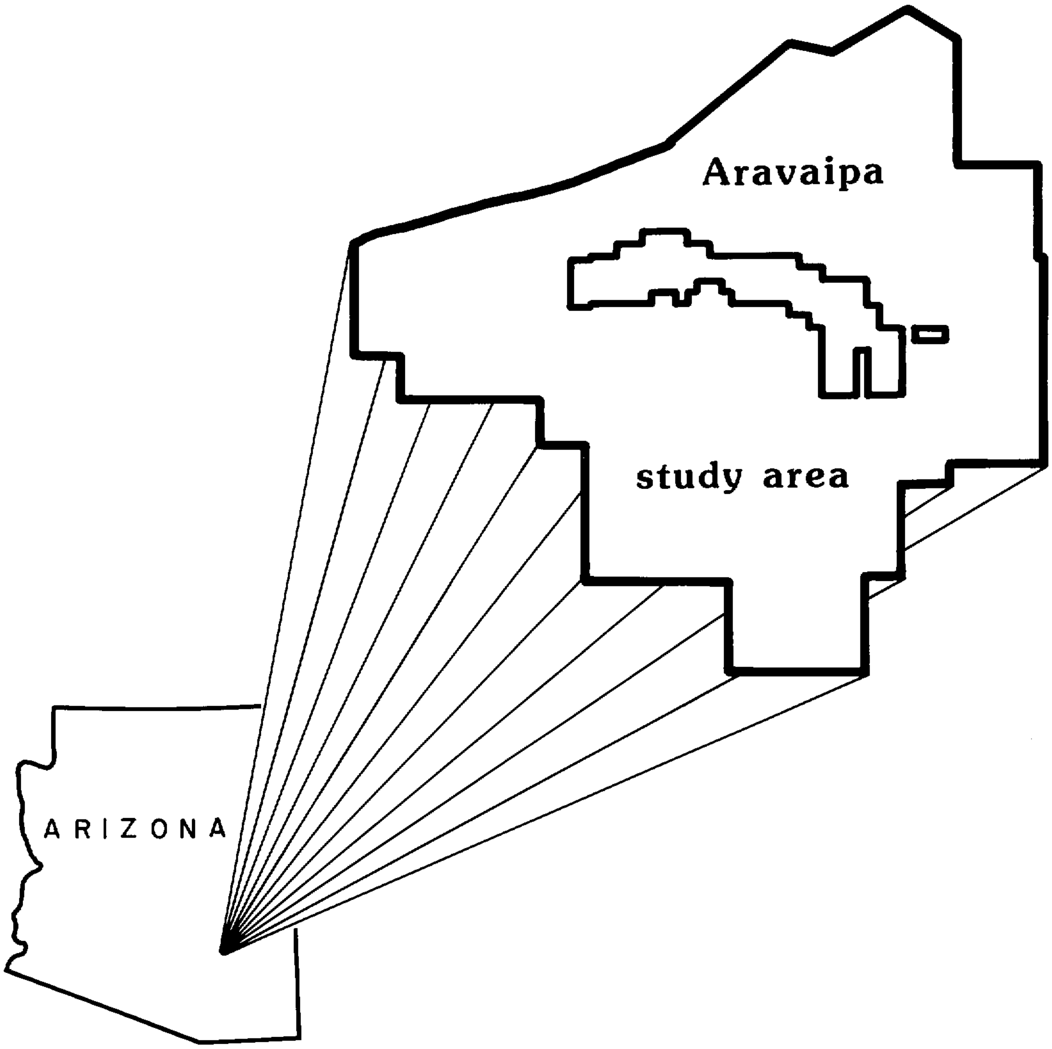
MLA 38-88

Mineral Land Assessment
Open File Report/1988

# Mineral Resources of the Aravaipa study area, Graham and Pinal Counties, Arizona




BUREAU OF MINES

UNITED STATES DEPARTMENT OF THE INTERIOR

# MINERAL RESOURCES OF THE ARAVAIPA STUDY AREA, GRAHAM AND PINAL COUNTIES, ARIZONA



by

David C. Scott

MLA 38-88
1988

Intermountain Field Operations Center,
Denver, Colorado

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

BUREAU OF MINES
T S Ary, Director

This open-file report summarizes the results of a Bureau of Mines mineral study as requested by the Bureau of Land Management. The report is preliminary and has not been edited or reviewed for conformity with the Bureau of Mines editorial standards. This study was conducted by personnel from the Resource Evaluation Branch, Intermountain Field Operations Center, P. O. Box 25086, Denver Federal Center, Denver, Colorado 80225.

