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Item 4

DEPARTMENT OF THE INTERIOR

Geological Survey

September 15, 1927.

Chalk Mountain, Quartz Mountain, Gold Basin, and  
King Mining Districts, Nevada.

The Chalk Mountain and Quartz Mountain mining districts are in southwestern Nevada southeast of Fallon, the nearest railroad station, to which the ore is hauled by autotrucks over the Lincoln Highway and thence shipped to Salt Lake City, Utah. The districts have recently been brought into prominence by the discovery of valuable ore bodies. This general region was examined by the Geological Survey several years ago, but in view of the recent discoveries and considerable production another visit was made in October, 1926. The work was done by F. C. Schrader, geologist, who received valuable aid and information from the local mining companies. The deposits occur mostly in Triassic (?) limestone and are associated with porphyritic intrusive rocks, like the ores of Tintic, Utah, and Leadville, Colo.

### Westgate Range

About 2 miles east of Chalk Mountain, in the west slope of the Westgate Range, which here is composed chiefly of Jurassic limestone, is a north-south series of active prospects or claim groups, including the Mogul, Huber-Morrill, Watkins, Sawyer, Twin Metals, and Wolff. These prospects extend through a distance of several miles and are mostly at altitudes between 5,000 and 5,500 feet. Some of them have made a small production. The deposits, like those at Chalk Mountain, carry lead and silver and occur in veins and replacement bodies in the limestone, but they are closely associated with intrusive andesite and rhyolite and therefore may belong to the Tertiary period of ore deposition.

### Quartz Mountain District

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The Quartz Mountain district is in Nye County, 60 miles east-southeast of Fallon, 25 miles south-southeast of Chalk Mountain, and just northwest of Marble and the old Illinois mine. (See fig. 2.) It is about 8 miles long east and west by 5 miles wide. Quartz Mountain and the town and post office of Quartz Mountain are near its center. (See fig. 1.) The population is about 200. A daily auto mail stage is in operation from Fallon.

The district lies in open rolling country. It is drained southward into Gabbs Valley. The dominant topographic and structural features and the ore deposits trend northwestward. The southeastern part of the district is occupied by the western half of the Lodi Hills, which have the form of an isosceles triangle with its apex on the northwest in Quartz Mountain. (See fig. 1.) The groundwater table probably stands at a depth of about 800 feet.

The district is named from Quartz Mountain, a low elliptical hill about half a mile long and 100 feet high, much of whose northern half is strewn with quartz and whitish silicified rock. Ore deposits similar to those it contains were discovered in 1858 at the neighboring Illinois mine, which produced more than \$100,000 in lead-silver-gold ore, and in 1905 ore was discovered in the western part of the district, 2 miles west of Quartz Mountain, where the Broken Hills mine has produced more than \$210,000 in similar ore.

Ore was discovered at Quartz Mountain in 1920, and by the end of 1925, under the Annette-Walker lease, the discovery property had produced \$90,000 worth of ore. Then the property, henceforth known as the San Rafael mine, and many surrounding claims were taken over by several mining companies, including the San Rafael Co., which has since produced and shipped from the mine about \$250,000 worth of silver-lead ore running about \$40 to the ton and has opened up sufficient ore to continue its present rate of output for a year.

Mining or deep prospecting is also being done on several other properties, including the Quartz Mountain Metals, Hasbrouck, Calico, San Felipe, Exchequer, Standard, Argentum, West Divide, Tripod, Desert, and Iron Mountain. Some of them are opened to depths of 400 feet, and some have made a small production.

### Geology

Most of the surface is covered by a mantle of alluvium or wash, 150 feet in maximum thickness, beneath which the consolidated rocks are mostly Tertiary volcanic flows, but the Lodi Hills, in which are nearly all the recently discovered ore deposits, is chiefly Cretaceous or Jurassic granodiorite porphyry or allied intrusive rocks, together with areas and masses of Triassic (?) limestone and greenstone. (See fig. 1.) The assignments to the Mesozoic are based on age determinations of similar rocks in the adjoining Paradise Range, on the southeast, made by H. G. Ferguson and S. H. Cathcart, of the Geological Survey. In the Lodi Hills the limestone is locally underlain by an older series of volcanic greenstones and tuffs of Triassic (?) age.

