MLA 43-85

Mineral Land Assessment
Open File Report/1985

# Mineral Resources of the Harquahala Mountains Study Area (AZ-020-095), La Paz and Maricopa Counties, Arizona




United States Department of the Interior
Bureau of Mines

# MINERAL RESOURCES OF THE HARQUAHALA MOUNTAINS STUDY AREA (AZ-020-095), LA PAZ AND AND MARICOPA COUNTIES, ARIZONA

by

John R. Thompson

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1985

Intermountain Field Operations Center, Denver, Colorado

UNITED STATES DEPARTMENT OF THE INTERIOR
Donald P. Hodel, Secretary

BUREAU OF MINES
Robert C. Horton, Director

## PREFACE

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine the mineral values, if any, that may be present. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral survey of the Harquahala Mountains Wilderness Study Area (AZ-020-095), La Paz and Maricopa Counties, Arizona.

This open-file report summarizes the results of a Bureau of Mines wilderness study and will be incorporated in a joint report with the Geological Survey. The report is preliminary and has not been edited or reviewed for conformity with the Bureau of Mines editorial standards. Work on this study was conducted by personnel from the Branch of Mineral Land Assessment (MLA), Intermountain Field Operations Center, Building 20, Denver Federal Center, Denver, CO 80225.

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## UNITS OF MEASURE ABBREVIATIONS USED IN THIS REPORT

| | |
|---|---|
| ft | foot/feet |
| in. | inch(es) |
| mi | mile(s) |
| oz/ton | ounces per ton |

# MINERAL RESOURCES OF THE HARQUAHALA MOUNTAINS STUDY AREA (AZ-020-095), LA PAZ AND AND MARICOPA COUNTIES, ARIZONA

by

John R. Thompson, Bureau of Mines

## SUMMARY

The Harquahala Mountains BLM Wilderness Study Area is in the Basin and Range physiographic province of west-central Arizona. The present study covers 24,735 acres of the 72,675 acre wilderness study area preliminarily recommended as suitable for inclusion in the National Wilderness Preservation System in La Paz and Maricopa Counties, Arizona. During the winter of 1983-84, under authority of the Federal Land Policy and Management Act (Public Law 94-579), the Bureau mapped and sampled mines and prospects in and near the WSA to determine the mineral resources present.

Mineralization in the study area is controlled by three large northwest-striking faults. Hydrothermal fluids related to Tertiary diorite dikes and a granite pluton were most likely the source for the mineralization in the veins. In the studied part of the Harquahala Mountains, 10 mineralized areas were identified--5 are wholly or partly inside the study area, 2 are adjacent to the boundary, and the other 3 are within 1 mi of the study area boundary.

The Crown Prince mineralized area in the remote east-central part of the study area contains two adits and a shaft. At least two quartz veins are exposed and gold content of samples is as much as 1.32 oz/ton. However, the abundant faulting, discontinuous quartz veins and gold values, and limited exposures of mineralized rocks, preclude the calculation of a resource. The quartz vein in the shaft requires further surface or underground exploration to determine its extent and amount of mineralization.

The Northwest mineralized area, about 1/4 mi inside the northwest boundary, contains an indicated resource of 900 tons and an inferred resource of 2,400 tons of material with an average grade of 0.03 oz gold per ton and 0.87 percent copper. A barite vein (as much as 49 percent barium) is 1/2 mi north of the gold-copper resource.

The North Sunset Canyon mineralized area, in the north-central part of the study area, contains an indicated resource of 2,500 tons of material with an average grade of 0.28 oz per ton gold and 1.03 percent copper. This area warrants further exploration because of the high gold and copper values, easy access, and the possibility of a continuation of the resource at depth.

Mineralized structures at five of the areas outside the study area (Sunshine Mine, Linda Mine, Browns Canyon, Arrastre Gulch, and Harquahala Mtn areas) could extend into the study area. Structures at Dushey Canyon and Blue Tank Canyon mineralized areas do not trend toward the study area.

The Hawke Goldmining Company Ltd., is conducting operations at the Sunshine Mine and Linda Mine mineralized areas, and results of their work should be checked to see if mining in the Harquahala Mountains is presently economic.

## INTRODUCTION

From November of 1983 through March of 1984, the Bureau of Mines, as part of a joint effort with the U.S. Geological Survey (USGS), completed field work on a mineral investigation of part of the Harquahala Mountains Wilderness Study Area (WSA). The Bureau mapped and sampled mines, prospects, and altered and mineralized zones in and near the study area to appraise mineral reserves and subeconomic resources. The USGS compiled a geologic map and did a regional geochemical survey of the area in order to assess the potential for undiscovered resources. Each agency will independently publish results of its studies and a joint report will address the total mineral values of the area. This report discusses the results of the Bureau of Mines study.

## GEOGRAPHIC SETTING

The Harquahala Mountains Wilderness Study Area contains 72,675 acres of Federal land in the Lower Gila Resource Area, managed by the Bureau of Land Management (BLM). The WSA is in La Paz (formerly northern Yuma) and Maricopa Counties, in west-central Arizona (fig. 1). The current study area (SA) covers 24,735 acres preliminarily recommended as suitable by the BLM for inclusion into the National Wilderness Preservation System.

The SA is in the northeast-trending Harquahala Mountains and extends from Dushey Canyon on the east to about 3 mi west of Harquahala Mountain. The study area is about 12 mi long and from 3 to 6 mi wide. Elevations range from 5,480 ft on the north ridge of Harquahala Mountain to about 2,200 ft in the southeastern corner.

The largest cities in the area are Wickenburg, Arizona, about 45 mi east of the SA, and Phoenix, Arizona, about 75 mi southeast. The nearest towns are Aguila and Salome. Aguila is at the junction of the Eagle Eye Road and U.S. Highway 60. The Eagle Eye Road connects with the Buckeye-Salome Road south of the Harquahala Mountains. This graded two-lane gravel road follows the southwest end of the Harquahala Mountains and continues north to the town of Salome at U. S. Highway 60.

The SA is accessible by gravel roads that lead to most of the major drainages. Access on the north and west sides is by gravel roads off of U.S. Highway 60. Access to the east and south is from the Eagle Eye Road, where gravel roads turn into jeep trails that go close to, and in some places into

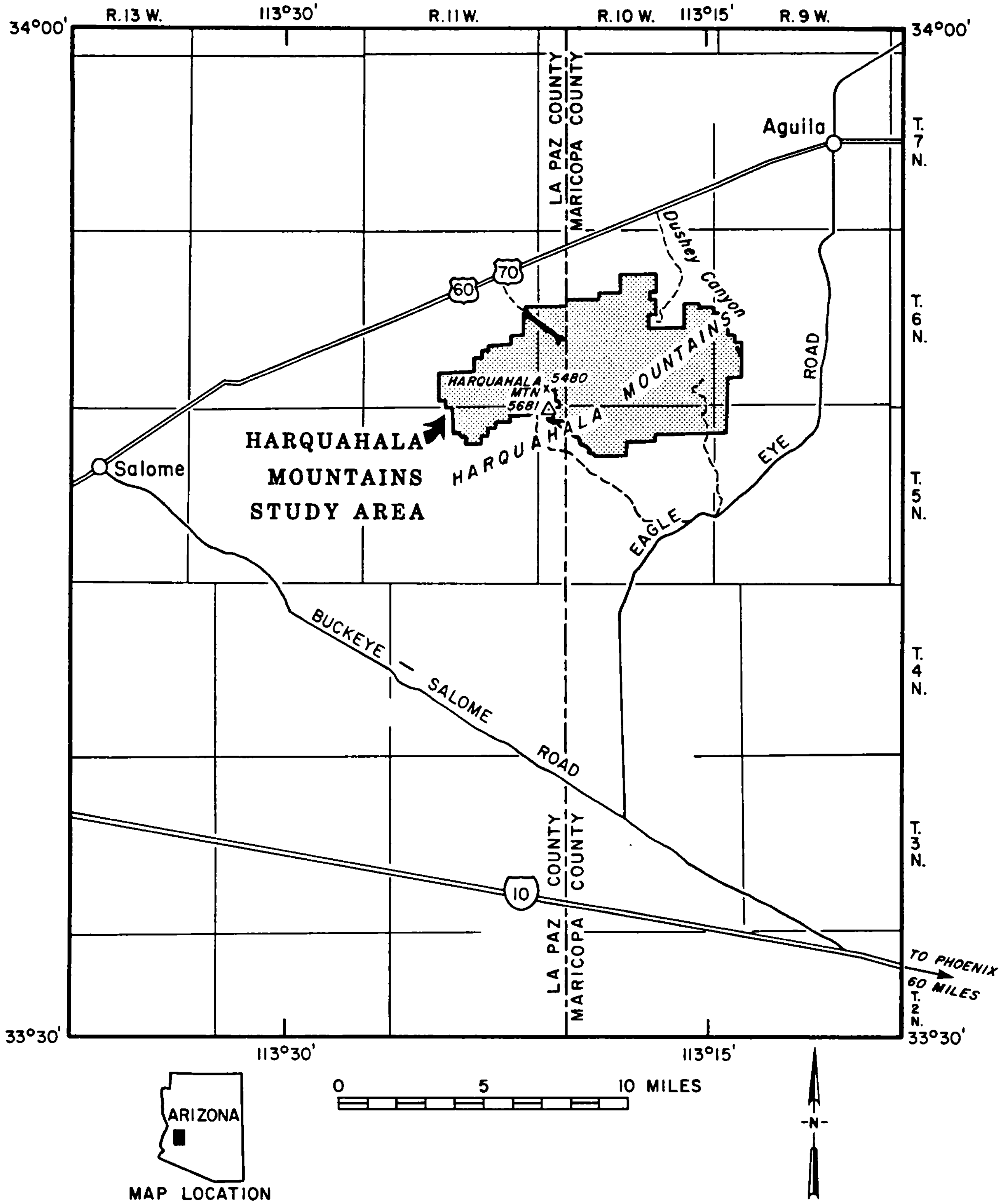


Figure 1.--Index map of the Harquahala Mountains SA, Arizona.

the SA. A good gravel road leads to the top of Harquahala Mountain from the south.

## PREVIOUS STUDIES

Little has been written previously on the mineralization in the central and northern parts of the Harquahala Mountains. Barite deposits were studied by Stewart and Ptistor (1960); fluorite deposits south of the SA were studied by Denton and Kumke (1949). This mineralization is discussed elsewhere under "Other Occurrences".

The geology and production of the Ellsworth gold mining district, in the southwest part of the Harquahala Mountains, was reported by Wilson and others (1934). The Aguila manganese mining district, south of the range, was studied by Farnham and Stewart (1958). Both areas are discussed elsewhere under "Mining History".

The tectonics of this region of Arizona was studied by Coney (1980), Davis (1980), Davis and others (1980), and Rehrig and Reynolds (1980).

## PRESENT INVESTIGATION

Prior to field investigations, a search for data relevant to mining and mineralization in the area was made of published and unpublished literature, Bureau of Mines files, and files of the Arizona Bureau of Geology and Mineral Technology. BLM records were searched for patented and unpatented mining claims, and oil and gas and geothermal lease information.

The field study, which took 126 employee-days, covered the area between U.S. Highway 60 on the north, Dushey Canyon and Browns Canyon on the east, and 1 1/2 mi beyond the SA boundary on the south and west. All mines, prospects, and mineralized areas in and within 1 1/2 mi of the SA boundary were mapped and sampled. Samples were taken from mineralized structures and zones at the workings, outcrops, and mine dumps. Where workings were inaccessible, dump material was selected by rock type and, if available, ore specimens were collected.

A total of 343 samples was taken. All were fire assayed for gold and silver and analyzed semiquantitatively for 40 elements (appendix) using emission spectrographic methods. For selected samples containing identified minerals, atomic absorption methods were used to determine copper, lead, zinc, iron, manganese, and barium; special analysis determined the fluorine content. Complete analytical results are available for public inspection at the Bureau of Mines, Intermountain Field Operations Center, Building 20, Denver Federal Center, Denver, CO 80225.

## ACKNOWLEDGMENTS

Special thanks are extended to Frank Stevenson of Hawke Goldmining Ltd., and Frank Russell, who gave helpful information on their mining claims.

## GEOLOGIC SETTING

Understanding of regional and local geology gives a better idea where important mineral deposits may lie. The Harquahala Mountains are an 18-mi-long, northeast-trending range of mountains in the Basin and Range physiographic province (fig. 2). To the northwest across the McMullen Valley, the Harcuvar Mountains are roughly parallel to the Harquahala Mountains. To the south and west, the regional trend of mountains is northwesterly, almost perpendicular to the Harquahala and Harcuvar Mountains.

Precambrian granite, gneiss, and schist are the most common rocks in the Harquahala Mountains; Tertiary granite occurs in the eastern part of the range. Mesozoic metasediments and Paleozoic marble crop out just south and west of the boundary, where low angle faulting juxtaposed Paleozoic marble and Precambrian schist.

In the SA, three major northwest-trending faults cut the northeast-trending Harquahala Mountains. The faults parallel mountain ranges to the southwest (fig. 2). These faults are an important control for the emplacement of dike systems and quartz vein systems. Most of the mineralized areas in the range are associated with these faults or with associated east-striking faults between them.

The Dushey Canyon fault, near the northeast boundary of the SA, strikes northwest through Dushey Canyon and Browns Canyon Wash and dips steeply to the northeast. The Sunset Canyon fault, near the middle of the SA, controls the orientation of Sunset Canyon in the middle of the range. This fault parallels the Dushey Canyon fault and has a similar dip. The third is a smaller parallel fault near Harquahala Mountain, on the west side of the SA (Spencer, 1984), and will be referred to here as the Harquahala Mountain fault.

Diorite dikes occur throughout the Harquahala Mountains. Nine of the 10 identified mineralized areas contained quartz veins in and adjacent to diorite dikes. The dikes extend from small predominantly calc-alkaline plutons and were emplaced along fractures and faults. As the diorite intrusives cooled and contracted, mineralized quartz veins formed from hydrothermal solutions along the contacts between the diorite and the intruded rock. Different physical and chemical features of the host rocks may explain why mineralization is not associated with diorite dikes.

## MINING HISTORY

Mines in and near the SA are widely scattered and not grouped into any organized mining districts. Two nearby districts, the Ellsworth and the Aguila, are south of the study area.

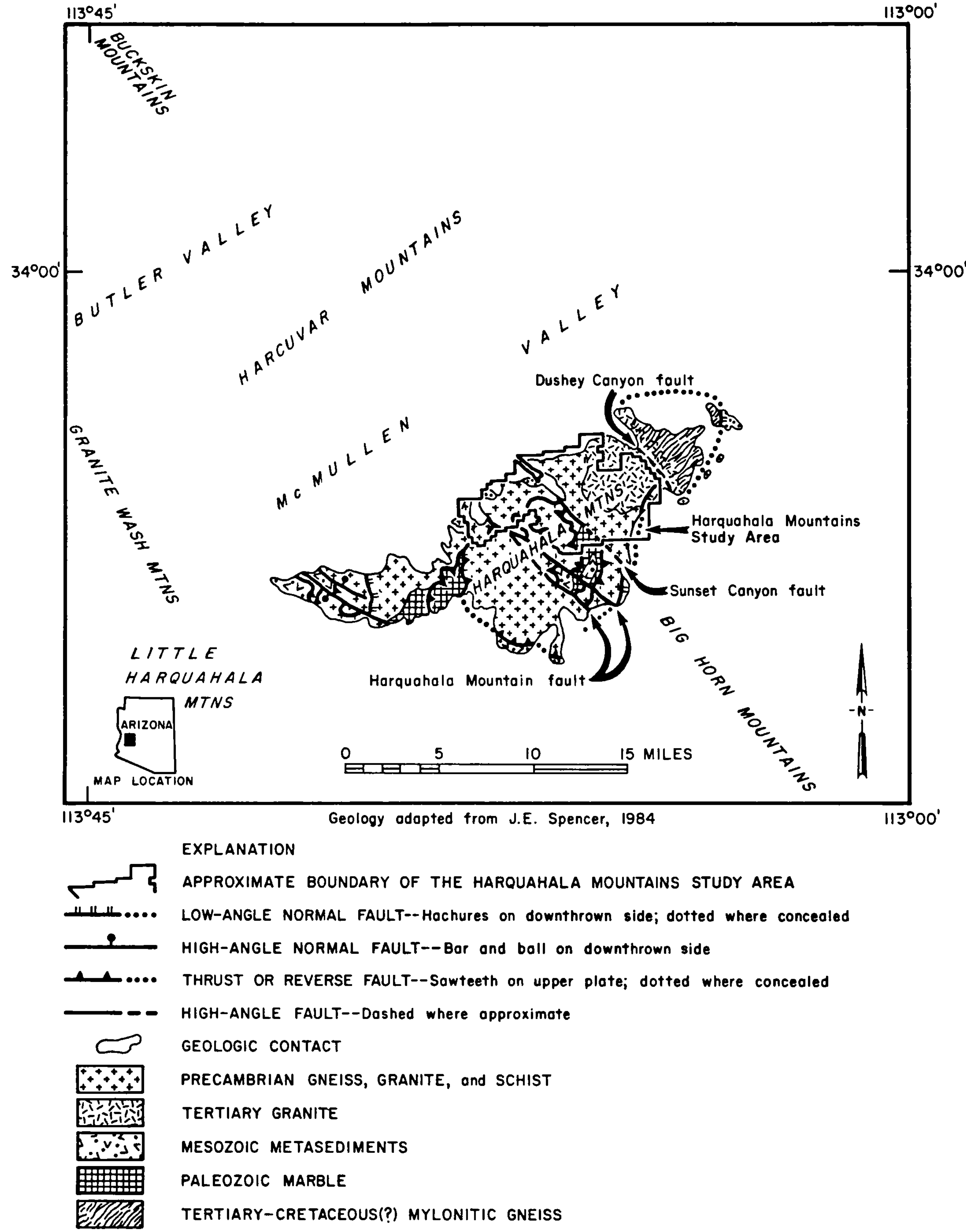


Figure 2.--Map showing regional geologic features in the Harquahala Mountains, Arizona.

The Ellsworth district (also called the Harquahala district), about 4 mi southwest of the SA, is a lode gold area that was discovered in 1888. The Bonanza, Golden Eagle, Socorro, San Marcos, Hercules, and Hidden Treasure Mines yielded over $2.5 million in gold between 1891-1929 from the district. Copper, silver, and some lead were also recovered. Mineralization occurs in steeply dipping faults cutting granite, hornfelsed shale, limestone, quartzite, and conglomerate. (See Wilson and others, 1934.) The geology in the southwest part of the Harquahala Mountains is different from that in the study area.

In the Aguila district, about 3 mi south of the SA, manganese was mined from Tertiary volcanics. About 20 mines are within a 15-mi-long and 4-mi-wide northeast-trending volcanic belt. The district became active in 1917 and declined after World War I. During this period, 3,496 tons of ore averaging 35.8 percent manganese was shipped. Mines in the district operated intermittently for short periods of time until World War II, when several were operated for about one year. Operations were terminated in 1944 and the district remained dormant until the Korean conflict in 1951, when the government purchase program for domestic manganese was announced. About 30,000 tons of low-grade manganese ore was mined between 1951 and 1954. (See Farnham and Stewart, 1958.) The geology of this district is dissimilar to the study area; it was not studied.

## APPRAISAL OF SITES EXAMINED

In this report, mineralized areas in and near the SA are named for their location or largest nearby mine. Clockwise, starting in the northeast, the mineralized areas discussed are: Sunshine Mine, Linda Mine, Dushey Canyon, Browns Canyon, Crown Prince, Arrastre Gulch, Blue Tank Canyon, Harquahala

Mountain, Northwest, and North Sunset Canyon (pl. 1). A summary of geology, production, commodities, and resources of these areas is shown on Table 1.

### Sunshine Mine area

The Sunshine Mine area is less than 1/2 mi outside the northern boundary of the SA in the southwest fork of Dushey Canyon (pl. 1). A gravel road from U.S. Highway 60 leads to the Sunshine Mine and several nearby prospects.

Gneiss, granite gneiss, and granite of Precambrian age are cut by gold-bearing quartz veins adjacent to diorite dikes. The veins strike east, and dip from 35° S. to vertical. These veins occupy fractures that strike roughly 60° to the Dushey Canyon fault, which is about 1 mi east of the mineralized area. The fractures could have resulted from strike-slip movement along the Dushey Canyon fault.

Six shafts, two adits, and five prospect pits make up the workings in the Sunshine Mine area. The Sunshine Mine (fig. 3) consists of an inclined shaft with two working levels on a quartz vein striking N. 70° E. and dipping 35° S. that ranges in thickness from 1 to 8 in. and contains abundant hematite. Six of the eight samples taken from the vein contained gold. Values were as much as 0.21 oz/ton, and averaged 0.1 oz/ton.

Samples taken on what appears to be the same or a related vein west of the Sunshine Mine, also contained gold. A sample of quartz from a stockpile contained 2.17 oz gold per ton (no. 11, table 2). The vein(s) trend(s) westward toward the SA, but no prospects or outcrops of quartz were found west of the sampled sites. An adit (fig. 4) driven about 100 ft into granite gneiss never reached the veins either because they dip south and the adit was too short, or the veins pinch out.

Mineralization within the vein appears to decrease with depth in the Sunshine Mine, but development is inadequate to determine rake on the ore shoot or if mineralization continues along strike or dip.

One select sample of magnetite (no. 26, table 2) taken from the dump of a shaft about 50 ft deep, contained 41.0 percent iron.

Hawke Goldmining Company Ltd., the current claim holder, is conducting exploration in the Sunshine Mine mineralized area and is developing sites to heap leach ore to recover gold.

## Linda Mine area

The Linda Mine area is on the northern SA boundary, about 1 mi south of the Sunshine Mine mineralized area (pl. 1, fig. 5A). A gravel road, a fork off the road that leads to the Sunshine Mine, continues up to the Linda Mine and nearby prospects. The area is along an irregular brecciated contact between Precambrian granite and schist on the north, and a Tertiary granite intrusive on the south.

Workings in the area consist of the Linda Mine, three short adits, two shafts, and five prospect pits. The Linda Mine (fig. 5B) was driven 600 ft into Tertiary granite to intersect the gold-bearing pyritiferous granite found above it. Several thin dikes were intersected in the adit, but no mineralized rocks, veins, or structures were encountered (table 3).

A 1-ft- to 5-ft-wide breccia zone, trending N. 40° E., and consisting of granite fragments in a calcite matrix, is exposed at sample sites 36, 37, 50, 52-56, (fig. 5A). All breccia samples contained gold - from a trace, to as much as 0.24 oz/ton (table 4).

Pyritiferous granite occurs just west of the breccia zone, but was not found in outcrop; a sample from an ore stockpile contained 0.83 oz gold per ton (no. 33, table 3). About 10 tons of material is estimated to be in the stockpile.

South of the Linda Mine workings, inside the SA boundary, fractured granite and a diorite dike are exposed in a short declined adit (sample sites 29-31). A sample (no. 30, table 3) of the hematite-bearing granite assayed 0.12 oz gold per ton. The vertical diorite dike, trending N. 25° W., contained 0.29 oz gold per ton (no. 31), unlike most dikes in the SA which are generally barren.

The pyritization of the granite is related to the contact between the different age granites. The strike of the contact is irregular; however, the apparent trend is toward the SA. Fractured granite could occur at other sites in the study area and could possibly be mineralized. The breccia zone can be traced on the surface for about 300 ft southwesterly inside the SA.

