in the peak contains fragments of basalt, is cut by many open joints, and is very rusty. The contact is irregular, its dip could not be determined but it is probably steep. Below the contact limestone, of low to moderate dip north-westward, is cut by dykes and thick irregular masses of basalt. The limestone and the basalt are cut by numerous dykes of quartz-diorite and hornblende-feldspar-porphyry which strike north-westerly. Relationships clearly marked elsewhere on Big Interior Mountain indicate that the hornblende-feldspar-porphyry is younger than the quartz-diorite.

At several points in a limited section along the contact of the batholith copper mineralization was seen a good deal richer than found elsewhere, with the exception of the occurrence halfway between the head of the draw "G" and the crest of the south spur at "B". The section extends from the cut and adit on the south spur, north-easterly below the main peak, almost to the saddle between "C" and "D", or about a quarter of a mile. Mineralization was found at several points within a vertical range of less than 150 feet and not more than 200 feet south-easterly from the contact. Farther to the south-east snow and talus masked the bed-rock as they did in considerable parts of the area outlined. The almost vertical cliffs below the peak are inaccessible. The examination was therefore limited to the base of the cliffs

and the ends where the cliffs merge with the inner slopes of the south spur and the saddle between "C" and "D". It was difficult to examine the base of the cliffs as the only footing available was the sharp top of the snow 2 or 3 feet from the face of the cliffs. Between the snow and the cliffs an opening extended down 6 to 10 feet. On the other side of the sharp top, the hard snow sloped only less steeply. Involuntarily the writer travelled by this route to the talus 150 feet below.

The cut at about 5775 feet elevation is a short distance east of the crest of the south spur. For 15 feet it follows a fracture westerly and from the end of the cut an adit continues a further 3 feet westerly. The rock here is basalt, but white limestone is exposed to the east, about 40 feet below the floor of the cut. The fracture strikes north 65 degrees west and dips 85 degrees north-eastward, and is at the northern side of the cut and adit. The rock has been silicified and sulphides are disseminated through it. Along the fracture for a width of a few inches there is abundant sulphide mineralization, some garnet replaces the wall-rock and quartz occurs with the sulphides. Molybdenite is present here in addition to chalcopyrite and a little pyrrhotite. A sample was taken at the widest part of the concentrated mineralization 12 feet from the eastern end of the cut. This sample, 8 inches wide, assayed: Gold, trace; silver, 2.0 oz. per ton; copper, 8.3 per cent; molybdenite, 3.3 per cent.

In the zone outlined, north-easterly from the cut, most of the rock exposed is unmineralized limestone; masses of basalt, also unmineralized, and wide dykes of quartz-diorite, containing little sulphide mineralization, make up most of the remaining rocks exposed. There are several rusty patches of garnetized rocks showing areas of malachite stain. Several basalt dykes strike east of north and pinch down northerly as they approach the batholith. Some of these are largely replaced by the garnet and show malachite stain. One basalt dyke, followed northerly for about 100 feet, pinches from 3 feet to 6 inches in width. The narrowed dyke continuing northerly is greatly altered and contains a good deal of malachite. About a third of the way along the zone a 3-foot vein consisting largely of garnet, contains malachite and some chalcopyrite. It strikes north 10 degrees east and dips steeply westward. A sample across the width of 3 feet assayed: Gold, trace; silver, trace; copper, 1.4 per cent. Followed northerly the width diminishes to 8 inches, in a distance of 60 feet or so. At about 5675 feet elevation, toward the north-eastern end of the zone, a sill-like mass, 20 feet thick, is exposed. It consists of fragments of

other rock in a ground-mass of quartz-diorite, strikes north 30 degrees east, and dips 55 degrees north-westward. Below the sill the rock is white limestone and above it there are small masses of limestone. The contact of the batholith is about 60 feet to the north-west up the steep slope. From 125 to 150 feet north-easterly from this exposure there is a band of garnet rock, thence for about 150 feet a mass of rock 10 feet thick contains a good deal of sulphide mineralization. This appears to be basalt replaced in part by garnet and otherwise altered. A sample from what seemed to be a fairly representative section of this rock assayed: Gold, trace; silver, trace; copper, 0.6 per cent. Quartz-diorite immediately above this rock contained very little sulphide mineralization. From this point to the saddle north-east of the main peak, a distance estimated at 500 feet, little bed-rock was exposed.

Limestone is exposed on the eastern side of the saddle, forming the knob "D" and extending easterly along the crest of the ridge for about three eighths of a mile to "E". From the saddle the limestone extends northerly for 800 or 900 feet, rising above the eastern edge of the glacier. Quartz-diorite outcrops in the saddle and continues westerly. On the south-eastern slope, just below the saddle, a considerable mass of basalt outcrops. Immediately above, there is a mass of rock composed almost entirely of bright green amphibole. No sulphide mineralization was observed here. At the eastern edge of the glacier, north of the saddle, the limestone is invaded from below by dykes of quartz-diorite. Beautifully crystallized garnet, epidote, and other silicates replace the limestone for a short distance from the contacts. With these silicates there is a little magnetite and a small quantity of sulphide minerals.