The most abundant of the granitic rocks is the granodiorite porphyry, which has intruded and metamorphosed the limestone and together with its complementary dikes of diorite, quartz monzonite, and aplite represents the magma from which the ores were derived. It is a dull greenish-gray medium-grained rock and is locally compressed, with most of its minerals considerably altered.

The oldest sedimentary rock is the limestone exposed in the Lodi Hills. These hills consist mainly of a batholith of granodiorite porphyry containing remnants of a huge limestone roof, most of which has been removed by erosion. The limestone is the principal ore repository. It is a medium to thick bedded

bluish-gray crystalline rock and contains a little interbedded black shale and volcanic greenstone. It has been metamorphosed, faulted, and folded. The structure is mostly monoclinical, as at Quartz Mountain. Just north of Quartz Mountain the limestone is thought to be down faulted and deeply buried by the Tertiary volcanic rocks. It has not yet been found in the Calico mine, which is 400 feet deep with its bottom in rhyolite and granodiorite porphyry. The faulting seems to have included the northeast side of Quartz Mountain, as neither the limestone nor the Lease vein occurs northeast of the fault.

Encircling Quartz Mountain on the north and west is a series of nearly flat-lying, mostly light-colored lavas of Tertiary age, consisting chiefly of rhyolite but including also basic types. The series consists of flows, tuff, and breccia and is about 500 feet thick. (See fig. 1.) These rocks are considerably altered hydrothermally, as well as by oxidation, and contain much sericite.

In places the volcanic rocks are cut by dikes which probably are branches of the younger flows. A large dike of this class is intruded along the contact of the lava flows with the older rocks of Quartz Mountain. It is a brownish-drab dense rock which is regarded as originally andesite but now consists mostly of secondary sericite. Branches of it in the San Rafael mine consist almost wholly of greenish chlorite and actinolite.

In the western part of the district the lava series, which there has not been differentiated, consists chiefly of the andesite and andesite breccia that contains the Broken Hills ore deposits. It has a known thickness of 350 feet.

#### Ore Deposits

The general distribution of the ore deposits and mineralization is indicated by the position of the mines, prospects, and claim groups shown on the map (fig. 1.) The ore deposits occur in two groups -- Mesozoic and Tertiary.

#### Mesozoic deposits

The Mesozoic deposits are genetically associated with the granodiorite porphyry and its complementary dikes. They occur in the limestone in the Lodi Hills area and are mostly the result of replacement. The ores, which yield silver and lead, are characteristically gray and yellowish lead carbonate ores containing lumps of galena. The ore minerals are chiefly cerusite, argentiferous galena, bindheimite, plumbojarosite, anglesite, cerargyrite, argentite, and gold. The gangue mineral consists chiefly of iron-stained comminuted quartz with chert or flint, jasperoid, calcite, dolomite, jarosite, and argillaceous material. Proximity to ore or an ore body in the limestone is usually indicated by the presence of iron or manganese oxides, cerusite, specks of galena, and copper stain. The largest deposits are those of the Lease vein, in Quartz Mountain, which have been most exploited in the San Rafael mine.

The Mesozoic ores were formed by ascending hot solutions as replacement deposits in the limestone at moderate depth and temperature. They were deposited as sulphides, principally argentiferous galena, from which oxidized ore minerals were subsequently leached by descending surface waters and concentrated at lower levels, where they formed new deposits and enriched the ore bodies already there.

The succession of events as indicated at Quartz Mountain was about as follows:

1. Upheaval and intrusion of the limestone by the granodiorite porphyry.
2. Deposition of the Lease vein by hot magmatic solutions ascending from the granodiorite porphyry and circulating through the limestone.
3. A long period of subaerial erosion during which Quartz Mountain and the Lease vein were brought to or nearly to the surface, and the ores were more or less oxidized.
4. Effusion of the Tertiary volcanic rocks, which probably covered Quartz Mountain and vicinity.
5. Intrusion of the andesite dike at the northeast side of Quartz Mountain, accompanied by faulting down of the limestone and the Lease vein on the northeast.
6. A second period of erosion during which the volcanic covering was removed from the Mesozoic rocks at Quartz Mountain and the deposits were further oxidized and partly enriched by descending surface waters.