The Hawke Goldmining Company Ltd. (working in the Sunshine Mine mineralized area to the north) is planning to explore the mineralized structures in the Linda Mine mineralized area and to leach the dumps if grades warrant it. If the Hawke Goldmining Company does develop this area, the rocks in the breccia zone are incompetent, and ground support would be needed to keep any underground workings open.

### Dushey Canyon area

The Dushey Canyon area is located about 1/2 mile northeast of the SA (pl. 1). A gravel road that forks off the road that leads to the Sunshine and Linda Mines continues along the east fork of Dushey Canyon and leads to the workings in this area. A 100 ft adit (fig. 6), a vertical shaft, and an inclined shaft are on an east-trending, gold-bearing quartz vein dipping 40° S. This vein fills an apparent tension fracture, related to possible strike-slip movement on the Dushey Canyon fault. The vein has roughly the same strike and dip, and is in line with the vein in the Sunshine Mine mineralized area, 2 mi west. They may be the same vein. Samples of the massive hematite-stained quartz vein in the adit contained as much as 0.07 oz gold per ton (table 5). Because of dangerous unsupported rock slabs along the back, no samples were taken from the inclined shaft.

Northeast of the adit, a sample of vein quartz in a stockpile contained 0.43 oz gold per ton (no. 81, table 6). Quartz veins do not crop out in this area and the source of this sample was not determined. It is possible that the vein quartz comes from a structure related to the Dushey Canyon fault.

Further exploration, in the form of drilling and trenching, would be needed to determine the continuity and grade of veins in this area. If additional mineralization exists on the west-striking vein between this area and the Sunshine Mine, it would be north of the SA.

### Browns Canyon area

The Browns Canyon area is adjacent to but outside the eastern boundary of the SA (pl. 1). A gravel road, from the Eagle Eye Road out of Aguila, leads up Brown Canyon Wash to workings in the area. Northwest-striking quartz veins, adjacent to diorite dikes and faulted and altered zones related to the Dushey Canyon fault, are exposed here in bulldozer trenches. These trenches are about 6 ft deep and as much as 20 ft wide and 180 ft long. The Dushey Canyon fault forms the contact between Tertiary granite to the west and Precambrian granite and schist to the east. Brecciated rocks in the area served as a permeable channel for the introduction of mineralizing fluids. Copper staining, quartz veins, fluorite, barite, breccia zones, and altered areas are possible surface indications of additional mineralized rocks at depth.

Analyses of samples from the Browns Canyon mineralized area (table 7) show several samples containing trace amounts of gold and arsenic, and one sample of granite (no. 105) containing 0.01 oz gold per ton. Several samples contained silver, and one fluorite sample (no. 111) contained 1.8 oz silver per ton, and 23.6 percent $CaF_2$. Two samples (no. 84 and 110) contained over 10 percent barium.

Arsenic and barium are highly mobile elements and are used as pathfinders for lead-zinc-silver deposits (Levinson, 1980), and lead, zinc, and silver values are above background for this area. This suggests that a base and precious metal deposit could exist at depth. Further exploration, in the form of drilling and trenching, would be needed to determine the continuity and grade of breccia zones in this area. If mineralization is found at depth in the Browns Canyon mineralized area, the indications are that it would be northeast of the Dushey Canyon fault, and not inside the SA.

### Crown Prince area

The Crown Prince Mine mineralized area (pl. 1) in the east-central part of the SA, is reached by a jeep trail off the road up Browns Canyon Wash. Two adits, a shaft, and two prospect pits constitute the workings. The Crown Prince adit (fig. 7) comprises over 300 ft of workings. At the portal, a near-horizontal 0.5-ft-thick quartz vein, trending about N. 80° E., crops out. A sample (no. 116, table 8) from the vein contained 0.51 oz gold per ton. Over 300 ft of cross-cutting did not expose any veins or mineralization, and samples from the adit contained only trace amounts of gold and low amounts of base metals (table 8). Seven northwest-trending faults cut granite and gabbro in the adit. Gabbro is not common in the Harquahala Mountains, occurring only here and in the Blue Tank Canyon area, south of the study area.

The quartz vein at the portal is not continuous and either pinches out or is faulted off.

About 30 ft west of the portal, a small pit was dug on the same or a related vein. A quartz sample (no. 114) from the vein contained 0.03 oz gold per ton.

About 160 ft southeast of the Crown Prince adit, an 80 ft adit (fig. 8) crosscuts to an 18 ft vertical shaft on a 0.5-ft-thick quartz vein striking N. 80° W. A sample (no. 132) of the vein contained 1.32 oz gold per ton and 0.2 oz silver per ton. There is no dike associated with the fractured quartz vein here as in other mineralized areas studied in the Harquahala Mountains.

About 1/2 mi east of these workings, a prospect pit was dug on a shear zone striking N. 50° W., and dipping 25° N. This 4-ft-wide shear zone contained vuggy quartz with abundant hematite and pyrite. A select sample (no. 113, table 17) of the quartz contained 0.15 oz gold per ton.

The quartz vein at the portal of the 300 ft adit contains gold values, but the vein could not be traced any distance as it either pinches out or is offset by a fault. The quartz vein at the shaft contains gold, and continues at depth. The lack of development on the veins makes it impossible to calculate resources. Both of the quartz veins may contain gold resources at depth and along strike. Such resources would be entirely inside the SA. The Crown Prince area should be further explored, especially at the quartz vein in the shaft.

### Arrastre Gulch area

The Arrastre Gulch area is situated about 1 mi southeast of the SA (pl. 1). The only patented claims in the studied part of the Harquahala Mountains are located here. A gravel road, from the Eagle Eye Road out of Aguila, leads up Arrastre Gulch to workings here, and to nearby marble quarries.

All of the workings are located on northwest-striking, gold- and copper-bearing quartz veins that parallel the Sunset Canyon fault. The veins are along contacts between diorite dikes and Mesozoic granite and granite gneiss. Marble, inferred to be of early to mid-Paleozoic age, lies directly on Precambrian basement rocks (Davis, 1980, p.59) and crops out northeast and southwest of Arrastre Gulch. Although diorite dikes intruded the marble, quartz veins were not found in or near the dikes, and the marble is not known to be mineralized.

The most recent working is a shaft (fig. 8) that had one level on the vein and was flooded below the drift. Additional levels could be present below the water level. The collar of the shaft had been cemented, and an ore bin is next to the collar. A ladder was present, but it was loose and broken in places, so ropes were used to safely gain access to the working level. Every sample from the quartz vein and wall rock contained at least a trace of gold, and one sample (no. 160, table 9) contained 2.07 oz gold per ton. Base metals were also present--as much as 1.4 percent copper, 0.11 percent lead, and 0.07 percent zinc. Samples from dumps of the inaccessible nearby shafts contained as much as 0.24 oz gold per ton, and 0.25 percent copper (table 10).

The SA boundary is 1 mi north of the Arrastre Gulch area, and mineralization could continue along strike into the area. Geophysical and geochemical surveys and drilling would be required to determine if these mineralized veins extend into the SA.

### Blue Tank Canyon area

The Blue Tank Canyon area is about 1 mi south of the SA. A gravel road, from the Eagle Eye Road out of Aguila, leads to workings in this canyon. Several quartz veins in and adjacent to diorite dikes were exposed in adits, shafts, and bulldozer trenches. Copper and silver were found in almost every sample of vein quartz.

Near the mouth of Blue Tank Canyon, southeast of the mineralized area, an adit (fig. 9) was driven on a northeast-trending skarn zone near the contact between granite and marble. Traces of gold and up to 0.2 oz silver per ton were found in samples from the adit.

A shaft and adit in Precambrian gneiss, on the east slope of the canyon (fig. 10), were driven on an east-striking vein along a fault and in a diorite dike. Gold, silver, and anomalously high copper values were detected in most of the analyzed samples. Samples taken along the 350-ft-long, 1- to 2-ft-wide quartz vein contained as much as 0.73 oz gold per ton, 0.7 oz silver per ton, and 6.0 percent copper. The vein was extensively stoped, often to the surface. The shaft at the portal was not accessible; therefore, the down-dip development on and continuity of the vein is unknown.

In the mineralized area, on the west slope of the canyon, a 12 ft by 12 ft declined adit (fig. 11) was driven to intersect veins exposed on the surface in trenches 100 ft above. The adit declines 10° and is about 200 ft long. The bottom half of the declined adit is flooded, but hematite staining could be seen at the face, suggesting that a vein was intersected.

Bulldozers were used in the past to expose veins on the west slope of Blue Tank Canyon. A quartz vein along the contact between a diorite dike and a vein along a contact between gabbro and granite gneiss were exposed by this trenching (fig. 12). This working is 100 ft above the adit shown in Figure 10. As much as 0.07 oz gold per ton, 0.4 oz silver per ton, and 5.0 percent copper were present in vein quartz samples from the bulldozed trenches. The walls of the trenches have sloughed in at most places preventing a sampling density adequate to calculate resources.

Just north of the bulldozed trenches (pl. 1), an adit (fig. 13) was driven on a steeply-dipping, west-trending quartz vein. The vein is azurite stained, and contained as much as 0.06 oz gold per ton, 0.3 oz silver per ton and 0.93 percent copper.

Further north, a quartz vein in a diorite dike was exposed by a bulldozer trench (fig. 14). The bench wall was 30 ft high and some pits were dug on the vein. The diorite was highly altered and chrysocolla was common in the quartz vein. A 100-ft-deep shaft was nearby and the dump material consisted only of granite. As much as 0.02 oz gold per ton, 0.2 oz silver per ton, and 3.3 percent copper was present in samples taken along the diorite dike and quartz vein.

East-trending quartz veins in the Blue Tank Canyon area occupy fissures in granite, gabbro, and gneiss. The east-striking veins are at an angle of about 45° to the northwest-trend of the Harquahala Mountain fault, and may fill tension fractures related to the Harquahala Mountain fault. The northwest-striking veins exposed at the trenches are parallel to and may be directly related to the Harquahala Mountain fault.

The trend of the major mineralization here is not toward the SA. Some of the veins are trending northwest and could extend into the SA. The Harquahala Mountain fault trends through the SA, and could control faults and mineralization that is as yet undiscovered. Further work, in the form of exploration drilling and trenching, would be needed to determine the continuity and grade of veins in this area.

## Harquahala Mountain

The highest point in the Harquahala Mountains is 5,681 ft Harquahala Mountain. A gravel road, from the Eagle Eye Road out of Aguila, leads up Blue

Tank Canyon to the top of Harquahala Mountain. Because of the graded gravel road, microwave relay tower, historic astronomy observation building, and extensive mineral exploration, Harquahala Mountain has been deleted from the SA. Harquahala Mountain mineralized area is within the WSA, but mostly outside the southern boundary of the area studied (pl. 1).

Bulldozers were used in the past to expose a steeply-dipping, northwest-striking, quartz vein adjacent to a dike on top of Harquahala Mountain (figs. 15A, 15B, and 15C). Copper, as much as 0.34 percent, was found in every sample. As much as 0.4 oz silver per ton and 0.01 oz gold per ton were also found in the samples (table 11).

A total of 13 prospect pits and 3 caved adits are north and south of Harquahala Mountain. Northwest of Harquahala Mountain, 20 samples (245-265) were taken from workings and altered zones within the WSA. Estimating from the size of the dump, a caved adit at sample sites 251-252 may have included 1,000 ft of workings. No mineralized structure was found near the area, but a sample (no. 252, table 12) of pieces of vein quartz found on the dump contained a trace of gold and 0.90 percent copper. Trace amounts of gold were found in several samples from the area, and 1.4 percent copper was found in sample 245 taken from a stockpile of vein quartz containing abundant pyrite and chalcopyrite. In and near the SA, quartz containing sulfides commonly contains gold, but on the northwest slope of Harquahala Mountain, copper is the primary metal of economic interest present.

Southwest of Harquahala Mountain, thirteen samples (nos. 204-208, 214-217, and 239-242) were taken from workings and altered zones outside the SA. Almost every sample contained some gold. The highest values were in sample no. 204 from a quartz vein which contained 2.15 oz gold per ton, and

4.0 percent copper. On the south side of Harquahala Mountain quartz veins containing sulfides also contain gold.

The small amounts of mineralization on top of Harquahala Mountain may be attributed to being near the top of a mineralized system. Since all of the mineralized areas are hydrothermal in origin, occur at or near diorites dikes, contain an unusually high gold to silver ratio and above normal amounts of copper, they may be related to a similar source. Zoning can be suggested from the available data, and a mineralized system is probably present in the area. Over 3,000 ft of elevation is gained from the Blue Tank Canyon area, which is on the same or a similar fault, and has a higher grade of mineralization.

The area northwest of Harquahala Mountain inside the SA is also higher in elevation than Blue Tank Canyon and contains low gold values, suggesting that it is in an upper zone of mineral deposition. Higher gold and copper values could occur at depth. The high gold and copper values southwest of Harquahala Mountain and outside the study area are from sites topographically lower and, therefore, lower in the mineralized system. Further exploration, in the form of drilling and trenching would be needed to determine the continuity and grade of veins in this area. Quartz veins near the peak of Harquahala Mountain, and northwest inside the SA, contain too low of a grade to merit further exploration.

### Northwest area

The Northwest area is along the northwest boundary of the WSA (pl. 1). A gravel road from U.S. Highway 60 leads to workings in this area. Workings inside and outside the SA are included in this discussion. Two short adits (fig. 16) inside the SA were driven on a silicified, azurite-stained, east-striking fracture zone in Precambrian granite. The silicified zone is

Figure 15B.--Photograph of the bulldozer trench on top of Harquahala Mountain (looking north).

Figure 15C.--Photograph of the bulldozer trench on top of Harquahala Mountain (looking south).

also fractured, a sign of subsequent movement along the structure. Sample no. 271 (table 13), of the vein in the upper adit, contained 12.4 percent copper; and sample no. 269, of the vein in the lower adit, contained 0.13 oz gold per ton.

For the Northwest mineralized area, assuming a strike length for both adits of 60 ft, width of 1.5 ft, and mineral continuity 30 ft above and below the adit, an indicated resource of 900 tons, and an inferred resource on the strike of the vein between adits of 2,400 tons of material with an average grade of 0.03 oz gold per ton, and 0.87 percent copper, is estimated.

Inside the SA, but outside the mineralized area, are prospects dug on two quartz veins, striking N. 75° E., and dipping 50° N. Samples from the 3-ft- and 4-ft-wide veins northeast of the adits had trace amounts of gold (samples 276 and 277, table 17).

Two prospect pits outside the SA were dug on a vertical barite vein trending N. 40° W. The 1-ft-thick vein is fractured, brecciated, and hematite stained. Samples contained up to 49 percent barium (nos. 273-274). The vein could not be traced laterally due to surface cover.

The Northwest mineralized area needs further exploration, in the form of drilling and trenching, to determine the continuity and grade of mineralized structures and to determine if they will be developed.

### North Sunset Canyon

North Sunset Canyon is inside the northern part of the WSA (pl. 1) at the end of a 2 mi jeep trail through the SA. Two adits, a shaft, and several prospect adits and pits are just inside the boundary.

About 500 ft west of the jeep trail, an adit (fig. 17) was driven to intersect a quartz vein adjacent to a diorite dike that is exposed at the surface about 100 ft above the portal. Inside the adit, sample no. 293 (table 14) of the 3-ft-wide quartz vein contained 0.53 oz gold per ton, and sample no. 290 contained 3.9 percent copper. A 2-ft-wide silicious zone adjacent to and above the quartz vein contained 0.08 oz gold per ton, and 0.24 percent copper (no. 292). The vein has been stoped along dip for at least 50 ft, and is exposed down dip for about 20 ft in a winze. The northwest-striking vein is either cut off by a fault or pinched out to the south, as the vein was absent in the main drift (fig. 17). The northwest extent of the vein is unknown.

Assuming a strike length of 120 ft, a width of 3.5 ft, and remaining material that hasn't been stoped as 20 ft above and 50 ft below the adit, an indicated resource of 2,500 tons of material with an average grade of 0.28 oz gold per ton, and 1.03 percent copper, is estimated for the North Sunset Canyon mineralized area.

Several pits, short prospect adits, and a shaft were dug to explore the quartz veins exposed at the surface (fig. 18). A sample from a stockpile of vein quartz contained 0.11 oz gold per ton and 0.67 percent copper (no. 309, table 15). Sample no. 302 of the quartz vein at the shaft contained 0.07 oz gold per ton, and 0.06 percent copper.

About 100 ft north of these quartz veins, an adit (fig. 19) was driven on a northwest-trending shear zone. Samples (table 16) from the adit showed the shear zone and country rocks to be essentially barren of mineralization.

Outside the mineralized area, but within the SA near the mouth of North Sunset Canyon, a short adit (fig. 20) was driven on a weakly defined structure in Precambrian gneiss. Samples from the adit showed the north-trending structure to be essentially barren of economic materials.

The North Sunset Canyon mineralized area is just inside the SA boundary. Further exploration, in the form of drilling and trenching would be needed to determine the continuity, and to expand the indicated resource laterally and at depth. This area could be developed because of the high gold and copper values and easy access.

## OTHER OCCURRENCES

Marble (metamorphosed Paleozoic limestone) crops out about 1/4 mi south of the SA boundary near Arrastre Gulch and South Sunset Canyon, and at the White Marble Quarry, about 1/2 mi west of the SA boundary (pl. 1). The White Marble Quarry is about 4 mi from Highway 60 and quarries in Arrastre Gulch and Sunset Canyon are about 20 mi from Highway 60. Marble from Arrastre Gulch and Sunset Canyon has been used as building stone, and marble from the White Marble Quarry has been used for terrazo, precasting, roofing granules, stucco, mineral food, and polyester filler (Keith, 1969).

The marble was not being mined in Sunset Canyon or Arrastre Gulch at the time of the field investigation, but signs stated that claim assessment work had been done for 1982. Mining activity at the White Marble Quarry is intermittent, according to the present caretaker. Operations at these quarries will not extend into the area because the marble is not present at the surface in the SA.

Manganese deposits occur in Tertiary volcanics about 3 mi south of the SA. Pyrolusite, psilomelane, and manganite, the chief manganese minerals in this area, occur in veins and fracture zones in volcanics that strike north and dip steeply west. The district has been prospected by extensive bulldozer trenches. An unknown amount of low-grade manganese ore remains in the district (see Farnham and Stewart, 1958). Manganiferous Tertiary volcanic rocks do not crop out in the SA and the nearest volcanic rocks containing manganese are at sample sites 133-135, about 1-1/2 mi south of the SA.

Barite and fluorite occur in northwest-striking fractures in a volcanic agglomerate about 3 mi south of Arrastre Gulch. Nearly 800 tons of about 75 percent barite was shipped from this area and the vein appears to extend northwest for some distance. (See Stewart and Ptistor, 1960.) The barite veins are parallel to, and possibly related to, the Harquahala Mountain fault. If the barite and fluorite bearing structure continues northwest for 6 mi, it will be in the SA, but too deeply buried to be economic.

Fluorite occurs 2 mi south of the Blue Tank Canyon mineralized area in a fault that strikes N. 69° W. and dips steeply to the northeast. Drilling and trenching in 1949 disclosed some high purity fluorite along with minor barite and pyrite (see Denton and Kumke, 1949). This fault trends the same as the Harquahala Mountain fault and may be a related parallel fault.

### Oil and gas

Western Arizona is largely unexplored for oil and gas. Thrust faults (overthrusts), block faults, gravity faults, and decollement faults, all present in the Harquahala Mountains, are possible structural traps for the accumulation of oil and gas. The sedimentary rocks in the Harquahala Mountains have been highly metamorphosed, and there are no known reservoir rocks in the area. Extensive volcanic activity to the south, emplacement of Tertiary dikes and a granite pluton, and the high degree of metamorphism of the sedimentary rocks would probably have driven off any accumulated hydrocarbons in the area. The valleys between the mountain ranges contain abundant sediments, and would be a more likely source for petroleum environments. Although the Harquahala Mountains contain oil and gas lease applications, there has been no exploratory drilling and no known geophysical work done in the area.

## Geothermal

Two low temperature (<100° C) geothermal areas are shown by Witcher and others (1982) in the McMullen Valley, north of the Harquahala Mountains, consisting of 10 drillholes, 7 west of the WSA, and 3 northeast. The valleys generally have higher temperature gradients than the mountains because clay, sand, and gravel are relatively poor thermal conductors and act as insulators trapping the earth's heat (see Witcher, J. C., and others, 1982). The geothermal areas are probably spatially related by northeast-trending faults in the valley. The WSA also contains major faults, but they trend northwest and the crystalline rocks in the area are not good insulators for trapping heat. In the WSA and to the south, igneous activity ceased in the late Tertiary indicating that the reservoir of magma is either very deep or has subsided. There are no surface indications of hot water springs or deposits in the area.

## Sand and gravel

Sand and gravel were quarried from alluvium north of the SA, near U.S. Highway 60, in the McMullen Valley. Although small amounts of sand and gravel are found in stream beds inside the SA, abundant alluvial deposits outside the SA in the inter-mountain valleys is sufficient to supply local needs.

# COMMODITY HIGHLIGHTS

The principal commodities in the Harquahala Mountains WSA are gold and copper. Silver, present in small amounts, could be recovered as a by-product if the gold and copper were mined. Currently, gold is one of the few mineral commodities that is actively explored for and mined in the western U.S. Commodity statistics are from the Bureau of Mines Mineral Commodity Summaries 1985.

| Commodity | Domestic mine production | Apparent consumption | Units | Major Import Sources | Net import reliance | Average 1984 domestic price ($U.S.) | Expected US demand through 1990 | Major uses |
|---|---|---|---|---|---|---|---|---|
| Gold | 2.3 | 4.8 | million troy oz | Canada, Switzerland, Uruguay | 16% | 365.00/oz | Annual increase rate of 2.0 percent | Jewelry, electronic, dental, investment |
| Copper | 1,050 | 2,100 | thousand metric tons | Chile, Canada, Mexico, Peru | 21% | 0.66/lb | Annual increase rate of 1.8 percent | Construction, electrical & electronic, industrial machinery, transportation |

## MINING FEASIBILITY

Copper and gold are present in the Harquahala WSA. Three factors determine if these commodities can be mined profitably: the grade and tonnage of ore, the price of the product, and the cost of production. The grade and tonnage of the ore has been calculated for some surface and underground mineralization. The deposits are small and of variable grade.

Ore deposition at the mineralized areas are controlled by large-scale faults and related structures. Hence, the question of continuity of mineralized structures is added to the uncertainty of mineral development.

The controlling factor for further exploration and development at any of the mineralized areas is the price of gold and copper. For several years the price of copper has remained relatively low, while the price of gold has varied widely.

A problem for the small company will be finding economic methods of processing the medium-grade low-tonnage deposits, which are economically and environmentally attractive. Cyanide heap leaching and portable milling equipment are environmentally sound and yet require small capital investment (See Eveleth, 1980.) Gold recovery by heap leaching is generally in the range of 65-80 percent. Other considerations with heap leaching would be the presence of deleterious minerals which increase cyanide consumption and some oxidized sulfides which prevent successful heap percolation. Laboratory tests would be required to determine the amenability of the mineralized material to heap leaching.

The U.S. Bureau of Mines Research Center in Reno, Nevada has been improving the cyanide-leach process since 1950. They also have information regarding proper grinding size, reagent consumption, and optimum leach cycle time, but only extensive testing can determine the economics.

The competent wall rock, found at most of the mineralized areas, allows the open stoping method of mining to be employed, which is probably one of the cheapest methods for mining a thin vein deposit.