### Tertiary deposits

The Tertiary deposits occur chiefly in veins and fault-breccia zones in the Tertiary volcanic rocks. They contain lead, silver, and gold. The ore minerals are chiefly cerusite, argentiferous galena, argentite, cerargyrite, and gold. The gangue consists chiefly of brecciated wall rock, more or less altered and mineralized, quartz, and calcite, with a little sphalerite and traces of antimony. Most of it is more or less stained with iron and manganese oxides. Besides the Tertiary deposits at Broken Hill, which are to be described in a later report, there are a few at Quartz Mountain.

At Quartz Mountain the deposits occur chiefly in the Vertical vein and several small fault-breccia veins in the volcanic rocks. The Vertical vein fills a normal fault fissure that cuts the limestone, granodiorite porphyry, and volcanic rocks. It extends longitudinally through Quartz Mountain and the San Rafael property, south of which it continues into the Quartz Mountain Metals ground, and 800 feet to the northwest of the mountain it appears in the Calico mine. It dips  $85^{\circ}$  NE. or stands about vertical, and it cuts off the Lease vein, as shown on the 350-foot level in the San Rafael mine. (See fig. 4 and section in fig. 1.) In its outcrops at the north end of the mountain and on the 450-foot level in the San Rafael mine it is 35 feet wide. In the Calico mine it is 80 feet wide and in places contains mineralized pockets running about \$6 in gold and silver to the ton. The filling of the vein is siliceous brecciated granodiorite porphyry, andesite, quartz, and calcite containing in places moderate quantities of galena and sphalerite, with traces of antimony and a little gold and silver.

The Tertiary deposits were formed by ascending hot solutions that circulated through the rocks after the eruption of certain of the Tertiary volcanic rocks. Those at or near Quartz Mountain seem to be genetically connected with the large andesite dike intruded along the contact of the Tertiary lavas with the Mesozoic rocks. Since they were deposited they have been partly oxidized and enriched by descending surface waters.

### Mines and prospects

The San Rafael mine, around which the history of the district as described above largely centers, is in the northwest end of Quartz Mountain. It is principally on the Lease vein, but it includes also a part of the Vertical vein and several other lesser veins or large ore bodies. The Lease vein strikes about N.  $40^{\circ}$  W., with the trend of the mountain, and dips  $25^{\circ}$  NE., into the mountain, toward the Vertical vein. (See figs. 1 and 4.) It is a large bedding-plane replacement deposit in the limestone and is the principal ore deposit in the district. It is opened by a 450-foot  $40^{\circ}$  inclined shaft sunk near its north end. From the 70-foot level to the 352-foot level the vein was an almost continuous ore body, from 3 to 14 feet in width and about 120 feet long, and much of the ore was of high grade. Decrease of the dip just below the 250-foot level gives to the vein, between the 250- and 352-foot levels, 180 feet of stoping ground in which the ore body is 5 feet in width. Here the ore is more uniform and of better grade, contains more sulphide than that on the higher levels, and runs high in silver, much of it yielding \$50 to the ton, of which \$14 is in gold. Some of it is rich galena ore running about \$100 to the ton. On the 200-foot level occurs a 13-foot bedding-plane ore body, which is at a higher geologic horizon than the Lease vein and contains more quartz and galena. It carries 12 feet of milling ore and on the footwall side 1 foot of shipping ore and shows good indications of persisting in depth. A 7-foot ore body has been found on the 352-foot level in the southeast drift, beyond the south end of the Lease vein. It is in virgin ground, with 400 feet of unexplored backs, and shows 3 feet of \$60 ore and 4 feet of mostly \$20 ore. The ore runs high in gold and silver and shows native silver in wire and other forms. In the footwall below the Lease vein is another vein which produced some shipping ore on and above the 200-foot level. In the northeast side of the mine the Vertical vein, on the 250-foot level south of the crosscut, contains an ore shoot 70 feet long consisting principally of galena ore, and below its junction with the Lease vein it shows 12 feet of milling ore in the crosscut.

In the Hasbrouck mine, at the south base of Quartz Mountain, the southeast workings on the 200-foot level are said to traverse a wide mineralized zone which has a limestone footwall and an aplite hanging wall and which contains several ore shoots or veins, including an east-northeast 3-foot vein of shipping ore similar to that of the San Rafael mine except that it contains more galena and 5 per cent of copper.