## CONCLUSIONS

In the studied part of the Harquahala Mountains, ten mineralized areas were identified. Mineralization occurs in and near diorite dikes related to large northwest-trending faults. Five mineralized areas are wholly or partially inside the SA, and two are adjacent to the boundary. The three mineralized areas completely inside the SA are the Northwest, North Sunset Canyon, and Crown Prince areas. The Linda Mine and Harquahala Mountain areas are partially within the SA. The Sunshine Mine and Browns Canyon mineralized areas are adjacent to the SA boundary, and Dushey Canyon, Arrastre Gulch, and Blue Tank Canyon mineralized areas are outside the SA.

In the Northwest mineralized area, about 1/4 mi inside the northwest boundary, gold and copper occur in a fracture zone. An indicated resource of

900 tons, and an inferred resource of 2,400 tons of material with an average grade of 0.03 oz gold per ton and 0.87 percent copper, is estimated to be present.

The North Sunset Canyon mineralized area, in the north central part of the SA, is accessible by a jeep trail that has been excluded from the SA. An indicated resource of 2,500 tons of rock with an average grade of 0.28 oz gold per ton and 1.03 percent copper is estimated for the North Sunset Canyon mineralized area.

The Crown Prince mineralized area in the east-central part of the SA contains gold-bearing quartz veins, but because of a lack of development on the veins, no resource can be identified with data available at this time. The quartz veins require further surface and/or underground exploration to determine the extent of mineralization.

The mineralized areas that warrant further exploration to determine the extent of mineralization are: the Sunshine Mine, Linda Mine, Arrastre Gulch, Blue Tank Canyon, southern part of Harquahala Mountain, and North Sunset Canyon. The Dushey Canyon, Browns Canyon, Crown Prince, northern part of Harquahala Mountain, and Northwest mineralized areas have a lesser prospect for further exploration.

All the mineralized areas contain evidence of previous mining operations. Resources have been calculated using available data. Drilling on each property, either on the surface or underground, and drifting underground, are needed to prove reserves and delineate ore zones. Opening up old small mines and producing ore at a profit is very difficult and expensive. Water in the area is scarce, and electricity is non-existent in the Harquahala Mountains SA. The known ore bodies are thin veins of unknown length and insufficient grade and tonnage to attract the interest of a large mining company but may be attractive to some small ambitious mining companies. The Hawke Goldmining Company Ltd., is presently conducting operations at the Sunshine and Linda Mine mineralized areas and should be observed to see if mining in the Harquahala Mountains is economically feasible at this time.

## SUGGESTIONS FOR FURTHER WORK

The Crown Prince mineralized area is in the east-central part of the area and could contain resources of gold. Drilling at the shaft would be needed to determine if gold reserves are present in this part of the SA. Access to the mineralized area would require a road probably from a "cherrystem". The Northwest mineralized area, which is less than 1/4 mi inside the WSA boundary, contains small identified resources. At present, these resources are subeconomic. Drilling would be needed to delineate possible reserves.

The North Sunset Canyon mineralized area and access road to it have been partly excluded from the SA. The identified resource is slightly within the SA as now drawn.

The Linda Mine, Browns Canyon, and Harquahala Mountain mineralized areas are just outside the WSA boundary. Detailed mapping, sampling, and geophysics work would be needed to verify that identified mineralized structures extend into the WSA.

The Sunshine, Dushey Canyon, Arrastre Gulch, and Blue Tank Canyon mineralized areas are either more than a mile from the WSA, or do not project into the SA.

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Table 1.--Summary of information regarding mineralized areas in and near the Harquahala Mountains Study Area.

[Possible by-products shown in parenthesis.]

| Mineralized area, sample numbers | Commodities | Geology: Setting | Geology: Deposit | Development and production | Resources* |
|---|---|---|---|---|---|
| Sunshine Mine, outside the WSA, samples 1-25. SW 11, T6 N, R 10W NE NE 15, " " | Au, Cu, (Zn, Pb). | Precambrian granite, gneiss, schist; Tertiary diorite dikes. | Quartz veins trending east, dips south. | 1 inclined shaft with 2 levels, 5 shafts, 2 adits. 4 prospect pits. Small Au, Ag production. | Medium* Au, Ag. |
| Linda Mine, partly inside the WSA, samples 28-56 NW NW 23, T 6 N, R10W | Au, Ag, (Cu, Pb, Zn). | Tertiary granite, contact with Precambrian granite. | Breccia zones trending northeast; fractured granite. | 4 adits, 2 shafts, 5 prospect pits. Small Au, Ag production. | Medium Au, Ag. |
| Dushey Canyon, outside the WSA, samples 64-82. NW 18, T6 N, R 9 W | Au, Ag, Cu, (Zn, As). | Precambrian granite gneiss; Tertiary diorite dikes. | Quartz veins trending west, dips south. | 2 adits with shaft, 4 prospect pits. Small Au, Ag production. | Medium Au, Ag, |
| Browns Canyon, outside the WSA, samples 83-112. SW SW 20, T6 N, R9 W NW 29, " " | Ag, Cu, (Pb, Zn, Ba, Au). | Precambrian granite, gneiss, diorite dikes. | Breccia zones trending northwest. | 6 bulldozer trenches, 2 prospect pits. | Small Ag, Pb, Cu, Zn. |

*For definition of low, medium, and high, see end of table.

Table 1.--Summary of information regarding mineralized areas in and near the Harquahala Mountains Study Area--Continued

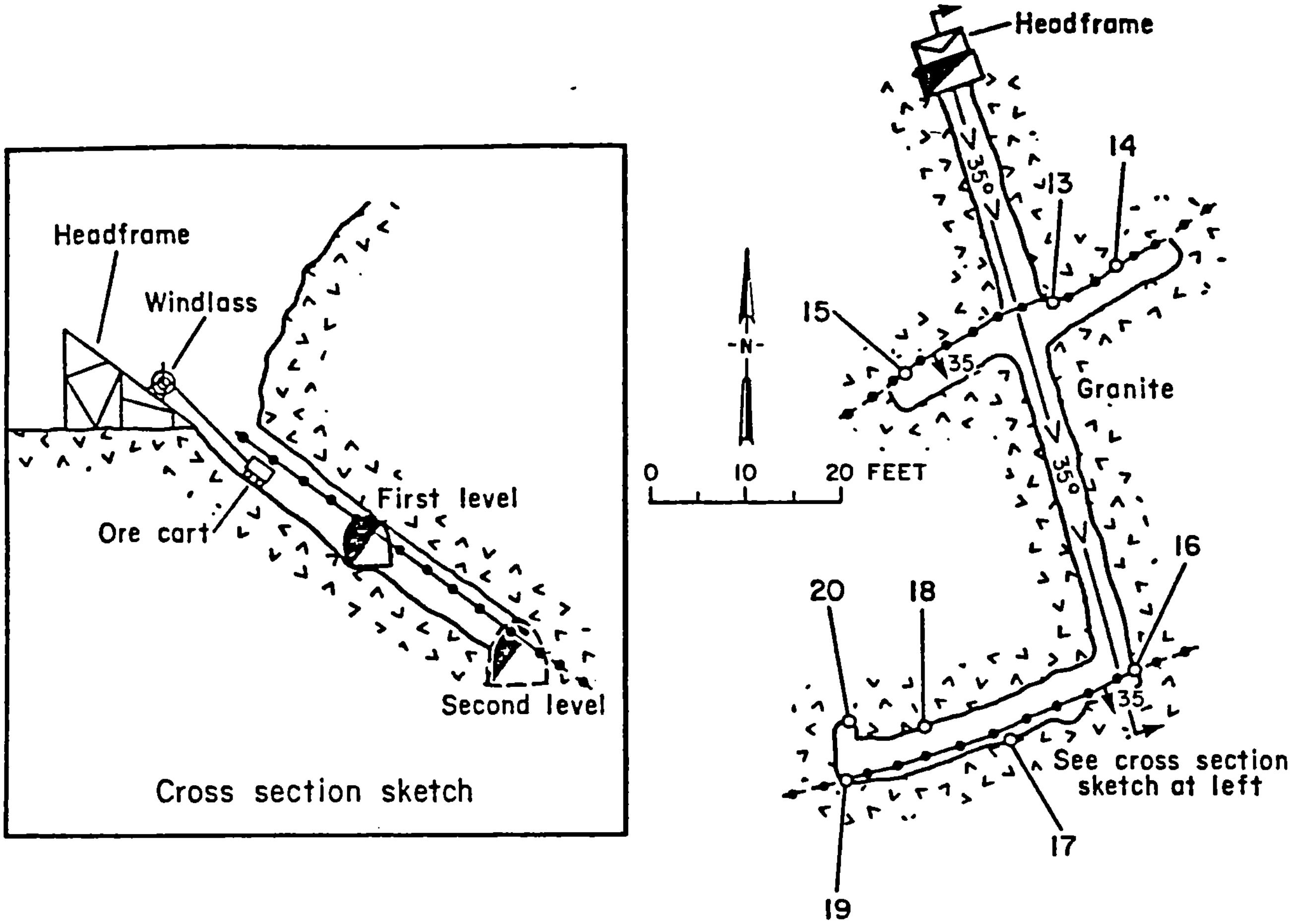
| Mineralized area, sample numbers | Commodities | Geology | | Development and production | Resources |
|---|---|---|---|---|---|
| | | Setting | Deposit | | |
| Crown Prince, inside the WSA, samples 113-132.<br>SW NE 35, T 6 N, R 10 W | Au, Ag, (Cu, Pb, Zn). | Precambrian granite, gabbro; Tertiary diorite dikes. | Quartz veins trending west. | 2 adits, 1 shaft. 2 prospect pits. Small Au, Ag production. | Small Au, Ag. |
| Arrastre Gulch, outside the WSA, samples 136-162.<br>NW 14, T 5 N, R 10 W | Au, Ag, Cu, (Pb, Zn). | Mesozoic granite, gneiss, gabbro, diorite dikes. | Quartz veins trending northwest. | 7 shafts, 1 prospect pit. Medium Au, Ag; Small Cu, Pb production. | Medium Au, Ag, Small Cu, Pb, Zn. |
| Blue Tank Canyon, outside the WSA, samples 174-203.<br>SE NE 17, T 5 N, R 10 W<br>NE SE 17, " " | Au, Ag, Cu, (Pb, Zn, V). | Precambrian granite, gabbro, gneiss, diorite dikes. | Quartz veins trending northwest. | 4 adits, 1 shaft, 2 dozer trenches, 2 prospect pits. Medium Au, Ag, Cu production. | Medium Au, Ag, Cu; Small Pb, Zn. |
| Harquahala Mountain, partially inside the WSA, samples 204-234, 237-252.<br>SW SW 31, T 6 N, R 10 W<br>NE 1, T 5 N, R 11 W | Au, Ag, Cu, (Pb, Zn). | Precambrian granite, gneiss; Tertiary diorite dikes. | Quartz veins trending northwest. | 3 caved adits, 1 dozer trench, 17 prospect pits. Medium Au, Ag; Small Cu. | Medium Au, Ag, Cu outside the WSA. |
| Northwest, inside the WSA, samples 267-272.<br>SE 27, T 6 N, R 11 W | Au, Cu, (Ag, Ba). | Precambrian granite, granite gneiss. | Fractured quartz veins trending west. | 2 short adits, Small Au, Cu production. | Small Au, Cu. |

Table 1.--Summary of information regarding mineralized areas in and near the Harquahala Mountains Study Area--Continued

| Mineralized area, sample numbers | Commodities | Geology: Setting | Geology: Deposit | Development and production | Resources |
|---|---|---|---|---|---|
| North Sunset Canyon, inside the WSA, samples 278-333. SE 19, T6N, R10W | Au, Ag, Cu, (Zn, Pb). | Precambrian granite, granite gneiss, schist; Tertiary diorite dikes. | Quartz veins, fault zones trending northwest. | 3 adits, 1 shaft, prospect pits. Small Au, Cu production. | Medium Au. Small Cu. |

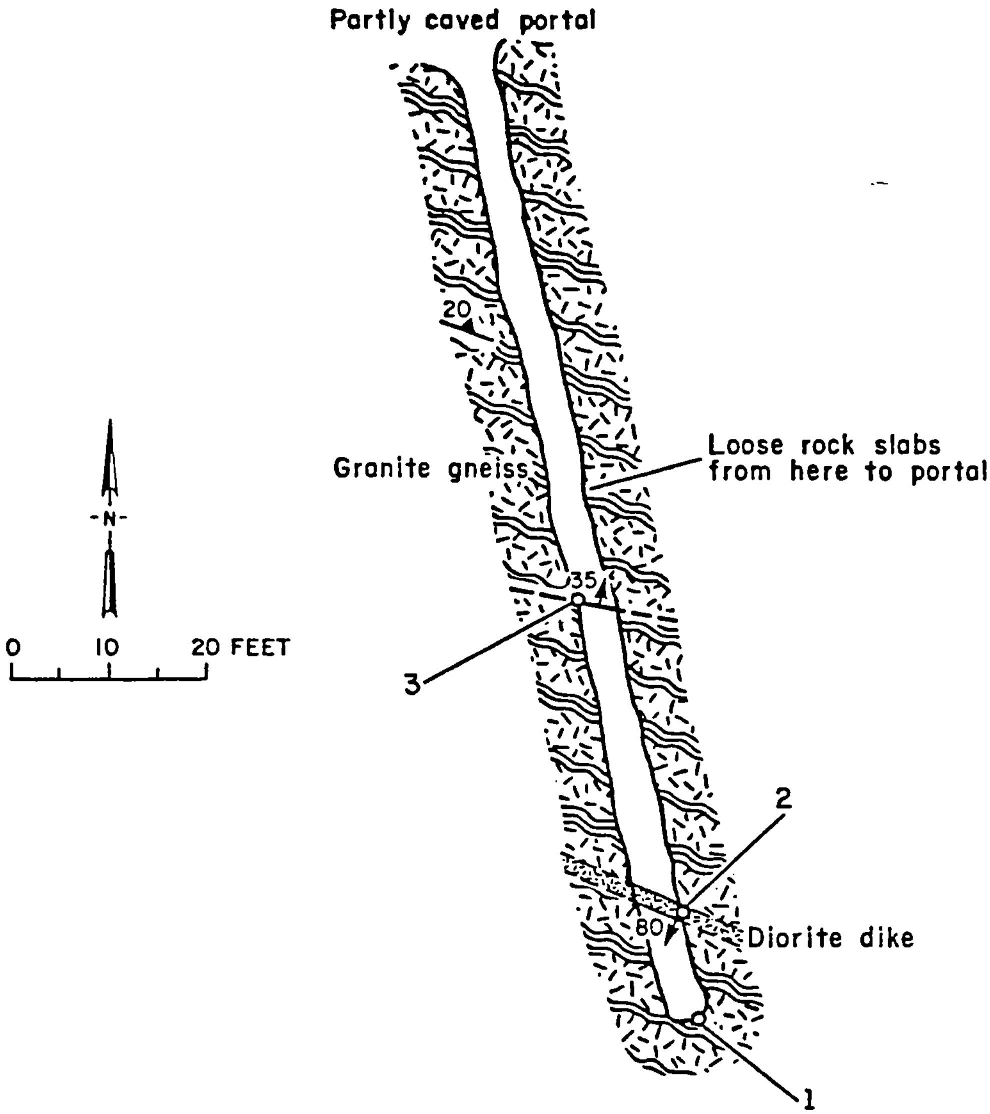
For purposes of this report the following definitions are used:

| | |
|---|---|
| Small production or resource: | gold--less than 200 oz |
| | silver--less than 2,000 oz |
| | copper or lead--less than 20,000 lb |
| Moderate production or resource: | gold--200-2,000 oz |
| | silver--2,000-20,000 oz |
| | copper or lead--20,000 -200,000 lb |




| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Au | Ag | Cu | Fe | Zn | Other |
| No. | Length of chip (ft) | Description | oz/ton | | percent | | | |
| 13 | 3.0 | 0.8-ft-thick quartz vein; altered granite. | 0.14 | --- | --- | 2.9 | --- | |
| 14 | 3.0 | Altered granite (under vein); hematite. | .10 | --- | 0.01 | 4.5 | 0.008 | 0.02 Sr |
| 15 | 2.0 | 2.0-ft-thick quartz vein; hematite, epidote. | .21 | --- | .009 | 4.8 | .001 | .01 Sr |
| 16 | 2.5 | 0.9-ft-thick quartz vein; hematite, epidote. | --- | --- | .02 | 6.0 | .02 | .02 Sr |
| 17 | .8 | 0.8-ft-thick quartz vein; hematite, chrysocolla. | .06 | --- | .19 | NA | --- | .01 Pb |
| 18 | 1.5 | Altered granite gneiss; epidote. | .02 | 0.2 | .07 | NA | .008 | |
| 19 | .4 | 0.3-ft-thick quartz vein; hematite. | --- | --- | .17 | NA | --- | .01 Pb |
| 20 | 3.0 | Altered granite gneiss (above vein); hematite. | .02 | --- | .02 | NA | --- | .01 Sr |

Figure 3.--Map of the Sunshine Mine showing sample localities 13-20.




| | Sample | | Analytical data | | | | |
|---|---|---|---|---|---|---|---|
| | | | Au | Ag | Cu | Fe | Zn |
| No. | Length of chip (ft) | Description | oz/ton | | percent | | |
| 1 | 4.0 | Granite gneiss; quartz, hematite. | --- | --- | --- | 4.1 | --- |
| 2 | .5 | Diorite dike, strikes N. 75° W., dips 80° S.; epidote. | --- | --- | --- | NA | 0.03* |
| 3 | 2.0 | Schist; gouge, epidote, hematite, quartz. | --- | --- | --- | NA | .02* |

Figure 4.--Map of the adit at the west part of the Sunshine Mine mineralized area showing sample localities 1-3.

Table 2.--Data for samples from the Sunshine Mine stet area not shown on Figures 3 and 4.

[For all samples: ---, tested for but not detected; NA, not analyzed for; xxx, not applicable; Cu, Pb, Zn, and Fe determined by atomic absorption, except *, determined by spectrographic analysis; Other, significant elements determined by spectrographic analysis.]

| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Au (oz/ton) | Ag (oz/ton) | Cu (Percent) | Fe (Percent) | Zn (Percent) | Other (Percent) |
| No. | Type | Length (ft) | Description | | | | | | |
| 4 | Chip | 2.0 | Diorite dike, strikes N. 75° W., dips 80° N.; calcite, azurite, chrysocolla. | --- | --- | 0.14 | 6.1 | --- | |
| 5 | do. | 3.0 | Diorite dike, strikes N. 74° W., dips 47° N.; epidote, calcite. | --- | 0.1 | .01 | 7.9 | 0.008 | |
| 6 | do. | 2.0 | Fault, strikes N. 76° E., dips 75° N., gouge, hematite, limonite, calcite. | --- | --- | .16 | 7.3 | .20 | |
| 7 | do. | 5.0 | 5.0-ft-thick quartz vein, strikes N. 78° W., dips 74° N.; hematite. | 0.15 | --- | .008 | 2.1 | .01 | |
| 8 | do. | 1.5 | Fault, strikes N. 85° E., dips 74° N.; gouge, epidote, hematite, limonite. | --- | .1 | .16 | 6.1 | .01 | 0.04 Sr |
| 9 | Grab | xxx | Granite; quartz, hematite. | .08 | .1 | --- | NA | .01* | |
| 10 | Chip | 3.0 | 0.8-ft-thick quartz vein, strikes N. 75° E., dips 50° S.; hematite, calcite. | .10 | --- | --- | NA | .01* | .08 Sr |
| 11 | Select | xxx | Quartz stockpile; hematite, limonite. | 2.17 | --- | --- | 2.9 | .03* | .06 Sr |
| 12 | Chip | 3.5 | Granite; hematite. | --- | --- | --- | 3.3 | --- | .04 Sr |
| 21 | do. | 3.5 | 0.8-ft-thick quartz vein, strikes N. 85° E., dips 60° S.; granite; hematite. | .05 | --- | --- | NA | .03* | |
| 22 | do. | 1.0 | 1.0-ft-thick quartz vein, parallel to above vein, but 15 ft away; hematite. | .81 | .2 | --- | NA | .01* | |

Table 2.--Data for samples from the Sunshine Mine stet area not shown on Figures 3 and 4--Continued

| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Length | | Au | Ag | Cu | Fe | Zn | Other |
| No. | Type | (ft) | Description | oz/ton | | percent | | | |
| 23 | Chip | 3.5 | Granite, diorite; hematite, epidote. | 0.02 | 0.2 | --- | NA | 0.01* | 0.02 Sr |
| 24 | Grab | xxx | Granite; epidote, hematite. | .01 | --- | --- | NA | --- | .03 Sr |
| 25 | Chip | 2.0 | 1.5-ft-thick quartz vein, strikes N. 75° W., | .01 | .1 | 0.03* | NA | .01* | .01 Sr |
| 26 | Select | xxx | Gneiss; magnetite, hematite, epidote. | --- | .3 | --- | 41.0 | .01 | .10 Te |
| 27 | Grab | xxx | Granite; hematite, epidote. | --- | --- | --- | NA | --- | .02 Sr |

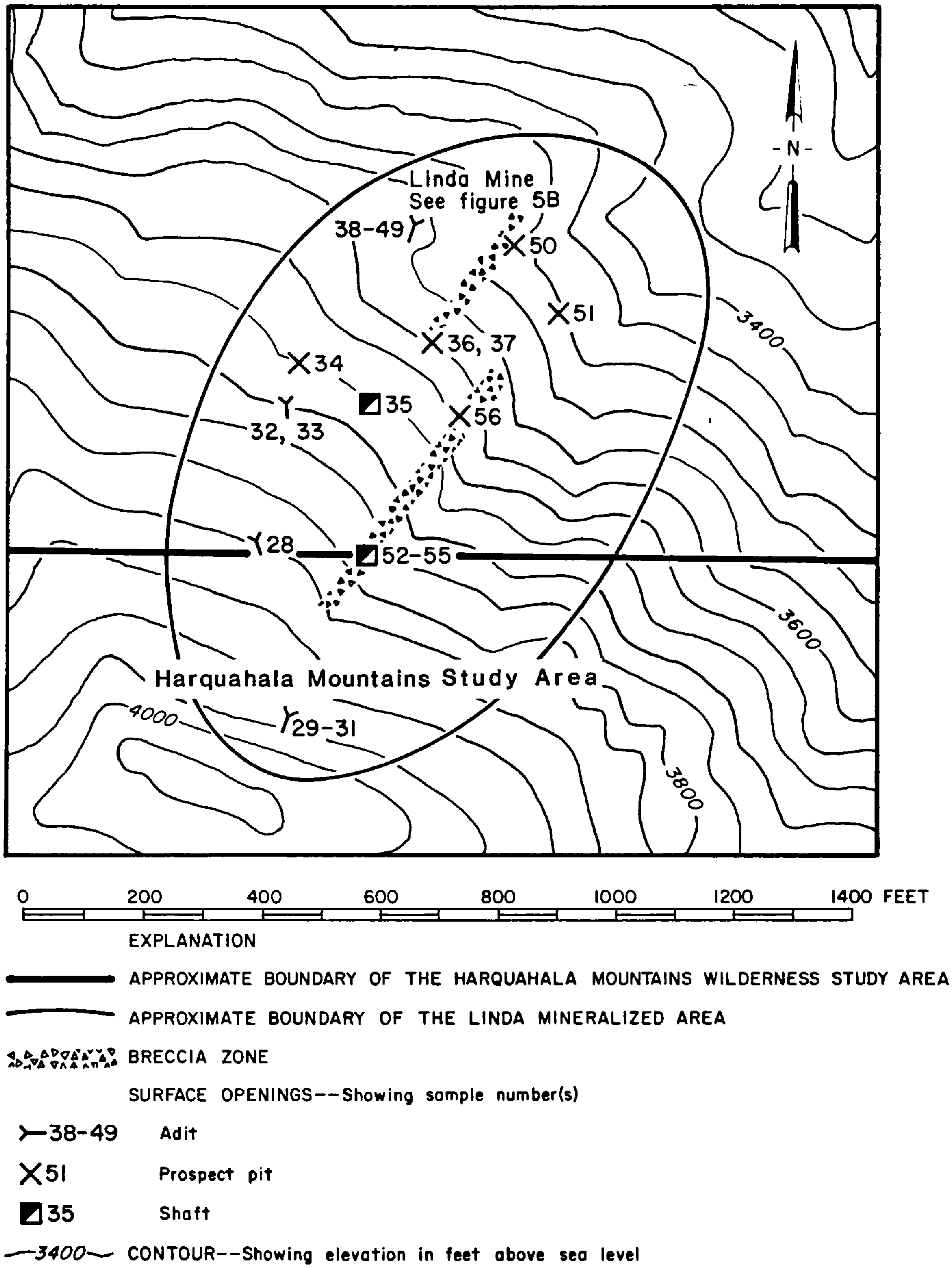



Figure 5A.--Map of the Linda Mine mineralized area showing sample localities 28-56.

Table 3.--Data for samples from the Linda Mine stet area shown on Figure 5A.

| Sample | | | | Analytical data | | |
|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | Au (oz/ton) | Ag (oz/ton) | Other (percent) |
| 28 | Grab | xxx | Granite; epidote. | Tr | --- | 0.01 Zn<br>.01 Sr |
| 29 | Chip | 3.0 | Fractured granite; quartz, hematite. | --- | --- | |
| 30 | do. | 3.0 | Fractured granite; abundant hematite, quartz. | 0.12 | --- | |
| 31 | do. | 3.0 | Diorite dike, strikes N. 25° W., dips vertical; epidote, calcite. | .29 | 0.1 | .01 Zn<br>.02 Sr<br>.01 V |
| 32 | Grab | xxx | Granite; hematite, epidote. | --- | --- | |
| 33 | Select | xxx | Granite; abundant hematite, pyrite, quartz. | .83 | --- | |
| 34 | Grab | xxx | Granite, schist; chlorite, hematite. | .11 | --- | |
| 35 | do. | xxx | Granite, schist, diorite; hematite, calcite. | .02 | Tr | |
| 36 | do. | xxx | Breccia zone, strikes N. 20° E., dips 44° E.; calcite, hematite. | .04 | Tr | |
| 37 | do. | xxx | Granite; hematite stains. | Tr | --- | .01 Sr |
| 50 | do. | xxx | Granite breccia, schist; abundant hematite. | .01 | Tr | |
| 51 | do. | xxx | Granite; calcite, hematite. | Tr | --- | |
| 52 | do. | xxx | Granite, schist; quartz, hematite stains. | .02 | --- | |
| 53 | Select | xxx | Granite; hematite, limonite, vuggy quartz. | .23 | .1 | |

Table 3.--Data for samples from the Linda Mine stet area shown on Figure 5A--Continued

| Sample | | | | Analytical data | | |
|---|---|---|---|---|---|---|
| | | Length | | Au | Ag | Other |
| No. | Type | (ft) | Description | oz/ton | | percent |
| 54 | Chip | 5.0 | Breccia zone, strikes N. 35° E., dips steeply; calcite, hematite. | 0.24 | --- | |
| 55 | Select | xxx | Granite; hematite, pyrite, limonite. | .15 | 1.2 | |
| 56 | Chip | 3.5 | Breccia zone, strikes N. 75° E., dips vertical; granite, hematite, limonite. | .05 | --- | |

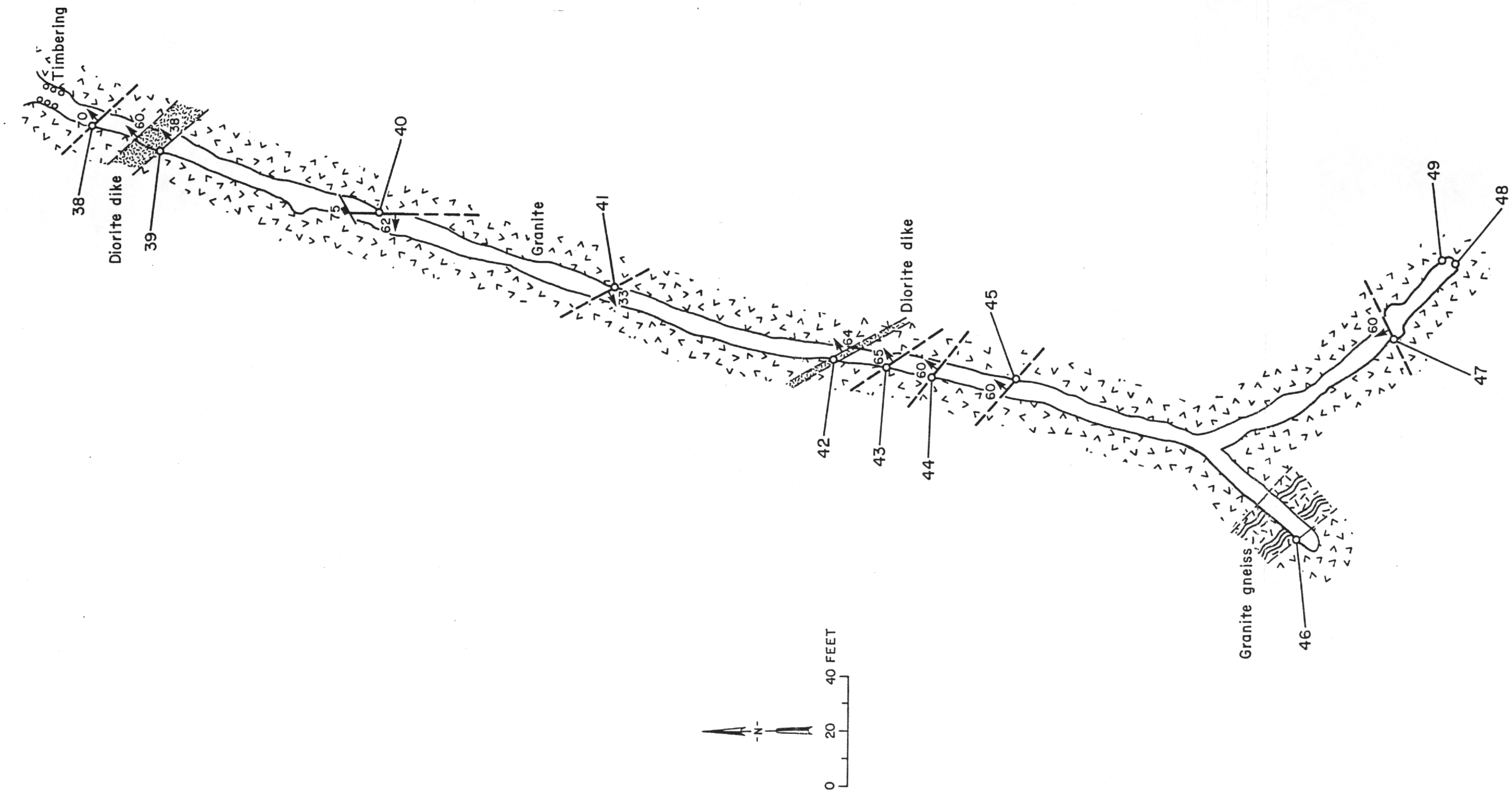



Figure 5B.--Map of the Linda Mine showing sample localites 38-49.

Table 4.--Data for samples from the Linda Mine shown on Figure 5B.

| Sample | | | Analytical data | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Length of chip (ft) | Description | Au (oz/ton) | Ag (oz/ton) | Cu (percent) | Pb (percent) | Zn (percent) | Other (percent) |
| 38 | 4.0 | Fault gouge, hematite, epidote. | --- | --- | --- | --- | --- | |
| 39 | 3.5 | Diorite dike; epidote, calcite, hematite. | --- | --- | --- | --- | --- | 0.01 Sr |
| 40 | 2.0 | Fault gouge, granite, hematite. | --- | --- | --- | --- | --- | .01 Sr |
| 41 | 3.0 | Granite; hematite. | --- | --- | --- | --- | --- | |
| 42 | 1.0 | Diorite dike; calcite, hematite. | --- | 0.1 | --- | --- | 0.04 | |
| 43 | 2.0 | Fault gouge, diorite, calcite. | Tr | --- | 0.01* | --- | .02* | .01 Sr |
| 44 | 2.0 | Fault gouge, hematite, diorite, calcite. | Tr | --- | --- | --- | .02* | .01 Sr |
| 45 | 4.0 | Fault gouge, hematite, diorite, calcite. | --- | --- | .01* | 0.10* | .20* | .01 Sr |
| 46 | 3.0 | Granite gneiss; quartz, hematite. | --- | --- | --- | --- | .01* | |
| 47 | 3.0 | Fault gouge, granite, hematite, malachite. | --- | --- | .10* | .01* | .03* | |
| 48 | 3.0 | Granite; hematite stains. | --- | --- | --- | --- | --- | |
| 49 | 4.0 | do. | --- | .4 | --- | --- | --- | .03 As |

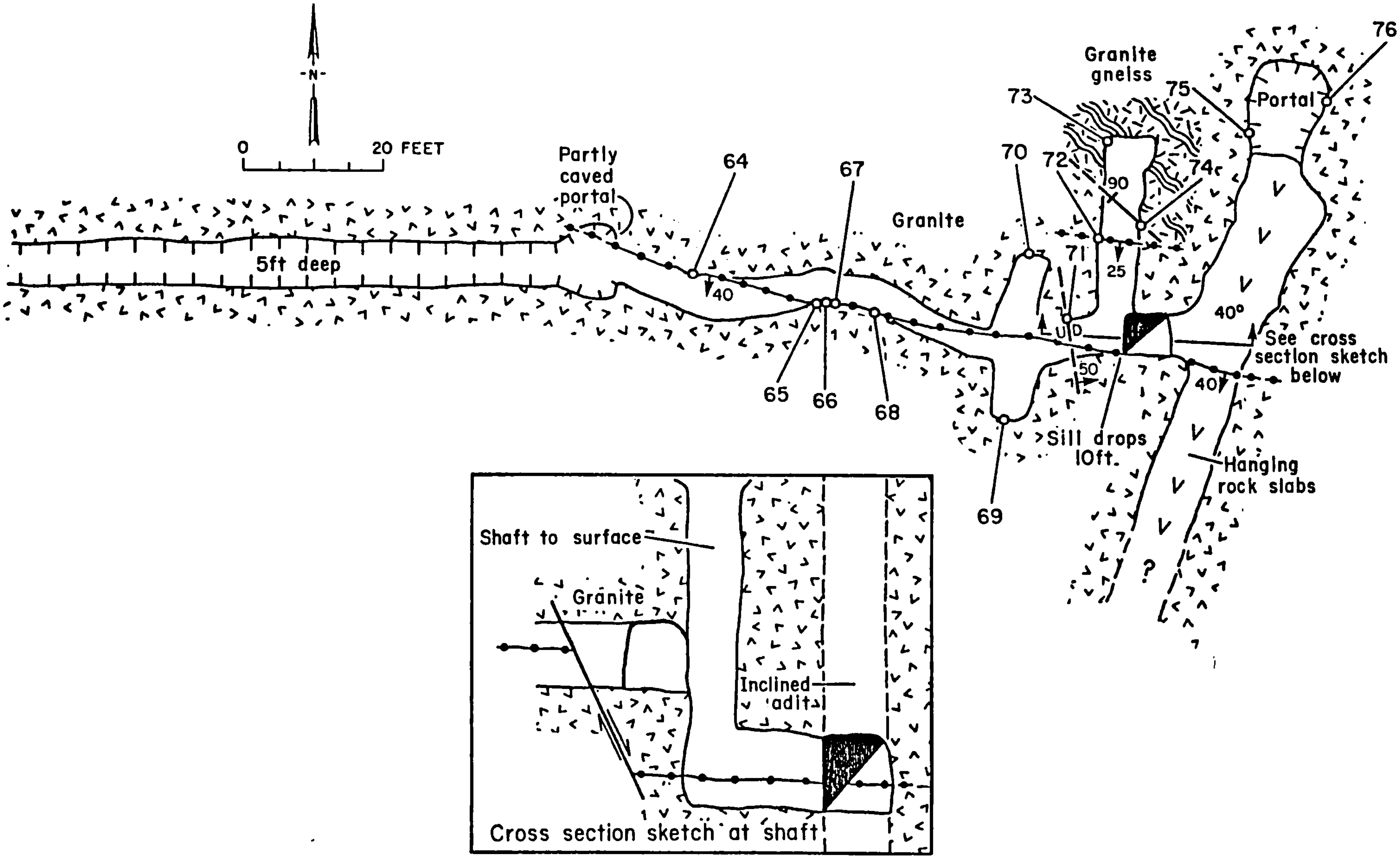



**Figure 6.--Map of the adit in the Dushey Canyon mineralized area showing sample localities sample localities 64-76.**

Table 5.--Data for samples from the adit in the Dushey Canyon mineralized area shown on Figure 6.

| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. | Length of chip (ft) | Description | Au (oz/ton) | Ag (oz/ton) | Cu (percent) | Pb (percent) | Zn (percent) | Other (percent) |
| 64 | 2.5 | 2.0-ft-thick quartz vein; gouge, chalcopyrite, epidote. | Tr | --- | 0.01 | --- | --- | |
| 65 | .6 | Upper 0.6-ft-thick quartz vein, hematite. | Tr | --- | --- | --- | --- | 0.02 Li |
| 66 | .8 | Gouge between quartz veins; phyllite; hematite. | Tr | --- | --- | --- | --- | .03 As |
| 67 | 1.0 | Lower 1.0-ft-thick quartz vein; hematite. | --- | --- | .01 | --- | --- | |
| 68 | 2.0 | 2.0-ft-thick quartz vein; gouge, epidote. | 0.01 | --- | --- | --- | --- | .03 Sr |
| 69 | 2.5 | Fractured granite; abundant hematite. | --- | 0.1 | --- | --- | 0.01* | .01 Sr |
| 70 | 3.0 | Granite; epidote, hematite, quartz. | --- | .1 | --- | --- | .02* | .02 Sr |
| 71 | 1.0 | Fault gouge, brecciated granite, epidote, hematite. | Tr | .1 | .03* | --- | .03* | .02 Sr |
| 72 | 5.0 | Four 1.0-ft-thick quartz veins, hematite; interbedded with thin layers of phyllite. | Tr | --- | .03 | --- | --- | |
| 73 | 2.0 | Granite gneiss; hematite, epidote. | --- | --- | .08 | --- | --- | .02 Sr |
| 74 | 1.5 | Crumbly granite; fault gouge, hematite, limonite. | .01 | .1 | .10* | --- | --- | |
| 75 | 1.5 | Altered granite; hematite. | .01 | --- | .09 | --- | --- | .02 Sr |
| 76 | 3.0 | 3.0-ft-thick quartz vein; abundant hematite. | .07 | --- | .02 | --- | --- | .05 As |

Table 6.--Data for samples in the Dushey Canyon mineralized area not shown on Figure 6.

| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | Au (oz/ton) | Ag (oz/ton) | Cu (percent) | Pb (percent) | Zn (percent) | Other (percent) |
| 59 | Chip | 3.5 | 3.0-ft-thick quartz vein, strikes N. 60° W., dips 24° S.; abundant hematite. | 0.05 | --- | --- | --- | --- | 0.03 As |
| 60 | do. | 1.5 | Fault, strikes N. 60° W., dips 37° N.; gouge hematite, malachite. | --- | 0.1 | 0.18 | --- | 0.03 | .03 As |
| 61 | do. | 4.0 | Massive quartz vein, strikes N. 85° W., dips 28° S.; abundant hematite. | --- | --- | --- | --- | --- | |
| 62 | do. | 4.0 | Granite; quartz, hematite, limonite. | --- | --- | --- | --- | --- | |
| 63 | do. | 3.0 | Granite; abundant quartz, hematite. | --- | --- | --- | --- | --- | .03 As |
| 77 | do. | 2.5 | 2.5-ft-thick quartz vein, strikes N. 75° W., dips 30° S.; abundant limonite, hematite. | .01 | --- | --- | --- | --- | .02 Sr |
| 78 | Grab | xxx | Diorite dike, strikes N. 70° W., dips steeply; epidote, hematite. | Tr | --- | --- | --- | .01 | .02 Sr |
| 79 | Select | xxx | Vein quartz, hematite, chrysocolla, chalcopyrite. | .14 | .2 | 1.0 | --- | --- | |
| 80 | Chip | 2.0 | Schist; epidote. | Tr | .1 | .1* | --- | .01* | .10 Sr |
| 81 | Select | xxx | Vein quartz, vuggy hematite, abundant limonite. | .43 | --- | --- | --- | --- | .03 As |
| 82 | do. | xxx | Vein quartz, pyrite, hematite, limonite. | .04 | --- | --- | --- | --- | .03 As |

Table 7.--Data for samples from the Browns Canyon stet area shown on Plate 1.

| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Au | Ag | Cu | Pb | Zn | Other |
| No. | Type | Length (ft) | Description | oz/ton | | percent | | | |
| 83 | Chip | 4.0 | Brecciated diorite; hematite. | --- | --- | --- | 0.05* | 0.08* | 0.01 Sr |
| 84 | do. | 4.0 | Brecciated diorite; granite; hematite. | Tr | 0.1 | --- | 2.0* | .9* | >10.0 Ba<br>.03 Sr |
| 85 | do. | 3.0 | Breccia zone, strikes N. 27° W., dips 40° N.; diorite; abundant hematite. | --- | --- | --- | .02 | .03 | |
| 86 | do. | 3.0 | Granite; hematite. | --- | --- | --- | --- | .01* | |
| 87 | do. | 2.0 | Brecciated diorite; gouge, hematite. | --- | --- | --- | .02* | .3* | |
| 88 | do. | 2.0 | Granite; hematite. | --- | --- | --- | .03* | .1* | .01 Sr |
| 89 | do. | 4.0 | Altered granite; chlorite, hematite. | --- | .8 | --- | --- | .09* | .03 As |
| 90 | do. | 4.0 | Brecciated granite; hematite. | --- | 1.6 | --- | .05* | .1* | .04 Li |
| 91 | do. | 4.0 | Altered granite; hematite. | --- | --- | --- | --- | .06* | .01 Li |
| 92 | do. | 2.0 | Brecciated granite; diorite; chlorite. | --- | .1 | --- | --- | .02* | |
| 93 | do. | 4.0 | Brecciated granite; hematite. | --- | 1.0 | --- | --- | .09* | .03 Li |
| 94 | do. | 4.0 | Altered granite; chlorite, hematite. | --- | .6 | --- | --- | --- | .03 As |
| 95 | do. | .5 | Shear zone, strikes N. 15° W, dips 65° N.; granite clasts, gouge, hematite. | Tr | --- | 0.07* | --- | --- | .03 As |
| 96 | do. | 4.0 | Granite; hematite, malachite. | Tr | --- | .23 | --- | --- | .03 As<br>.01 Sr |
| 97 | do. | 1.0 | Shear zone, strikes N. 35° W., dips 60° N.; granite clasts, hematite. | Tr | --- | .1* | --- | --- | |

Table 7.--Data for samples from the Browns Canyon stet area shown on Plate 1--Continued

| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | Au (oz/ton) | Ag (oz/ton) | Cu (percent) | Pb (percent) | Zn (percent) | Other (percent) |
| 98 | Chip | 2.0 | Fault, strikes N. 25° E., dips 70° S.; gouge, abundant hematite. | --- | --- | --- | --- | --- | |
| 99 | do. | 3.0 | Granite; hematite. | --- | --- | --- | --- | --- | |
| 100 | do. | 1.3 | Shear zone, strikes N. 75° W., dips 50° N.; diorite; hematite, chlorite. | --- | --- | 0.03* | --- | 0.1* | |
| 101 | do. | 4.0 | Granodiorite; chlorite, hematite. | --- | --- | --- | --- | .02* | |
| 102 | do. | 2.0 | Granite; hematite. | --- | --- | --- | --- | --- | 0.02 Sr |
| 103 | do. | 1.3 | Fault, strikes N. 25° W., dips 55° N.; gouge, granite clasts, hematite. | --- | --- | --- | 0.01* | .06* | .01 Li |
| 104 | do. | 2.5 | Diorite; abundant hematite. | Tr | --- | .02* | --- | .1* | |
| 105 | do. | 4.0 | Granite; hematite. | 0.01 | --- | --- | --- | --- | .03 As<br>.01 Sr |
| 106 | do. | 4.0 | Diorite; chlorite, epidote. | --- | 0.1 | --- | --- | --- | .01 Sr |
| 107 | do. | 4.0 | Granite; hematite. | Tr | --- | --- | --- | --- | .01 Sr |
| 108 | do. | .4 | 0.4-ft-thick quartz vein, strikes N. 80° W., dips 60° N.; gouge, hematite, chlorite. | --- | --- | --- | --- | .1* | .01 Sr |
| 109 | do. | 4.5 | Gneiss; chlorite. | Tr | --- | --- | --- | .06* | .01 Sr |
| 110 | do. | 1.0 | Breccia zone, strikes N. 35° W., dips 50° N.; abundant hematite, quartz. | Tr | .3 | --- | 2.0* | .4* | >10.0 Ba<br>.06 Sr |
| 111 | Select | xxx | Silicious fluorite, abundant hematite. | Tr | 1.8 | --- | --- | .2* | .03 Li<br>23.6 $CaF_2$ |
| 112 | Grab | xxx | Granite; hematite. | Tr | --- | .02 | --- | .02 | .03 Sr |