In the eastern base of Quartz Mountain the lower 70 feet of the Quartz Mountain Metals shaft, which is 300 feet deep, is said to be in mineralized limestone that looks promising.

Just north of Quartz Mountain, on the Nye-Mineral and other claims, are prospects on several fault breccia veins in the rhyolite (flow No. 4 in the section accompanying fig. 1) in which a little galena and lead carbonate occur. The San Felipe prospect, three-quarters of a mile northwest of Quartz Mountain, is opened 145 feet deep in rhyolitic rocks. It was supposed to be on the continuation of the Vertical vein, which recently, however, has been found to have a more westerly course. A little mineralized rock was found which assayed about \$2 in gold and silver to the ton, but the prospect is not encouraging.

The outlook for the Quartz Mountain district is regarded as favorable. Its best probability is that of finding further ore deposits in the limestone. There is also a fair measure of probability that new deposits may be found in the large area of volcanic rocks extending from Quartz Mountain to Broken Hills. Owing to the irregularity in occurrence and the replacement character of the deposits, the best guide in prospecting is to follow mineralization in the limestone. The most promising places are on or near the contact of the limestone with the intrusive rocks, especially granitic rocks, as granodiorite porphyry and quartz monzonite. The larger the intrusive body the more chance there is of discovering an ore deposit.

Promising platinum deposits are being developed south of Lodi Tank. High-grade scheelite deposits are being developed in Cottonwood Canyon, east of Lodi. The Illinois mine has recently opened up a large body of high-grade silver-lead ore.

#### Gold Basin District

*Churchill County*

The Gold Basin district is 45 miles southeast of Fallon, 5 miles south of Chalk Mountain, and just east of Fairview Peak. (See fig. 2.) It is a north-south area 3 miles long by 2 miles wide, which drains northwestward into Fairview Valley. The surface consists mostly of steep ridges and deep valleys eroded in faulted and folded Tertiary volcanic rocks. The predominant rock is a dull-gray quartz latite like that of the Wonder district, where it is commonly called a rhyolite.