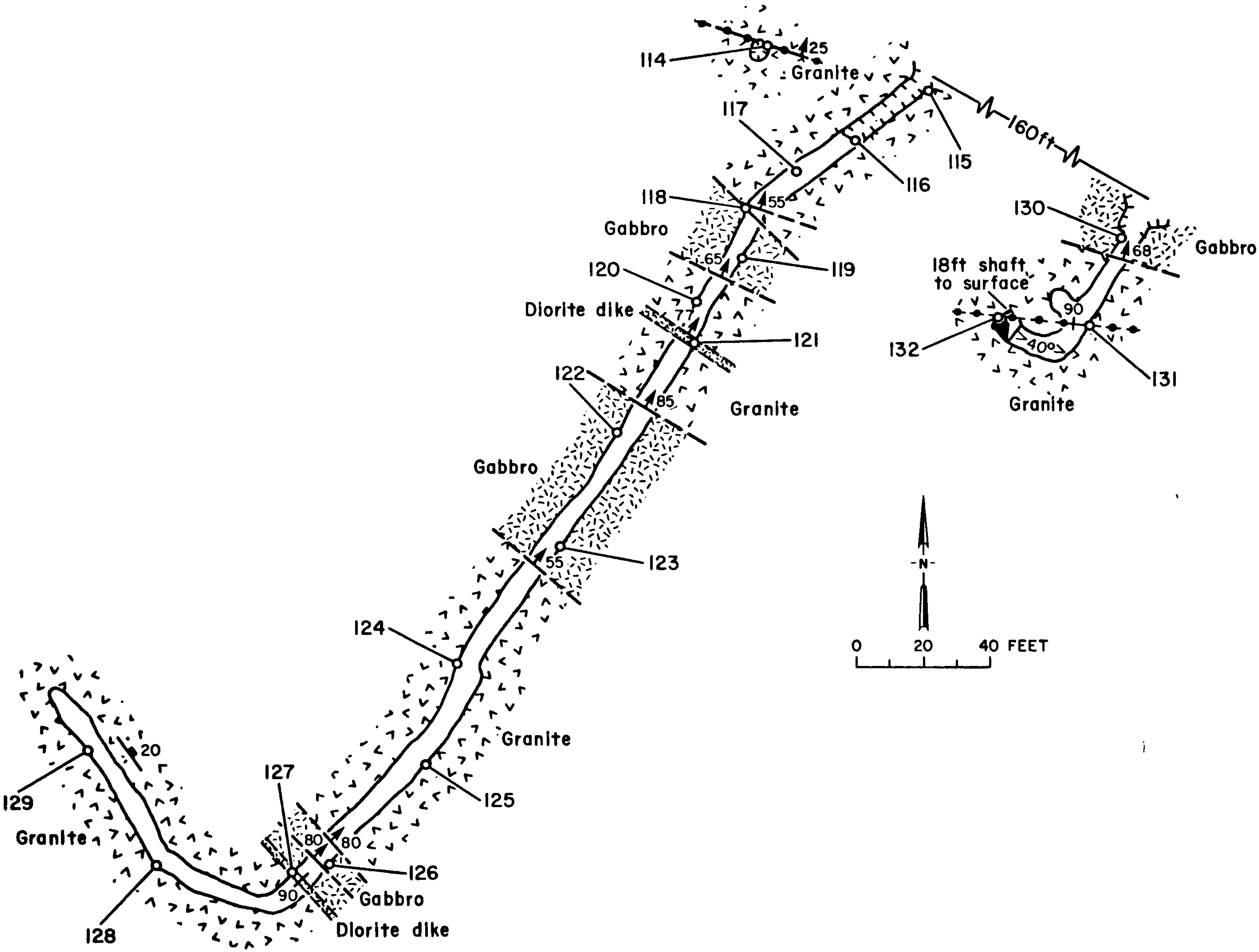



**Figure 7.--Map of the Crown Prince mineralized area showing sample localities 114-132.**

Table 8--Data for samples from the Crown Prince stet area shown on Figure 7.

| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. | Length of chip (ft) | Description | Au (oz/ton) | Ag (oz/ton) | Cu (percent) | Pb (percent) | Zn (percent) | Other (percent) |
| 114 | 1.0 | 1.0-ft-thick quartz vein; gouge hematite. | 0.03 | --- | --- | 0.01 | --- | |
| 115 | 3.0 | Unaltered granite, hematite. | .08 | --- | --- | --- | --- | |
| 116 | .5 | 0.5-ft-thick flat-lying quartz vein; hematite, pyrite. | .51 | Tr | --- | --- | --- | |
| 117 | 4.0 | Unaltered granite; hematite. | --- | --- | --- | --- | --- | |
| 118 | .4 | Fault gouge; abundant hematite, epidote. | --- | 0.1 | 0.1 | .01 | 0.07 | 0.02 Sr |
| 119 | 5.0 | Altered gabbro; hematite. | --- | --- | --- | --- | .02 | .05 Sr |
| 120 | 4.0 | Unaltered granite. | --- | --- | --- | --- | --- | .01 Sr |
| 121 | 1.5 | Fractured diorite dike; epidote. | --- | --- | .01 | --- | .01 | .02 Sr |
| 122 | 4.5 | Altered gabbro; hematite. | --- | --- | --- | --- | .01* | .02 Sr |
| 123 | 4.0 | Altered gabbro; hematite, epidote. | --- | Tr | .01 | --- | .01 | .02 Sr |
| 124 | 2.0 | Unaltered granite. | --- | --- | --- | --- | --- | |
| 125 | 5.0 | Unaltered granite; hematite. | --- | --- | --- | .01* | --- | .02 Li<br>.01 Sr |
| 126 | 3.0 | Altered gabbro; epidote. | --- | --- | --- | --- | --- | .07 Sr |
| 127 | .6 | Altered diorite dike; hematite, epidote. | --- | Tr | --- | --- | .01 | .07 Sr |
| 128 | 2.0 | Altered granite. | Tr | --- | --- | --- | --- | |
| 129 | 2.0 | do. | --- | --- | --- | --- | --- | |

Table 8--Data for samples from the Crown Prince stet area shown on Figure 7--Continued

| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. | Length of chip (ft) | Description | Au | Ag | Cu | Pb | Zn | Other |
| | | | oz/ton | | percent | | | |
| 130 | 3.0 | Altered/weathered gabbro. | --- | --- | 0.02 | --- | 0.02 | 0.02 Sr |
| 131 | 1.0 | 0.5-ft-thick quartz vein. | 0.15 | 2.1 | --- | 0.02* | .01* | |
| 132 | .5 | 0.5-ft-thick fractured quartz vein; hematite. | 1.32 | .2 | .01 | .02 | .01 | |

The following sample was taken from a prospect in the mineralized area, about 1/2 mi NE of the above workings.

| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | Au | Ag | Cu | Pb | Zn | Other |
| | | | | oz/ton | | percent | | | |
| 113 | Select | xxx | Shear zone, strikes N. 50° W., dips 25° N.; quartz, hematite, pyrite. | 0.15 | 0.1 | 0.01 | 0.01 | --- | |

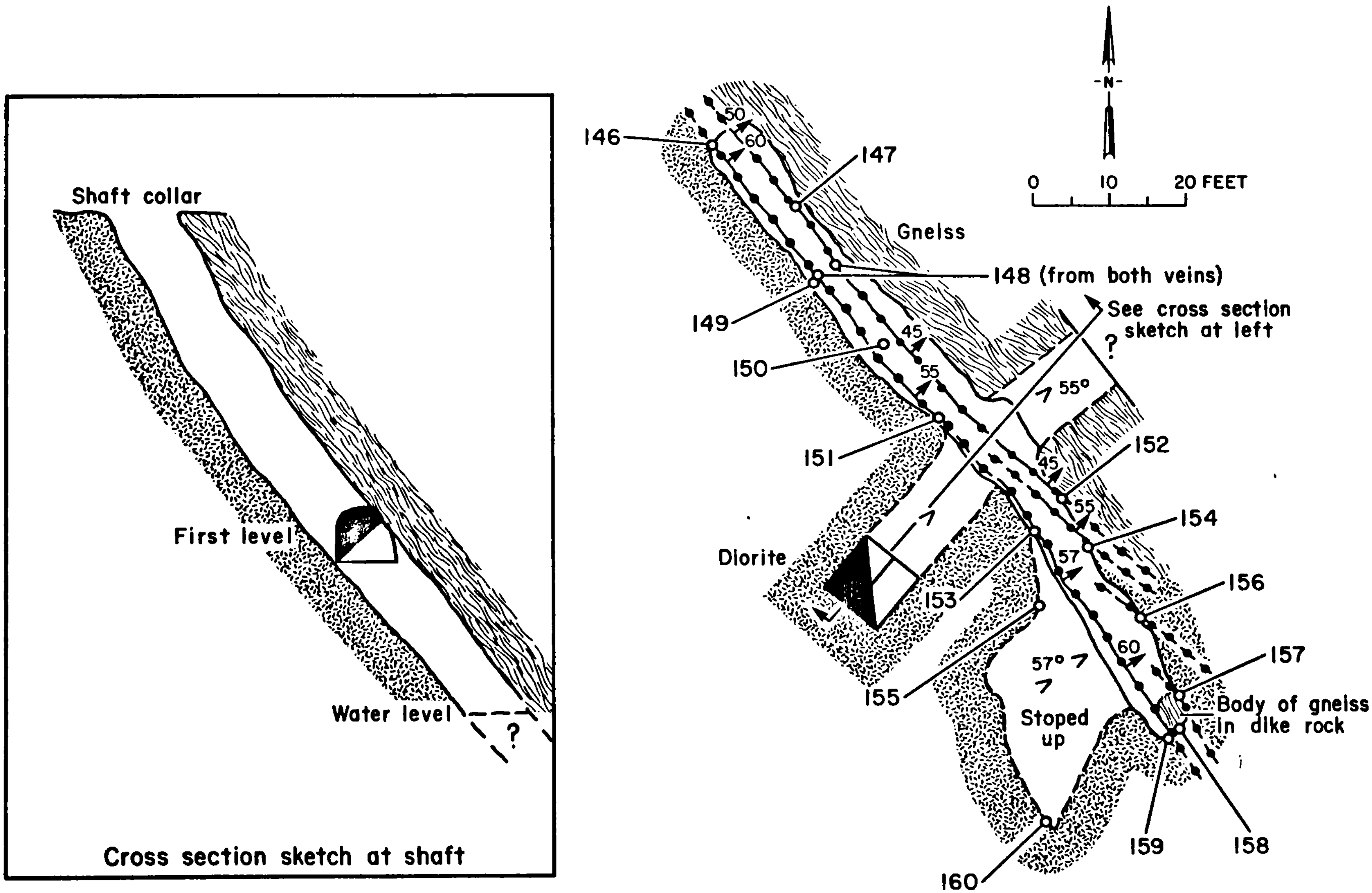


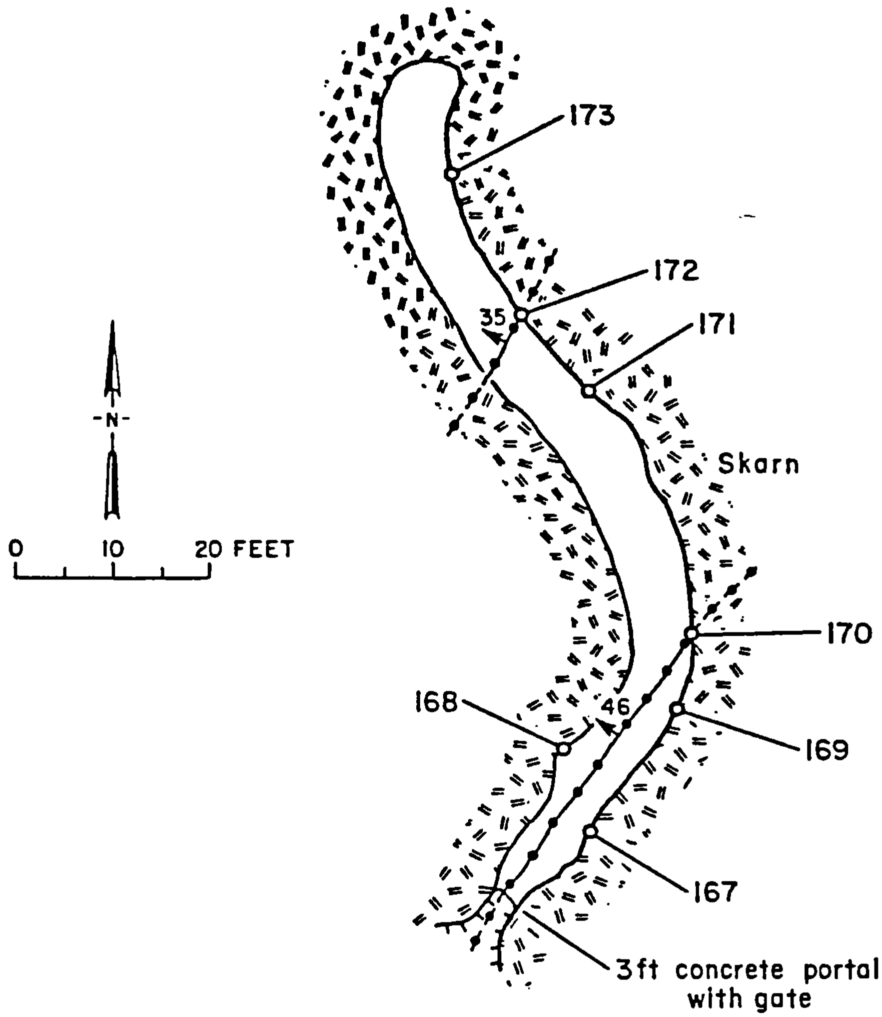

Figure 8.--Map of a shaft in the Arrastre Gulch mineralized area showing sample localities 146-160.

Table 9--Data for samples from a shaft in the Arrastre Gulch mineralized area shown on Figure 8.

| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Au | Ag | Cu | Pb | Zn | Other |
| No. | Length of chip (ft) | Description | oz/ton | | percent | | | |
| 146 | 0.6 | 0.6-ft-thick quartz vein; hematite, chrysocolla. | 0.47 | 0.1 | 0.80 | 0.04 | 0.06 | 0.01 Sr |
| 147 | .4 | 0.4-ft-thick quartz vein; hematite, chrysocolla. | .10 | --- | .39 | .06 | .06 | .03 Sr |
| 148 | .7 | 0.7-ft-thick quartz vein; hematite, chrysocolla. | .20 | --- | .98 | .09 | .07 | .03 Sr |
| 149 | 1.5 | Unaltered diorite dike; hematite, calcite. | Tr | --- | .04* | --- | .02* | .03 Sr |
| 150 | 1.0 | Unaltered diorite dike; hematite, malachite. | Tr | --- | .34 | --- | .04 | .05 Sr |
| 151 | 1.2 | Brecciated 1.2-ft-thick quartz vein; hematite. | .25 | --- | .40 | .11 | .04 | .04 Sr |
| 152 | .2 | 0.2-ft-thick epidote vein; hematite, limonite. | Tr | --- | .13 | --- | .03 | |
| 153 | .6 | 0.6-ft-thick quartz vein; hematite, chrysocolla, calcite. | .21 | --- | 1.4 | .04 | .07 | |
| 154 | .5 | 0.5-ft-thick quartz vein; epidote, hematite. | Tr | --- | .11 | .02 | .01 | |
| 155 | .7 | 0.7-ft-thick quartz vein; hematite, chrysocolla. | .28 | --- | .25 | .02 | .05 | |
| 156 | .3 | Epidote and calcite veinlets; hematite. | Tr | --- | --- | --- | --- | .1 Sr |
| 157 | .5 | Fault gouge; hematite, limonite. | Tr | --- | .04 | --- | .02 | .02 Sr |
| 158 | 2.5 | Augen gneiss; hematite. | .01 | --- | .03* | --- | .06* | .07 Sr |
| 159 | .9 | 0.9-ft-thick quartz vein; hematite, calcite. | .22 | --- | .27 | .03 | .04 | .02 Sr |
| 160 | 1.2 | 1.2-ft-thick quartz vein; hematite, calcite. | 2.07 | .1 | .26 | .03 | .01 | |

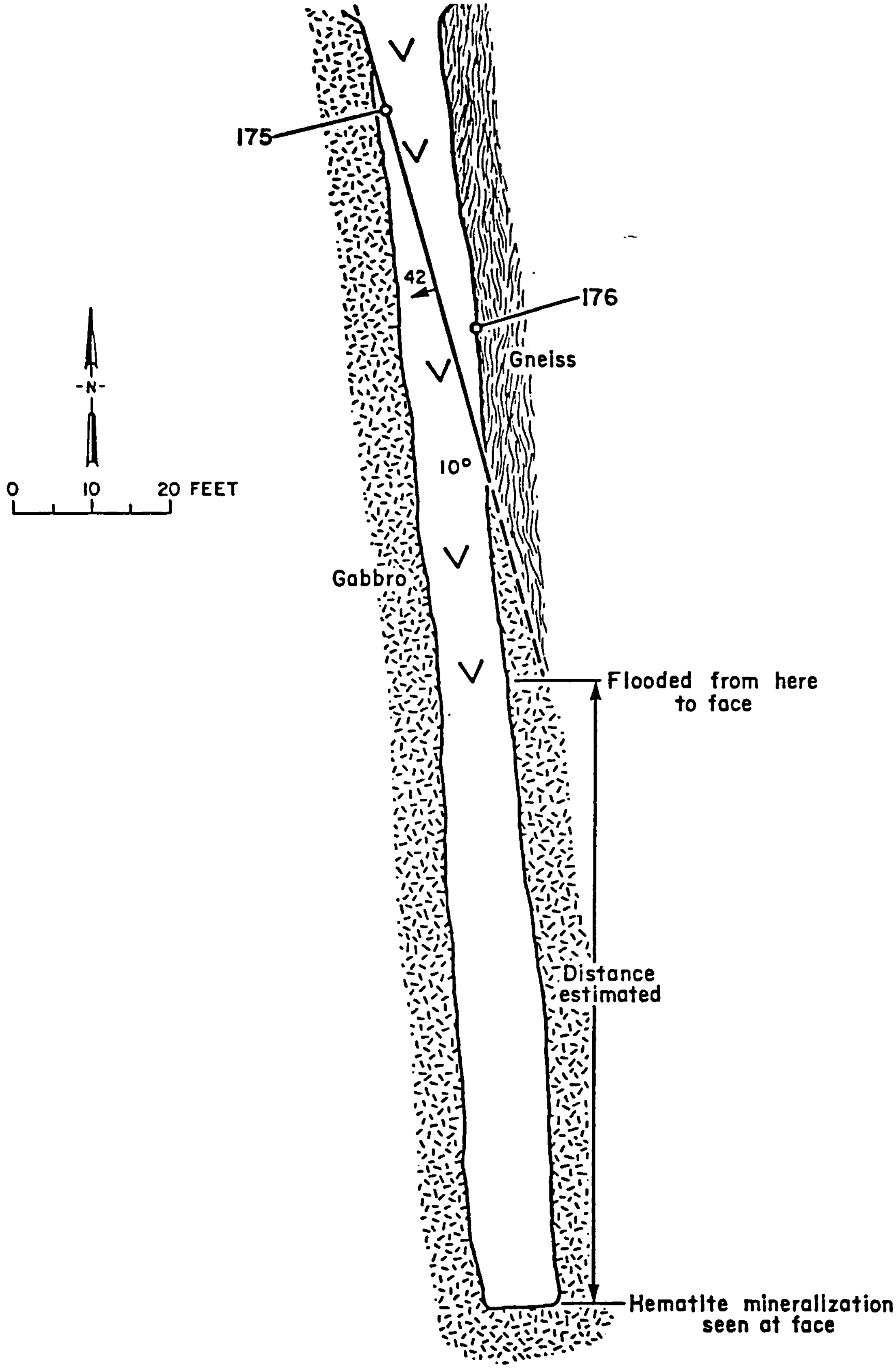
Table 10.--Data for samples from the Arrastre Gulch mineralized area not shown on Figure 8.

| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | Au (oz/ton) | Ag (oz/ton) | Cu (percent) | Pb (percent) | Zn (percent) | Other (percent) |
| 136 | Chip | 2.0 | Fault, strikes N. 40° W., dips vertical; hematite, limonite, quartz | --- | --- | 0.25 | 0.08 | 0.05 | 0.01 V |
| 137 | Select | xxx | Quartz vein, strikes N. 35° W., dips 45° N.; abundant hematite, pyrite. | --- | --- | .07 | .03 | .01 | .04 V |
| 138 | Grab | xxx | Diorite; calcite, hematite. | --- | --- | --- | --- | .04* | .01 Cr<br>.01 Ni |
| 139 | Select | xxx | Quartz vein, strikes N. 30° W., dips 62° N.; abundant hematite, pyrite. | 0.24 | --- | .04 | .01 | --- | |
| 140 | Grab | xxx | Diorite; hematite, epidote. | Tr | --- | --- | --- | .01* | .01 Cr<br>.01 Ni |
| 141 | Select | xxx | Quartz vein, strikes N. 30° W., dips 70° N.; abundant hematite, epidote, pyrite. | --- | --- | .12 | --- | --- | .02 V |
| 142 | Grab | xxx | Gabbro; hematite. | --- | --- | --- | --- | .02* | .03 Sr |
| 143 | do. | xxx | Diorite; epidote, hematite. | --- | --- | --- | --- | .01* | .05 Li |
| 144 | Select | xxx | Quartz vein, strikes N. 62° W., dips 65° N.; abundant limonite, goethite. | .07 | --- | .06 | .01 | --- | |
| 145 | Grab | xxx | Epidote vein next to above quartz vein; pyrite. | --- | --- | .03 | --- | --- | .1 Sr |
| 161 | Chip | 4.0 | Altered granite zone, strikes N. 70° W., dips vertical; hematite, epidote, quartz. | Tr | --- | .02 | --- | .02 | .03 Sr |
| 162 | Select | xxx | Quartz vein, strikes N. 60° W., dips vertical; abundant hematite, calcite. | .05 | --- | --- | .01 | --- | .03 V |



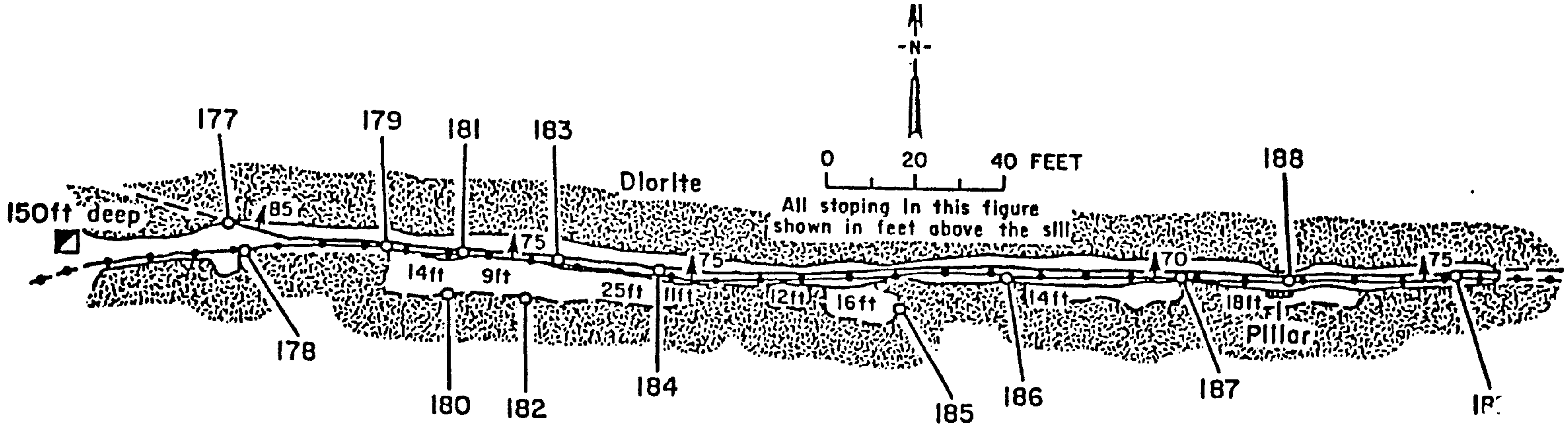

| Sample | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|
| Length of chip (ft) | Description | Au | Ag | Cu | Pb | Zn | Other |
| | | oz/ton | | percent | | | |
| 3.5 | Skarn; calcite, hematite. | --- | --- | --- | --- | 0.01 | |
| 2.0 | Diorite; hematite, calcite, epidote. | --- | 0.1 | --- | --- | --- | 0.01 Sr |
| 3.0 | Skarn; hematite, calcite. | --- | --- | 0.01 | --- | --- | .03 V |
| 2.0 | do. | Tr | --- | --- | --- | --- | .02 V |
| 1.5 | Altered diorite; hematite. | --- | .1 | .01 | --- | 0.01 | .01 Sr |
| 0.5 | Skarn; quartz, hematite. | Tr | .1 | --- | --- | .01 | .03 V |
| 1.0 | Altered diorite; hematite. | --- | .2 | --- | --- | --- | .02 V |

Figure 9.--Map of an adit near the Blue Tank Canyon mineralized area showing sample localities 167-173.