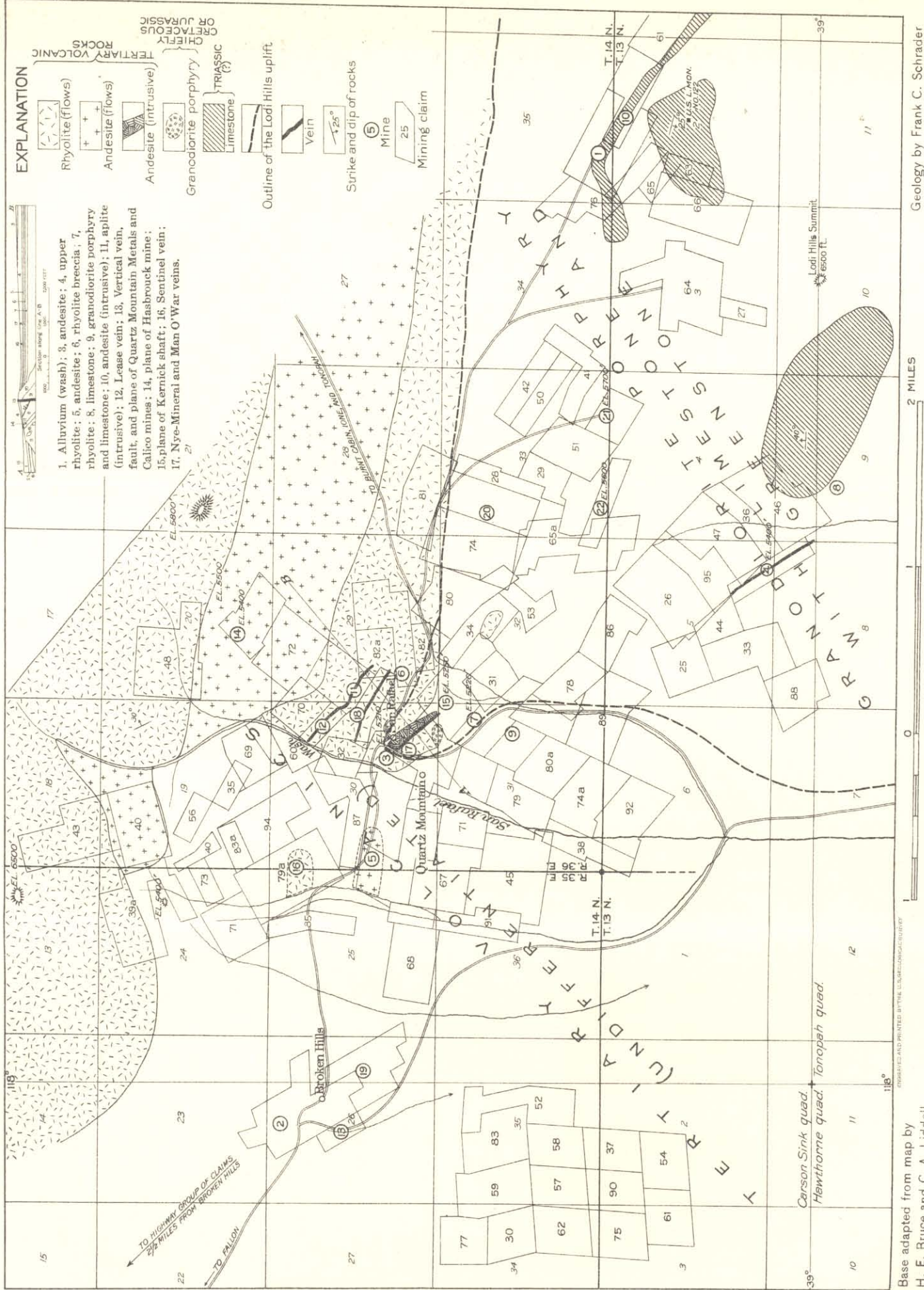
The ore bodies are principally gold-bearing deposits such as commonly occur in veins in Tertiary volcanic rocks of the Southwest. They contain a little silver besides the gold. Outside the veins free gold in fine particles is widely distributed in nearly all the rocks, but it is not recoverable. The deposits occur mostly in eight or ten veins or breccia zones, which in general contain but little quartz or gangue mineral other than wall-rock breccia. The deposits were formed by hot ascending magmatic solutions that circulated through the rocks soon after the eruption and consolidation of certain members of the volcanic group. They were probably deposited mostly as argentite and gold. Since they were formed the deposits in the oxidized zone have been enriched by downward concentration of detrital mineral, especially gold leached from the disintegrated veins and rocks of higher levels removed by erosion. For this reason the deposits pan well in free gold.

The Gold Bug mine, owned by the Gold Bug Mining Co., lies near the south end of the district, at an altitude of about 5,400 feet, on a fault-breccia vein or zone that dips about 50° NE., in andesite. The vein, which was discovered by Henry Knight in 1924, is 2 to 6 feet wide and 1,700 feet long. It is opened by a 40° inclined shaft with two 50-foot drifts on the 50 and 100 foot levels and seems to persist still farther downward. It consists mainly of gray fault-brecciated andesite, partly replaced by vuggy quartz stained by iron and manganese oxides. In places it is fairly siliceous, and its metal content, mostly free gold, is as much as \$20 to the ton. The ore contains also a little argentite and cerargyrite.

In Branch Canyon, about 1½ miles north of the Gold Bug mine, are five or six prospects in the quartz latite, mostly owned by Messrs. Branch, Hunt, Smith, and Wilson. The Smith prospect, situated on a hill toward the east, consists of a fault-breccia ledge or zone 2 to 4 feet wide, dipping 70° E. It is opened by a 35-foot shaft which shows only brecciated country rock, with but little quartz, silicification, or indication of mineral. The rock, however, pans well in gold, which is in very small particles and most of which has probably been concentrated in the ledge by leaching from higher levels. The prospect does not seem to be of any commercial value. The Branch prospect, farther west, at the north edge of the bottom of Branch Canyon, is on a brecciated fault zone that dips 75° SE. It is opened by a 50-foot tunnel and contains more quartz than some of the other prospects in this canyon.



FIGURE 1



Geology by Frank C. Schrader

GEOLOGIC MAP AND SECTION IN QUARTZ MOUNTAIN MINING DISTRICT, NYE COUNTY, NEVADA

Base adapted from map by  
H. E. Bruce and C. A. Liddell