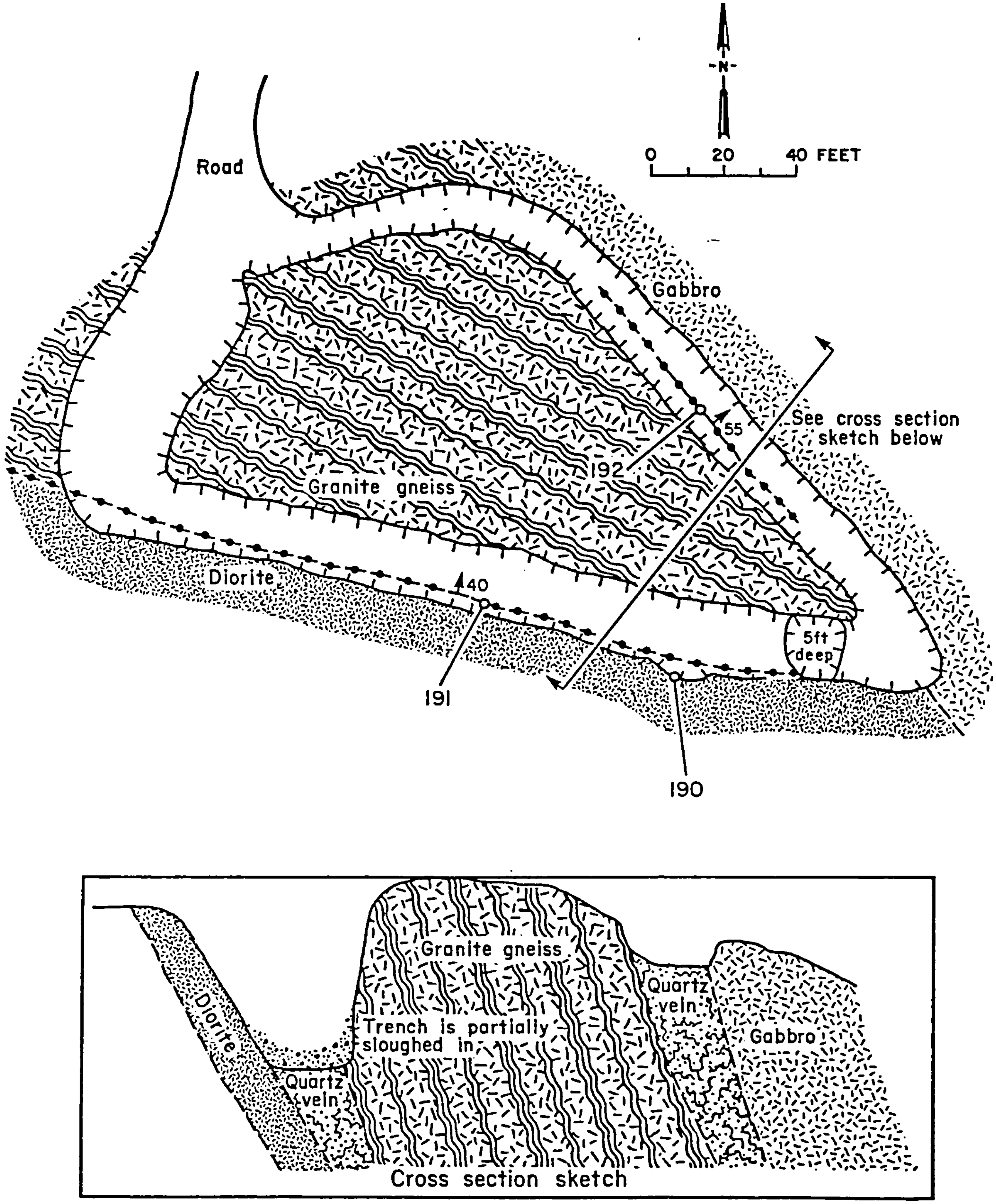

| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| Type | Length (ft) | Description | Au | Ag | Cu | Pb | Zn | Other |
| | | | oz/ton | | percent | | | |
| Chip | 1.0 | Fault gouge, hematite. | --- | 0.1 | --- | --- | --- | |
| do | 3.0 | Gneiss; hematite. | --- | --- | --- | --- | 0.01* | 0.03 Sr |

**Figure 10.--Map of an adit in the Blue Tank Canyon mineralized area showing sample localities 175-176**



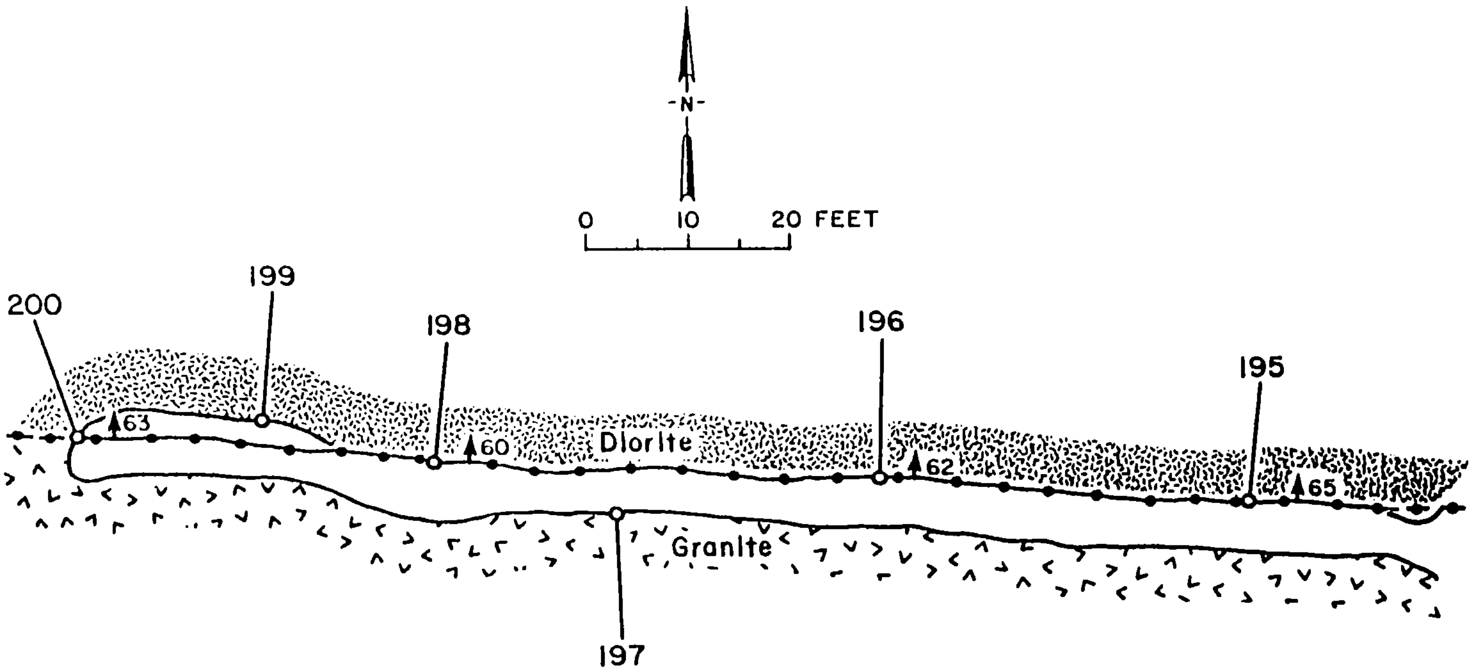

| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Au | Ag | Cu | Pb | Zn | Other |
| No. | Length of chip (ft) | Description | oz/ton | | percent | | | |
| 177 | 0.4 | Fault gouge, diorite, hematite. | Tr | --- | 0.01 | --- | --- | |
| 178 | 1.5 | Diorite; quartz vein; hematite, chrysocolla. | 0.48 | 0.7 | 1.9 | 0.02 | --- | 0.01 Li |
| 179 | 1.5 | Quartz vein; hematite, chrysocolla, pyrite. | .17 | .2 | 2.9 | --- | 0.01 | .01 Li<br>.02 V |
| 180 | 3.0 | Quartz vein; hematite, azurite, chalcopyrite, pyrite. | .45 | .1 | 3.9 | .01 | --- | |
| 181 | 1.2 | Quartz vein; hematite, chrysocolla. | .02 | --- | 1.2 | --- | --- | |
| 182 | 1.0 | Quartz vein; hematite, azurite, chalcopyrite. | .03 | .2 | 2.9 | --- | .01 | |
| 183 | .9 | Quartz vein; hematite, chrysocolla, pyrite. | .18 | .4 | 4.7 | .03 | .01 | .02 V |
| 184 | 1.5 | Quartz vein, breccia; azurite, chalcopyrite, hematite. | .11 | --- | 2.1 | .02 | .01 | |
| 185 | 1.0 | Quartz vein; hematite, chrysocolla, pyrite, hematite. | .46 | .3 | 3.9 | .01 | --- | .02 V |
| 186 | 2.0 | Diorite; quartz, bornite, chalcopyrite, chrysocolla, hematite, azurite. | .73 | .3 | 3.2 | --- | --- | |
| 187 | 2.1 | Quartz vein, breccia; hematite, bornite, chalcopyrite. | .10 | .2 | 6.0 | --- | --- | .02 V |
| 188 | 1.8 | Diorite; chrysocolla, hematite, malachite. | .01 | .1 | .34 | --- | --- | |
| 189 | 1.8 | Quartz breccia; hematite, azurite, chalcopyrite. | .63 | .1 | .72 | .01 | --- | .02 Li<br>.03 V |

Figure 11.--Map of and adit in the Blue Tank Canyon mineralized area showing sample localities 177-189.



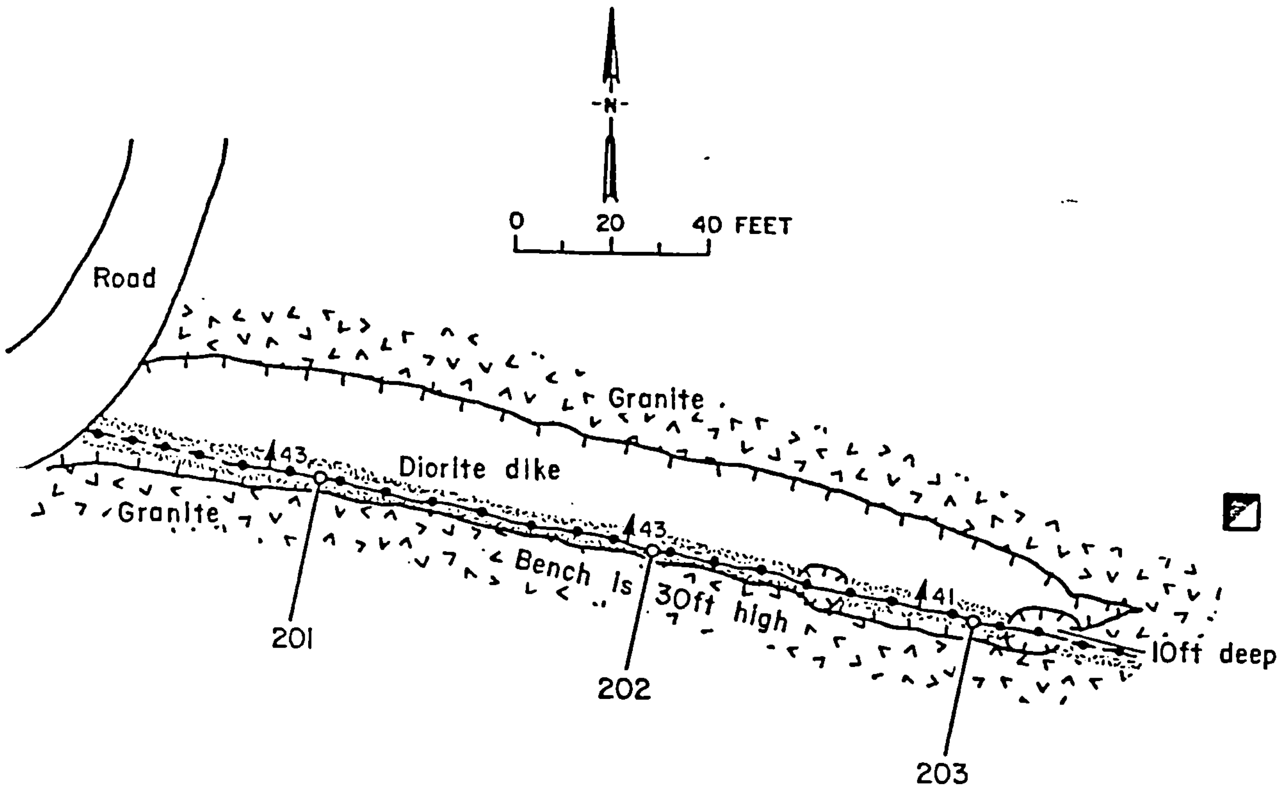

| Sample | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|
| Length of chip (ft) | Description | Au (oz/ton) | Ag (oz/ton) | Cu (percent) | Pb (percent) | Zn (percent) | Other (percent) |
| 5.0 | Altered diorite; hematite, chrysocolla. | 0.07 | --- | 0.34 | --- | --- | |
| 2.0 | 2.0-ft-thick quartz vein; hematite, chrysocolla. | .04 | 0.4 | 5.0 | --- | --- | 0.05 Li |
| 3.0 | Quartz; altered gabbro; hematite. | .01 | .3 | .11 | --- | --- | .01 Sr |

Figure 12.--Map of a bulldozer trench in the Blue Tank Canyon mineralized area showing sample localities 190-192.




| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. | Length of chip (ft) | Description | Au oz/ton | Ag oz/ton | Cu percent | Pb percent | Zn percent | Other |
| 195 | 0.5 | 0.5-ft-thick quartz vein; hematite, chrysocolla, calcite. | --- | 0.3 | 0.93 | --- | --- | |
| 196 | .5 | do. | --- | .1 | .30 | --- | --- | |
| 197 | 2.0 | Altered granite; calcite, quartz, hematite. | 0.06 | .2 | .02 | --- | --- | |
| 198 | .5 | 0.5-ft-thick quartz vein; hematite, chrysocolla, calcite. | .01 | .2 | .63 | --- | --- | 0.01 Li |
| 199 | 3.0 | Diorite; hematite, epidote. | .03 | .2 | .03* | --- | --- | .02 Sr |
| 200 | .5 | 0.5-ft-thick quartz vein; hematite, calcite. | Tr | .2 | .02 | --- | --- | |

Figure 13.--Map of an adit in the Blue Tank Canyon mineralized area showing sample localities 195-2-0.




| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Length of chip | | Au | Ag | Cu | Pb | Zn | Other |
| No. | (ft) | Description | oz/ton | | percent | | | |
| 1 | 5.0 | Altered diorite dike; quartz, hematite. | Tr | 0.2 | 0.1* | --- | --- | 0.02 Sr |
| 202 | .7 | 0.7-ft-thick quartz vein; chrysocolla, hematite. | --- | .1 | 3.3 | 0.08 | 0.02 | |
| 3 | 2.0 | Altered diorite; quartz, chrysocolla, hematite, calcite. | 0.02 | --- | 1.2 | --- | --- | |

Figure 14.--Map of a bulldozer trench in the Blue Tank Canyon mineralized area showing sample localities 201-203

Table 11.--Data for samples from the Blue Tank stet area that are not shown on figures.

| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Au | Ag | Cu | Pb | Zn | Other |
| No. | Type | Length (ft) | Description | oz/ton | | percent | | | |
| 174 | Select | xxx | Vein quartz, chrysocolla, azurite, hematite. | 0.77 | 0.2 | 3.3 | 0.01 | 0.01 | |
| 193 | Chip | 1.0 | Fault strikes N. 8° W., dips 48° E.; gouge, hematite, chlorite, calcite. | --- | --- | .03 | --- | --- | |
| 194 | do. | 2.0 | Gneiss; quartz, calcite, hematite, chlorite. | --- | --- | --- | --- | --- | |

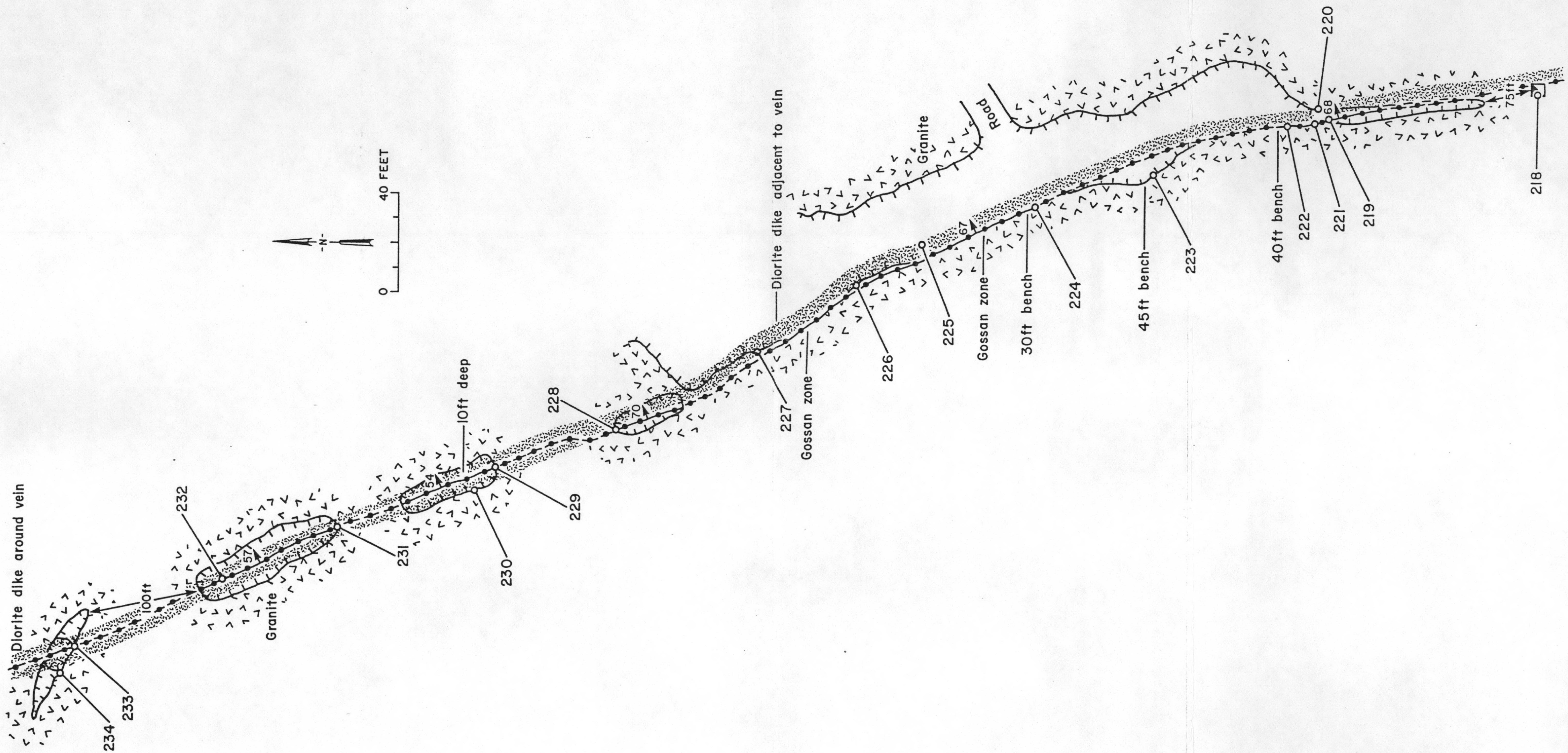



Figure 15A.--Map of the bulldozer trench on top of Harquahala Mountain showing sample localites 218-234.

Table 12--Data for samples from the bulldozer trench on top of Harquahala Mountain shown on Figure 15A.

| Sample | | | Analytical data | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Length of chip (ft) | Description | Au | Ag | Cu | Pb | Zn | Other |
| | | | oz/ton | | percent | | | |
| 218 | 1.5 | Altered granite; quartz, hematite, azurite. | --- | --- | 0.12 | --- | --- | |
| 219 | 1.5 | Altered granite; quartz pods, azurite, chlorite. | Tr | --- | .3* | --- | --- | |
| 220 | 4.0 | Diorite dike; hematite. | --- | --- | .4* | --- | 0.01* | 0.01 Li<br>.04 V |
| 221 | 1.5 | Altered granite; quartz pods, hematite. | Tr | 0.2 | .09* | --- | --- | |
| 222 | 2.5 | Altered granite; hematite. | --- | --- | .3* | 0.02* | --- | .02 Li |
| 223 | 3.5 | Altered granite; limonite. | --- | .4 | .2* | --- | --- | |
| 224 | 6.0 | Gossan zone, strikes N. 35° W., dips 60° N.; hematite, limonite. | 0.01 | .4 | .16 | .16 | --- | .03 V |
| 225 | 3.0 | Diorite dike; hematite. | --- | .1 | .13 | --- | .02 | .02 Li |
| 226 | 6.0 | Granite; quartz pods, stringers of diorite. | --- | --- | .01* | --- | --- | .01 Sr |
| 227 | 1.5 | Fractured quartz zone; limonite. | Tr | .1 | .02 | --- | --- | |
| 228 | 2.0 | Gossan zone, strikes N. 18° W., dips 68° N; hematite, limonite. | --- | .4 | .05 | .01 | --- | .03 V |
| 229 | 1.5 | Silicious gossan zone; hematite, limonite. | .01 | --- | .34 | --- | --- | .02 V |
| 230 | 4.0 | Altered diorite dike; hematite. | --- | --- | .2* | --- | --- | .02 Sr |
| 231 | 2.0 | Quartz vein; hematite, limonite. | --- | --- | .15 | --- | --- | |

Table 12--Data for samples from the bulldozer trench on top of Harquahala Mountain shown on Figure 15A--Continued

| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. | Length of chip (ft) | Description | Au | Ag | Cu | Pb | Zn | Other |
| | | | oz/ton | | percent | | | |
| 232 | 2.0 | Quartz vein; hematite. | Tr | --- | 0.10 | --- | --- | |
| 233 | 2.0 | Quartz vein; hematite, gouge. | Tr | --- | .06 | --- | --- | 0.02 V<br>.02 Zr |
| 234 | 2.0 | Altered diorite dike; hematite. | --- | --- | .01* | --- | --- | |

Table 13.--Data for samples from the Harquahala Mountain mineralized area shown on Plate 1.

| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (feet) | Description | Au (oz/ton) | Ag (oz/ton) | Cu (percent) | Pb (percent) | Zn (percent) | Other (percent) |
| 204 | Chip | 0.5 | 0.5-ft-thick quartz vein, strikes N. 30° W., dips 45° N.; hematite, pyrite, chrysocolla. | 2.15 | --- | 4.0* | --- | 0.04* | |
| 205 | do. | 4.0 | Diorite dike; hematite. | --- | --- | .01* | --- | .01* | 0.04 Li<br>.02 Sr |
| 206 | do. | 2.5 | Altered gneiss; hematite, chrysocolla. | Tr | --- | .12 | --- | --- | .07 Li |
| 207 | Select | xxx | Vein quartz; hematite, pyrite, malachite. | Tr | 0.1 | .32 | --- | --- | .01 Li |
| 208 | Chip | 1.0 | 1.0-ft-thick quartz vein, strikes N. 40° W., dips 55° N.; hematite, malachite. | .06 | --- | .91 | --- | --- | .2 Li |
| 209 | do. | 2.5 | Gossan zone, strikes N. 60° W., dips 80° N.; hematite, chrysocolla. | Tr | --- | .18 | 0.02 | --- | .01 V |
| 210 | do. | 5.0 | Altered granite gneiss; hematite. | --- | --- | .03* | --- | --- | .02 Sr |
| 211 | do. | 3.5 | Altered diorite dike, strikes N. 30° W., dips 60° N.; quartz, hematite, malachite. | .36 | .1 | .59 | --- | --- | .02 Sr |
| 212 | do. | .8 | 0.8-ft-thick quartz vein, strikes N. 29° W., dips steeply; hematite, malachite. | Tr | .1 | .99 | --- | --- | .02 V |
| 213 | do. | .5 | 0.5-ft-thick quartz vein, strikes N. 35° W., dips 60° N.; hematite, malachite. | .12 | --- | .27 | --- | --- | .01 V |
| 214 | Select | xxx | Vein quartz; hematite, pyrite, malachite. | .05 | .3 | 2.0 | --- | --- | |
| 215 | Chip | 2.0 | Gneiss; hematite. | --- | .1 | .07* | --- | --- | |
| 216 | do | 6.0 | Altered diorite dike, strikes N. 34° W., dips 48° N.; quartz vugs. | .61 | .1 | --- | --- | --- | .01 Sr |

Table 13.--Data for samples from the Harquahala Mountain mineralized area shown on Plate 1--Continued

| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No. | Type | Width (ft) | Description | Au (oz/ton) | Ag (oz/ton) | Cu (percent) | Pb (percent) | Zn (percent) | Other (percent) |
| 217 | Select | xxx | Vein quartz; hematite, pyrite, malachite. | --- | 0.1 | 2.3 | --- | --- | |
| 235 | Chip | 1.0 | 1.0-ft-thick quartz vein, strikes N. 28° W., dips 62° N.; hematite, pyrite. | Tr | --- | --- | --- | --- | 0.03 Sn |
| 236 | do. | 3.0 | Altered granite gneiss; hematite. | --- | --- | --- | --- | --- | .02 Sr |
| 237 | do. | 1.5 | 1.5-ft-thick quartz vein, strikes N. 40° W., dips vertical; hematite, malachite. | Tr | --- | .39 | --- | --- | .02 V |
| 238 | do. | 2.0 | Altered diorite; hematite. | Tr | --- | .26 | --- | --- | |
| 239 | do. | 3.0 | Diorite dike, strikes N. 36° W., dips 70° N.; chlorite, epidote. | 0.07 | .3 | .04* | --- | --- | |
| 240 | do. | 2.0 | Granite; hematite, quartz, epidote. | .02 | .2 | .21 | --- | --- | |
| 241 | do. | 3.0 | Altered and fractured quartz vein, abundant hematite, malachite. | 1.35 | .4 | .27 | --- | --- | |
| 242 | do. | 5.0 | Diorite dike, strikes N. 36° W., dips 70° N.; abundant hematite, quartz vugs, malachite. | --- | Tr | .83 | --- | --- | |
| 243 | Select | xxx | Silicified shear zone; quartz, hematite, chalcopyrite. | .01 | --- | 1.3 | --- | --- | .02 V |
| 244 | Grab | xxx | Granite, diorite; hematite. | Tr | --- | --- | --- | --- | |
| 245 | Select | xxx | Vein quartz; pyrite, chalcopyrite, malachite, hematite. | --- | --- | 1.4 | --- | --- | |
| 246 | Chip | 1.5 | Fault, strikes N. 35° W., dips 80° N.; gouge, hematite, malachite, quartz. | --- | --- | 1.2 | --- | --- | |

Table 13--Data for samples from the Harquahala Mountain mineralized area shown on Plate 1--Continued

| Sample | | | | Analytical data | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | Length | | Au | Ag | Cu | Pb | Zn | Other |
| No. | Type | (ft) | Description | oz/ton | | percent | | | |
| 247 | Chip | 0.7 | Altered diorite dike, strikes N. 38° W., dips vertical; hematite, epidote, malachite. | --- | --- | 0.26 | --- | --- | |
| 248 | do. | 1.0 | Fault, strikes N. 35° W., dips 46° N.; gouge, hematite. | --- | --- | .02* | --- | 0.01* | |
| 249 | do. | 1.0 | Fault, strikes N. 15° W., dips 73° E.; gouge, hematite, epidote. | --- | 0.1 | .02* | --- | .01* | 0.01 Sr |
| 250 | do. | 3.0 | Silicified shear zone, hematite. | --- | --- | --- | --- | --- | |
| 251 | Grab | xxx | Diorite; epidote. | --- | --- | --- | --- | --- | |
| 252 | Select | xxx | Vein quartz; pyrite, chrysocolla, calcite. | Tr | --- | .90 | --- | --- | |
| 253 | do. | xxx | Vein quartz; hematite. | Tr | .2 | --- | --- | .03 | |
| 254 | Chip | 1.4 | Diorite dike, strikes N. 40° W., dips 50° N.; epidote. | --- | --- | --- | --- | --- | .01 Sr |
| 255 | do. | 2.0 | Diorite dike, strikes N. 20° W., dips 60° N.; epidote, hematite. | --- | .1 | --- | --- | --- | .05 Sr |
| 256 | do. | 1.5 | Fault, strikes N. 20° W., dips 60° N.; gneiss; gouge, hematite. | --- | --- | --- | --- | --- | .01 Li<br>.02 Sr |
| 257 | do. | 3.5 | Altered augen gneiss; pyrite, hematite. | --- | --- | --- | --- | --- | .02 Sr |
| 258 | do. | 2.0 | Fault, strikes N. 20° W., dips 60° N.; gneiss; hematite. | Tr | --- | --- | --- | --- | .02 Li<br>.01 Sr |
| 259 | do. | 2.0 | Sheared quartz, strikes N. 45° W., dips vertical; hematite. | Tr | --- | --- | --- | --- | |

Table 13.--Data for samples from the Harquahala Mountain mineralized area shown on Plate 1--Continued

| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | Au (oz/ton) | Ag (oz/ton) | Cu (percent) | Pb (percent) | Zn (percent) | Other (percent) |
| 260 | Chip | 3.0 | Augen gneiss; hematite, epidote, chlorite. | --- | --- | --- | --- | --- | |
| 261 | do. | 3.0 | Diorite dike, strikes N. 5° E., dips 49° E.; calcite, hematite. | --- | --- | --- | --- | --- | 0.02 Sr |
| 262 | do. | 4.0 | Altered dike, strikes N. 74° W., dips 54° N.; hematite. | --- | --- | --- | --- | --- | .03 Li<br>.02 Sr |
| 263 | do. | 5.0 | Silicious zone; hematite, limonite. | Tr | --- | --- | --- | --- | .02 Li<br>.05 V |
| 264 | Select | xxx | Vein quartz; pyrite, hematite, limonite. | Tr | 0.1 | --- | --- | --- | |
| 265 | Chip | 5.0 | Fractured granite; hematite, limonite. | Tr | --- | --- | --- | --- | |

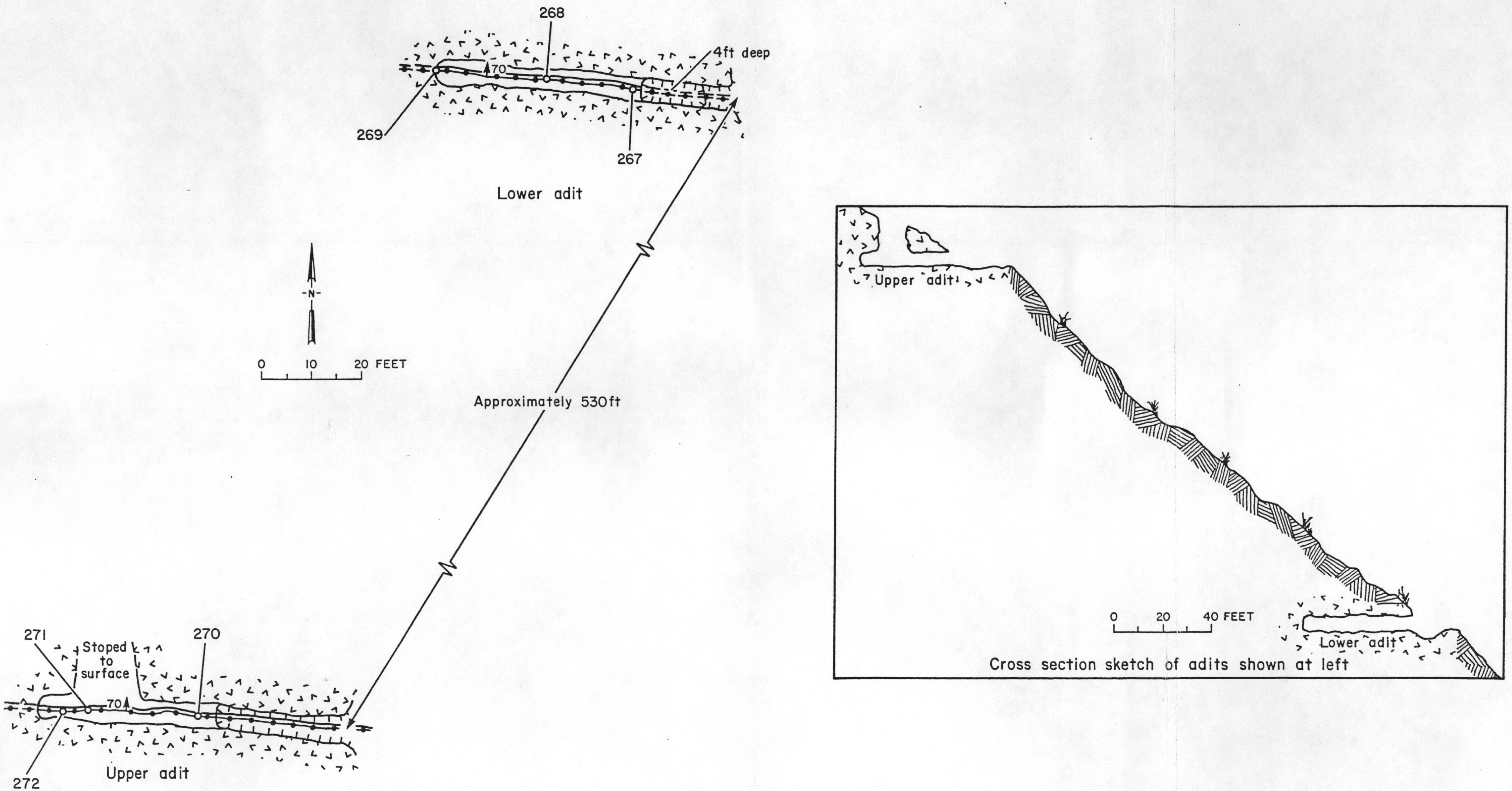



Figure 16.--Map of two adits in the Northwest mineralized area showing sample localities 267-272.

Table 14.--Data for samples from two adits in the Northwest stet area shown on Figure 16.

| Sample | | | Analytical data | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Length of chip (ft) | Description | Au (oz/ton) | Ag (oz/ton) | Cu (percent) | Pb (percent) | Zn (percent) | Other (percent) |
| 267 | 1.5 | Silicified fracture zone; hematite. | 0.01 | --- | --- | --- | --- | |
| 268 | 1.5 | Silicified fracture zone; gouge, hematite, chrysocolla. | .03 | --- | 0.46 | --- | --- | |
| 269 | 1.5 | do. | .13 | --- | .44 | --- | --- | |
| 270 | 3.0 | Fracture zone; gouge, hematite. | Tr | --- | .06 | --- | --- | 0.1 Li |
| 271 | 1.0 | Silicified fracture zone; chrysocolla, malachite, hematite. | .12 | --- | 12.4 | --- | --- | |
| 272 | 1.0 | Silicified fracture zone; hematite, chrysocolla. | .01 | --- | .40 | --- | --- | .03 Li |

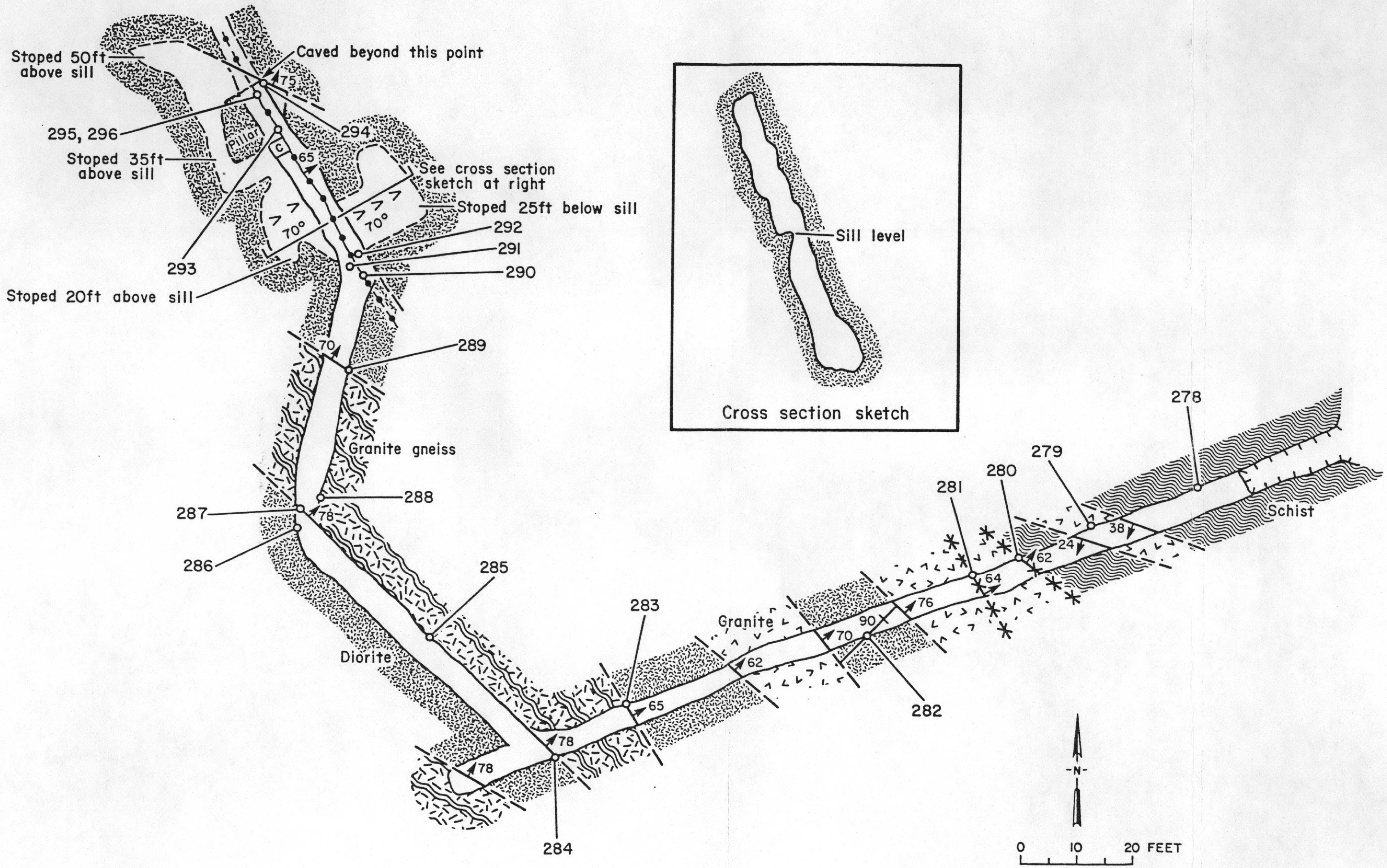



Figure 17.--Map of an adit in the North Sunset Canyon mineralized area showing sample localities 278-296.

Table 15--Data for samples from an adit in the North Sunset Canyon mineralized area shown on Figure 17.

| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Au | Ag | Cu | Pb | Zn | Other |
| No. | Length of chip (ft) | Description | oz/ton | | percent | | | |
| 278 | 3.5 | Schist; hematite. | --- | --- | --- | --- | 0.02* | |
| 279 | 3.5 | Granite; hematite stains. | --- | --- | --- | --- | --- | |
| 280 | 0.9 | Diorite dike; epidote, hematite. | --- | --- | 0.06* | --- | .01* | 0.01 Sr |
| 281 | 0.5 | Diorite dike; hematite. | --- | --- | .03* | --- | .01* | .02 Sr |
| 282 | 1.2 | Fault gouge; epidote, hematite. | --- | --- | .01 | 0.01 | .01 | .03 Sr |
| 283 | 1.5 | Fault gouge; epidote. | --- | --- | --- | --- | --- | .09 Sr |
| 284 | 4.0 | Diorite dike; epidote, hematite. | --- | --- | --- | --- | .02* | .06 Sr |
| 285 | 3.0 | do. | --- | --- | --- | --- | .02* | .01 Li<br>.05 Sr |
| 286 | 2.4 | do. | --- | --- | --- | --- | .01* | .06 Sr |
| 287 | 0.7 | Fault; gouge, altered diorite, hematite, limonite. | --- | --- | --- | --- | --- | .02 Sr |
| 288 | 3.0 | Granite gneiss; hematite staining. | --- | --- | --- | --- | --- | |
| 289 | 0.5 | Fault; gouge, epidote, hematite. | --- | --- | --- | --- | --- | .01 Cr<br>.03 Sr |
| 290 | 0.5 | 0.5-ft-thick quartz vein, azurite, chrysocolla, hematite. | 0.28 | 0.1 | 3.9 | --- | --- | .02 Li<br>.04 V<br>.01 Zr |
| 291 | 2.1 | Altered diorite dike; quartz, hematite. | .01 | --- | .07 | --- | --- | .01 Sr |

Table 15--Data for samples from an adit in the North Sunset Canyon mineralized area shown on Figure 17--Continued

| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. | Length of chip (ft) | Description | Au (oz/ton) | Ag (oz/ton) | Cu (percent) | Pb (percent) | Zn (percent) | Other (percent) |
| 292 | 2.0 | Silicious zone above quartz vein; hematite, limonite. | 0.08 | --- | 0.24 | --- | --- | |
| 293 | 2.5 | 2.5-ft-thick quartz vein; hematite, chrysocolla, malachite. | .53 | --- | 1.7 | --- | --- | |
| 294 | 1.0 | Intersecting faults; gouge, hematite. | --- | --- | --- | --- | --- | .02 Sr |
| 295 | 2.0 | 2.0-ft-thick quartz vein, hematite, malachite. | .01 | --- | .03 | --- | --- | |
| 296 | 2.8 | Altered diorite dike; epidote, hematite, gouge. | --- | --- | .20 | --- | --- | .03 Sr |

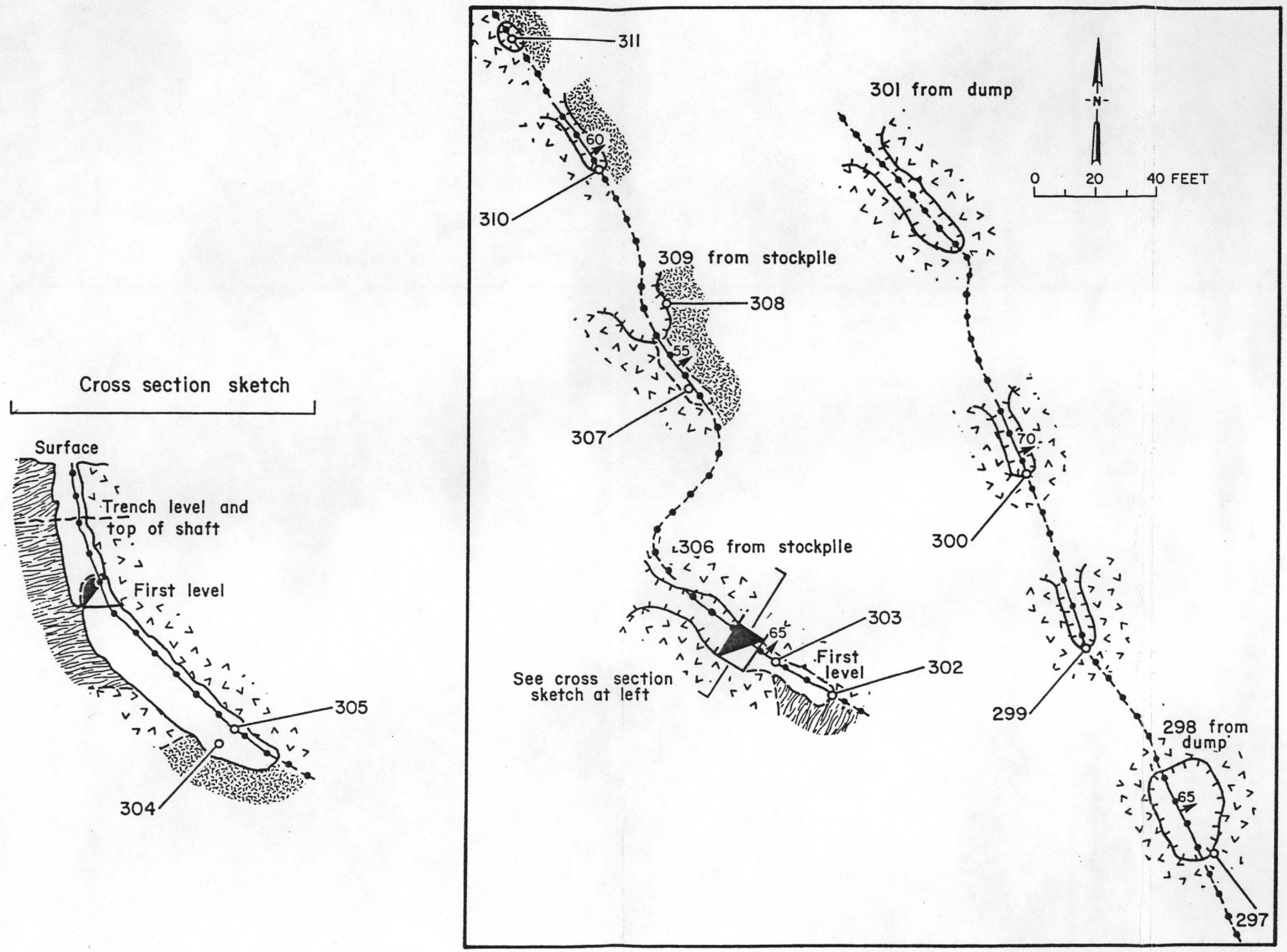



Figure 18.--Map of part of the North Sunset Canyon mineralized area showing sample localities 297-311.

Table 16.--Data for samples from North Sunset Canyon stet area shown on Figure 18.

| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Length | | Au | Ag | Cu | Pb | Zn | Other |
| No. | Type | (ft) | Description | oz/ton | | percent | | | |
| 297 | Chip | 4.0 | Granite epidote | --- | --- | --- | --- | --- | 0.04 Sr |
| 298 | Select | xxx | Vein quartz; hematite, chrysocolla, limonite. | 0.01 | --- | 0.24 | --- | --- | |
| 299 | Chip | 3.0 | 3.0-ft-thick quartz vein, strikes N. 25° W., dips 60° E.; azurite, hematite, epidote. | .01 | --- | .10 | --- | --- | |
| 300 | do. | 3.4 | 3.4-ft-thick quartz vein, strikes N. 35° W., dips 71° E.; hematite, epidote. | --- | --- | .01 | --- | --- | |
| 301 | Select | xxx | Vein quartz; hematite epidote. | Tr | --- | .03 | --- | --- | .01 Li<br>.01 Sr |
| 302 | Chip | .7 | 0.5-ft-thick quartz vein, strikes N. 34° W., dips 56° E.; 0.2 ft fault gouge, hematite. | .07 | --- | .06 | --- | --- | |
| 303 | do. | 1.1 | 1.1-ft-thick quartz vein, strikes N. 36° W., dips 56° E.; hematite. | .01 | --- | .04 | --- | --- | .01 Sr |
| 304 | do. | 2.5 | Diorite dike, strikes N. 26° W., dips 54° E.; hematite, epidote. | --- | --- | --- | --- | --- | .04 Sr |
| 305 | do. | 1.2 | 1.2-ft-thick quartz vein, strikes N. 26° W., dips 54°; hematite, limonite, epidote. | .01 | --- | .04 | --- | --- | |
| 306 | Select | xxx | Vein quartz; hematite, limonite. | .01 | --- | .03 | --- | --- | |
| 307 | Chip | 3.5 | 3.5-ft-thick quartz vein, strikes N. 44° W., dips 57° E.; hematite, epidote. | Tr | --- | .08 | --- | --- | .01 Sr |

Table 16.--Data for samples from the North Sunset Canyon mineralized area shown on Figure 18--Continued

| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Length | | Au | Ag | Cu | Pb | Zn | Other |
| No. | Type | (ft) | Description | oz/ton | | percent | | | |
| 308 | do. | 3.0 | Diorite dike, strikes N. 45° W., dips 55° E.; epidote. | --- | --- | 0.02* | --- | --- | 0.04 Sr |
| 309 | Select | xxx | Vein quartz; hematite, chrysocolla, limonite. | 0.11 | --- | .67 | --- | --- | |
| 310 | Chip | 2.0 | 2.0-ft-thick quartz vein, strikes N. 43° W., dips 60°; hematite, epidote. | --- | --- | .04 | 0.02* | --- | .03 Li |
| 311 | do. | 1.0 | 1.0-ft-thick quartz vein, strikes N. 35° W., dips 55° E.; hematite. | --- | --- | .02 | --- | --- | |

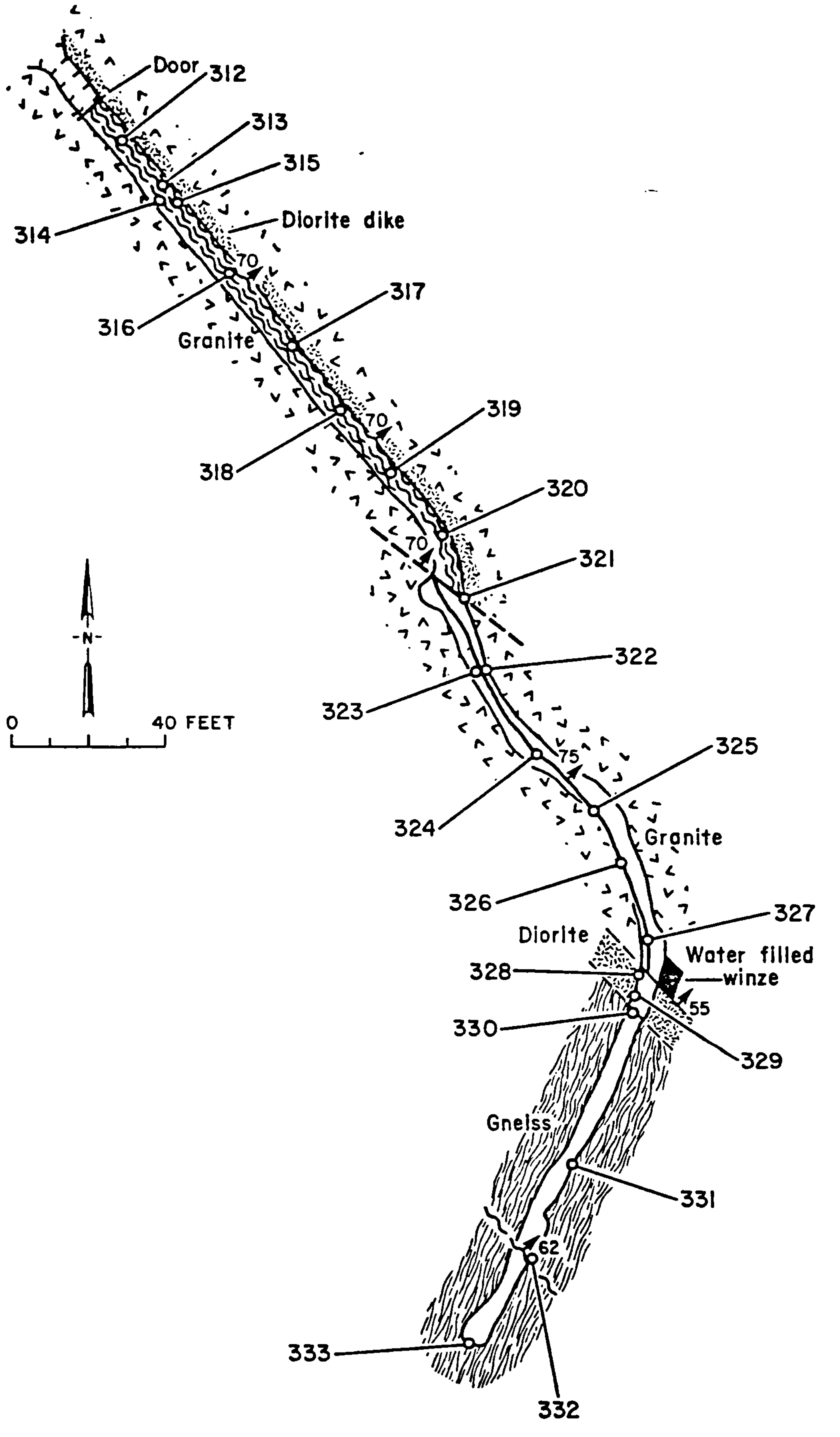


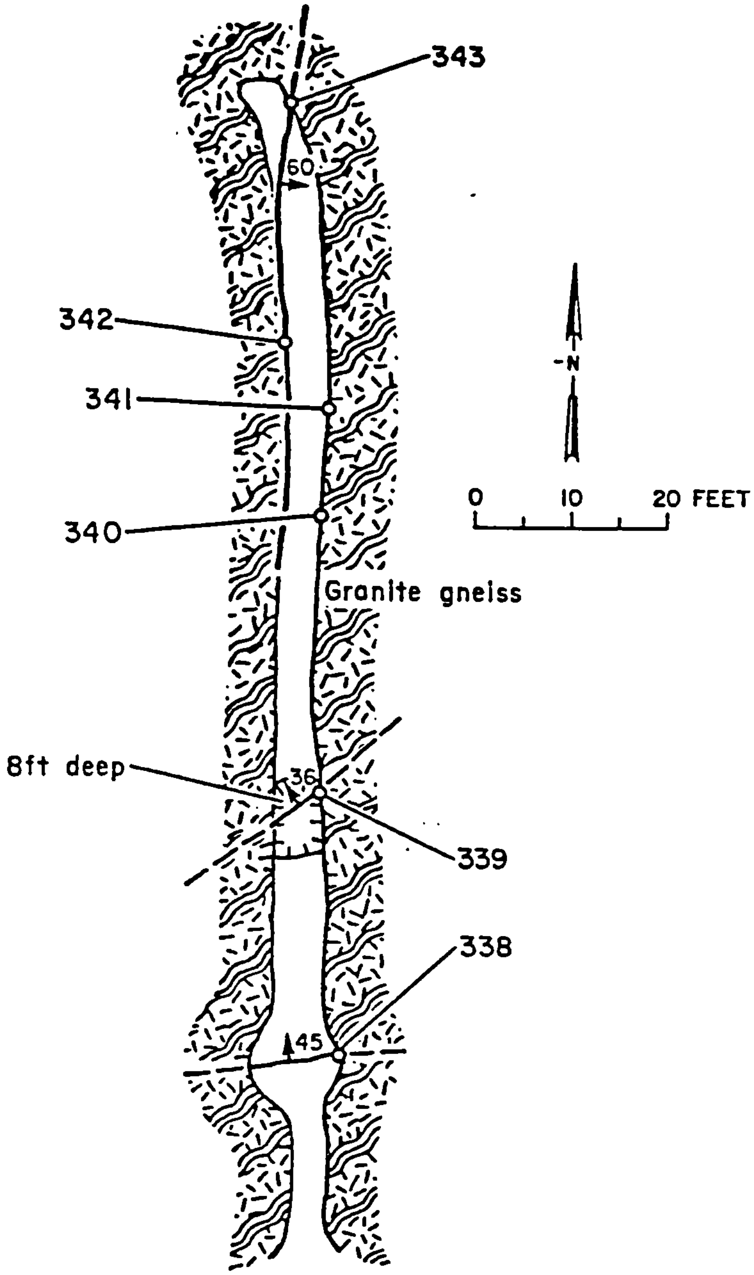

**Figure 19.--Map of an adit in the North Sunset Canyon mineralized area showing sample localities 312-333.**

Table 17--Data for samples from an adit in the North Sunset Canyon mineralized area shown on Figure 19.

| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. | Length of chip (ft) | Description | Au | Ag | Cu | Pb | Zn | Other |
| | | | oz/ton | | percent | | | |
| 312 | 4.0 | Shear zone; diorite, epidote, hematite, calcite. | --- | --- | --- | --- | --- | 0.01 Sr |
| 313 | 2.0 | Shear zone; diorite, hematite, calcite. | --- | --- | --- | --- | 0.03* | .01 Sr |
| 314 | 3.0 | Unaltered granite; hematite. | --- | --- | --- | --- | .02* | |
| 315 | 1.0 | Shear zone; diorite, hematite, limonite, chlorite. | --- | --- | --- | --- | --- | |
| 316 | 1.0 | Shear zone; diorite, hematite. | --- | --- | 0.05 | 0.01 | .02 | .03 Sr |
| 317 | 1.0 | do. | --- | 0.1 | .02* | .02* | .05* | .01 Li<br>.02 Sr |
| 318 | 4.0 | do. | --- | --- | --- | --- | --- | .01 Sr |
| 319 | 1.0 | do. | --- | --- | .02* | --- | .01 | .02 Sr |
| 320 | 4.0 | do. | --- | --- | .18 | --- | --- | .02 Sr |
| 321 | 3.0 | Fault gouge; epidote, chlorite, hematite. | --- | --- | --- | --- | --- | .03 Sr |
| 322 | 3.0 | Fault gouge; granite; chlorite, hematite. | --- | --- | .01 | --- | --- | .1 Li<br>.02 Sr |
| 323 | 4.0 | Unaltered granite; epidote, hematite. | --- | --- | --- | --- | --- | .02 Sr |
| 324 | 3.0 | Sheared granite; hematite, chlorite, epidote. | --- | --- | --- | --- | --- | |
| 325 | 3.0 | do. | --- | --- | --- | --- | --- | .02 Sr |
| 326 | 3.0 | do. | --- | .1 | --- | --- | --- | .01 Sr |

Table 17--Data for samples from an adit in the North Sunset Canyon mineralized area shown on Figure 19--Continued

| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. | Length of chip (ft) | Description | Au (oz/ton) | Ag (oz/ton) | Cu (percent) | Pb (percent) | Zn (percent) | Other (percent) |
| 327 | 1.0 | Altered granite; epidote, hematite. | --- | --- | 0.01* | --- | --- | 0.1 Sr |
| 328 | .5 | Altered diorite; hematite. | 0.01 | --- | .2* | --- | 0.01* | |
| 329 | .9 | Unaltered diorite; epidote, hematite. | --- | 0.1 | --- | --- | .01* | .05 Sr |
| 330 | .3 | Contact between dike and gneiss; epidote, hematite. | --- | --- | .01 | --- | --- | .02 Sr |
| 331 | 3.0 | Unaltered gneiss; hematite. | --- | --- | --- | --- | .01* | .05 Sr |
| 332 | 2.5 | Fault gouge; chlorite, hematite, limonite. | --- | --- | --- | --- | .04 | |
| 333 | 3.0 | Unaltered gneiss; epidote, hematite. | --- | --- | --- | --- | --- | .04 Sr |




| Sample | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Length of chip | | Au | Ag | Cu | Pb | Zn | Other |
| No. | (ft) | Description | oz/ton | | percent | | | |
| 338 | 4.0 | Fault; quartz, hematite. | Tr | --- | --- | --- | --- | 0.02 Sr |
| 339 | 1.0 | Fault; gouge, hematite. | --- | --- | --- | --- | 0.01* | .03 Sr |
| 340 | 1.5 | Granite gneiss; hematite. | --- | --- | --- | --- | --- | .01 Sr |
| 341 | 1.5 | do. | --- | --- | 0.02* | --- | .02* | .04 Sr |
| 342 | 1.5 | Fault; gouge, hematite, breccia. | --- | --- | --- | --- | --- | .03 Sr |
| 343 | 1.5 | do. | --- | --- | --- | --- | .02* | |

Figure 20.--Map of an adit near the North Sunset Canyon mineralized area showing sample localities 338-343.

Table 18.--Data for samples not shown on other tables or figures.

| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | Au (oz/ton) | Ag (oz/ton) | Cu (percent) | Pb (percent) | Zn (percent) | Other (percent) |
| 57 | Chip | 2.0 | Granite; hematite, quartz. | 0.02 | Tr | --- | --- | --- | |
| 58 | do. | 2.0 | Schist; quartz, chlorite. | Tr | 0.3 | 0.10 | --- | 0.02 | |
| 133 | Chip | 2.0 | Rhyolite breccia zone, strikes N. 25° E., dip unknown; abundant hematite. | --- | --- | --- | .02 | .02 | 5.0 Fe<br>.37 Mn<br>.03 Sr |
| 134 | do. | 5.0 | Rhyolite; abundant hematite. | --- | --- | --- | --- | .05 | 4.8 Fe<br>3.0 Mn<br>.2 Sr |
| 135 | do. | 3.5 | Rhyolite breccia zone, strikes N. 25° E., dip unknown; hematite, calcite. | --- | --- | --- | --- | .02* | 4.2 Fe<br>2.6 Mn<br>.03 Sr |
| 163 | do. | 3.0 | Diorite dike, strikes N. 30° W., dips 28° N.; | --- | --- | --- | --- | .01* | .01 Sr<br>.02 V |

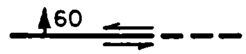
| Sample | | | | Analytical data | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Description | Au (oz/ton) | Ag (oz/ton) | $Al_2O_3$ (percent) | $CaCO_3$ (percent) | $MgCO_3$ (percent) | $SiO_2$ (percent) | $Fe_2O_3$ (percent) |
| 164 | Grab | xxx | White marble. | --- | 0.2 | 0.05 | 92.8 | 0.38 | 1.1 | 0.04 |
| 165 | do. | xxx | do. | --- | .1 | .08 | 88.6 | 1.0 | .85 | .09 |
| 166 | do. | xxx | White marble, epidote, chlorite, biotite. | --- | --- | 1.4 | 76.7 | .39 | 15.0 | 15.0 |
| 266 | do. | xxx | White marble. | --- | .1 | .07 | 89.4 | .4 | .95 | .04 |

Table 18.--Data for samples not shown on other tables or figures--Continued

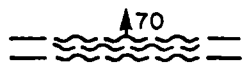
| Sample | | | | Analytical data | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Length | | Au | Ag | Cu | Pb | Zn | Other |
| No. | Type | (ft) | Description | oz/ton | | percent | | | |
| 273 | Grab | xxx | Massive barite; hematite. | --- | --- | 0.01* | --- | --- | 49.0 Ba<br>.7 Sr |
| 274 | do. | xxx | Brecciated barite, strikes N. 65° E., dips 24° N.; hematite. | --- | --- | --- | --- | --- | 10.3 Ba<br>.1 Sr |
| 275 | Chip | 2.4 | 2.4 ft quartz vein, strikes east, dips vertical; hematite. | --- | --- | --- | --- | --- | .01 Sr |
| 276 | do. | 1.0 | 3.0 ft quartz vein, strikes N. 75° E., dips 50° N.; hematite, diorite. | Tr | --- | .01 | --- | --- | .03 Li |
| 277 | do. | 4.5 | 4.5 ft quartz vein, strikes east, dips 45° N.; hematite, chlorite. | Tr | --- | --- | --- | --- | .03 Li |
| 334 | do. | 2.5 | Diorite dike, strikes N. 42° W., dips 65° E.; epidote, hematite. | --- | --- | --- | --- | --- | .01 Li |
| 335 | do. | 4.5 | Fault, strikes N. 42° W., dips 65° E.; gouge, hematite, limonite, quartz. | --- | --- | .3* | --- | 0.03* | .01 Li |
| 336 | do. | 1.8 | Granite gneiss; hematite, epidote, quartz. | --- | --- | .1* | --- | --- | .01 Sr |
| 337 | do. | 1.0 | Augen gneiss; hematite. | --- | --- | --- | --- | --- | |

EXPLANATION OF SYMBOLS FOR FIGURES 3-20

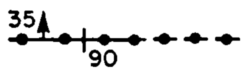
SAMPLE LOCALITY--Showing sample number



FAULT--Showing strike and dip and relative movement; dashed where approximate



FAULT OR SHEAR ZONE--Showing strike and dip; dashed where approximate



VEIN--Showing strike and dip; dashed where approximate

JOINT--Showing strike and dip

DIKE--Showing strike and dip; dashed where approximate


CONTACT--Dashed where approximate

FOLIATION--Showing strike and dip


SHAFT


INCLINED SHAFT


FLOODED SHAFT


DRIFT INTO FACING WALL

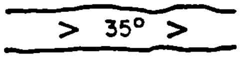

DRIFT INTO REMOVED WALL


CROSSCUT IN VERTICAL SECTION

CHUTE

EXPLANATION OF SYMBOLS FOR FIGURES 3-20--Continued

WINZE




INCLINED WORKINGS--Showing degree of inclination; chevrons pointing down

PIT

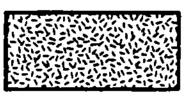
OPEN CUT

TRENCH

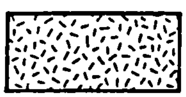
PORTAL

SURFACE--In cross section

LITHOLOGY

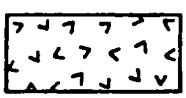


DIORITE; DIORITE DIKE

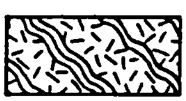


GABBRO

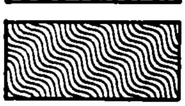
GNEISS



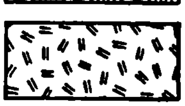
GRANITE



GRANITE GNEISS



SCHIST

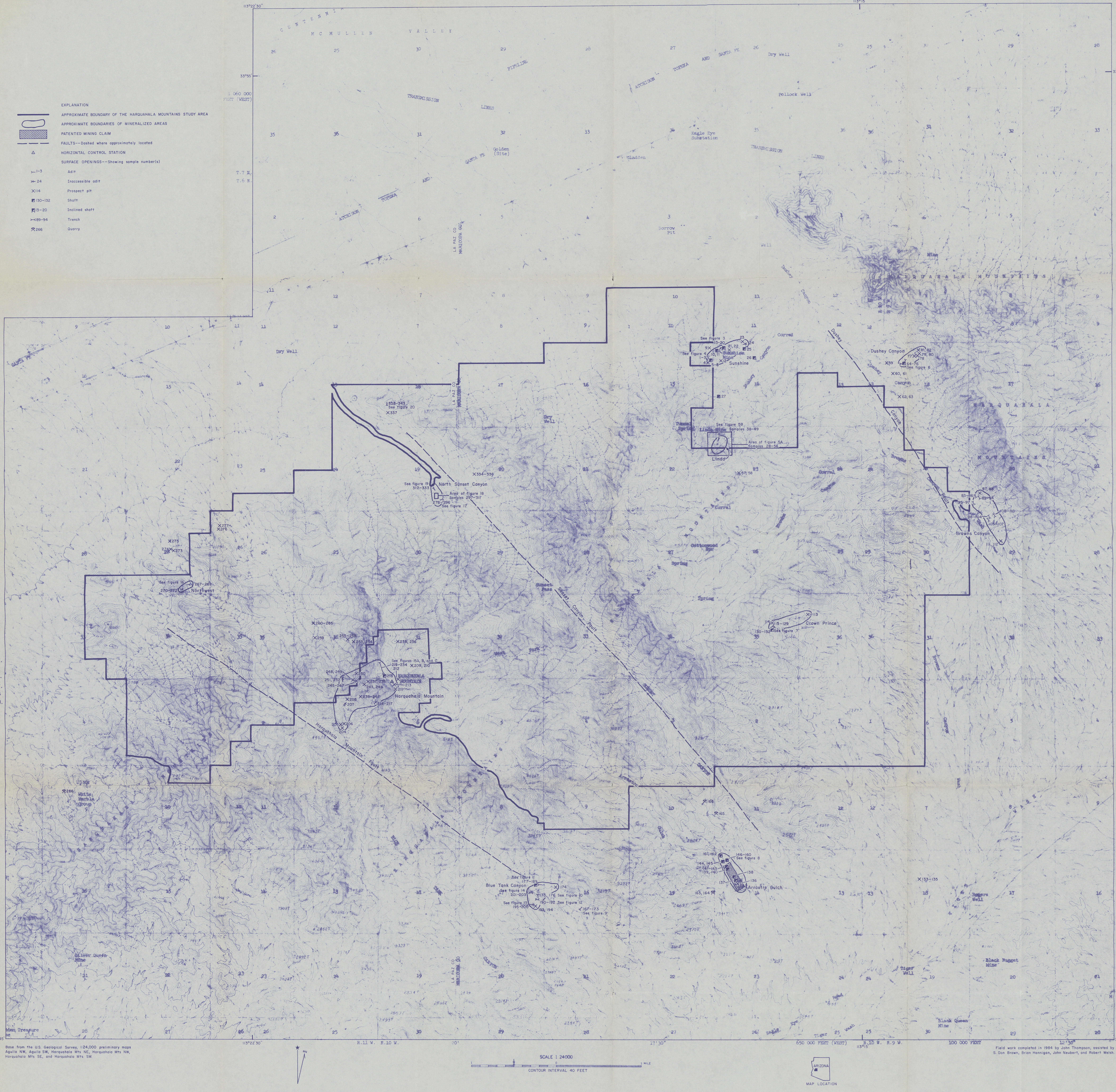


SKARN

APPENDIX--Semiquantitative optical emission spectrographic analysis detection limits. U.S. Bureau of Mines, Reno Research Center.

| Element | Detection limit (percent) | Element | Detection limit (percent) |
|---|---|---|---|
| Ag | .002 | Mo | .0001 |
| Al | .001 | Na | .3 |
| As | .01 | Nb | .007 |
| Au | .002 | Ni | .0005 |
| B | .003 | P | .7 |
| Ba | .002 | Pb | .001 |
| Be | .0001 | Pt | .0001 |
| Bi | .01 | Re | .0006 |
| Ca | .05 | Sb | .06 |
| Cd | .0005 | Sc | .0004 |
| Co | .001 | Si | .0006 |
| Cr | .0003 | Sn | .001 |
| Cu | .0006 | Sr | .0001 |
| Fe | .0006 | Ta | .02 |
| Ga | .0002 | Te | .04 |
| K | 2.0 | Ti | .03 |
| La | .01 | V | .005 |
| Li | .002 | Zn | .0001 |
| Mg | .0001 | Zr | .003 |
| Mn | .001 | Y | .0009 |

These detection limits represent and ideal situation. In actual analyses, the detection limits vary with the composition of the material analyzed. These numbers are to be used only as a guide.




# MINE AND PROSPECT MAP OF THE HARQUAHALA MOUNTAINS STUDY AREA, LA PAZ AND MARICOPA COUNTIES, ARIZONA

BY

JOHN R. THOMPSON, U.S. BUREAU OF MINES

1985