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UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

| | |
|---|---|
| $ft^3/st$ | cubic foot per short ton |
| ° | degree |
| ft | foot |
| in. | inch |
| mi | mile |
| ppb | part per billion |
| ppm | part per million |
| % | percent |
| lb | pound |
| st | short ton |
| oz | troy ounce |
| oz/st | troy ounce per short ton |

MINERAL RESOURCES OF THE ARAVAIPA STUDY AREA,
GRAHAM AND PINAL COUNTIES, ARIZONA

by

David C. Scott, Bureau of Mines

SUMMARY

In January 1988, at the request of the Bureau of Land Management, the Bureau of Mines evaluated the mineral resources of approximately 75,000 acres in the Aravaipa study area, Graham and Pinal Counties, Arizona. Bureau personnel investigated mines, prospects, and mineralized zones in and near the area to appraise reserves and identified mineral resources. Based on these data, regional and detailed geologic mapping, and stream-sediment data, the Bureau also identified areas where undiscovered mineral resources may be present in the Aravaipa study area.

Approximately 85% of the study area is underlain by a thick sequence of Galiuro Volcanics which are devoid of near-surface mineral occurrences. However, at the Table Mountain Mine area, in the extreme southern part of the study area, erosion of the volcanics has exposed a section of Escabrosa Limestone, the upper part of which contains a massive 25-100-ft-thick body of jasperoid breccia. The jasperoid breccia is host to barite, copper, gold, lead, and zinc mineralization. Although the origin of neither the jasperoid breccia nor mineralization is known, the Copper Creek pluton, 4 mi south of the mine, may be related to one or both processes.

Gold and other metal concentrations in the jasperoid breccia at the Table Mountain Mine are irregularly distributed making resource estimates difficult. An identified subeconomic resource of at least 35,500 short tons of jasperoid breccia averaging 0.034 oz gold/st is present at the Table

Mountain Mine. The inplace value of this resource is about $530,000. The jasperoid breccia also extends into the study area. The resource in the mine area is considered subeconomic for a large commercial mining operation because of the low grade and especially the small tonnage.

Bureau studies indicate that geologic conditions are favorable for mineral resources similar to the one at the Table Mountain Mine to exist beneath the Galiuro Volcanics in about 3,000 acres surrounding the mine. The rest of the study area may have base- and precious-metal occurrences beneath the volcanics, but there is no surface evidence for this. The entire study area is unlikely to have petroleum and natural gas resources because the geologic environment was not favorable for their accumulation. Sand and gravel resources are present in the drainages throughout the study area, but they are far removed from a market, making the resources commercially unattractive.

## INTRODUCTION

The area investigated in this report is one of two parcels of land acquired in a land exchange between the Bureau of Land Management (BLM) and the Arizona State Land Department. In January 1988, the Bureau of Land Management arranged for the Bureau of Mines to investigate the mineral resources of the parcel designated as the Aravaipa property. This parcel of land will subsequently be referred to in this report as the Aravaipa study area. The area consists of approximately 75,000 acres of BLM land in Graham and Pinal Counties, Arizona, and is administered by the Safford District Office. The study area completely surrounds the Aravaipa Canyon Primitive Area, which had been studied previously, and therefore was not investigated in this study. The purpose of the investigation is to provide the BLM with data concerning mineral resources in the Aravaipa study area in order to facilitate a management plan for the Safford District.

The Bureau of Mines surveyed and studied mines, prospects, and mineralized areas to appraise reserves and identified mineral resources. Based on these data, regional and detailed geologic mapping, and stream-sediment data, the Bureau identified other areas that may have mineral resources in the Aravaipa study area.

## Geographic setting

The study area encompasses the northern part of the Galiuro Mountains, in the Basin and Range physiographic province, southeastern Arizona. Safford, Arizona, the nearest major municipality, is about 45 mi east (fig. 1).

Access to and travel within the study area is good except for the northernmost part. The northern and eastern parts of the area can be reached via State Highway 70, north from Safford to Eden, then west on a well-maintained gravel road 32 mi to the village of Klondyke, then northwest about 5 mi to the boundary (fig. 1). The southern part of the area can be reached by the Copper Creek road, east of Mammoth, then by jeep trail north over Boulder Mountain to the southern boundary. The west-central boundary can be reached by a well-maintained gravel road that leads easterly starting approximately 9 mi north of Mammoth on State Highway 77. Jeep and foot trails provide access to the interior.

The deeply incised east-west Aravaipa Canyon essentially bisects the study area. Most of the canyon is part of the Aravaipa Canyon Primitive Area and access is restricted to foot or horse travel. North of Aravaipa Canyon, the area consists of a rolling upland broken locally by eminences such as Brandenburg Mountain, which rises to 4,366 ft (pl. 1). Five to six mi south

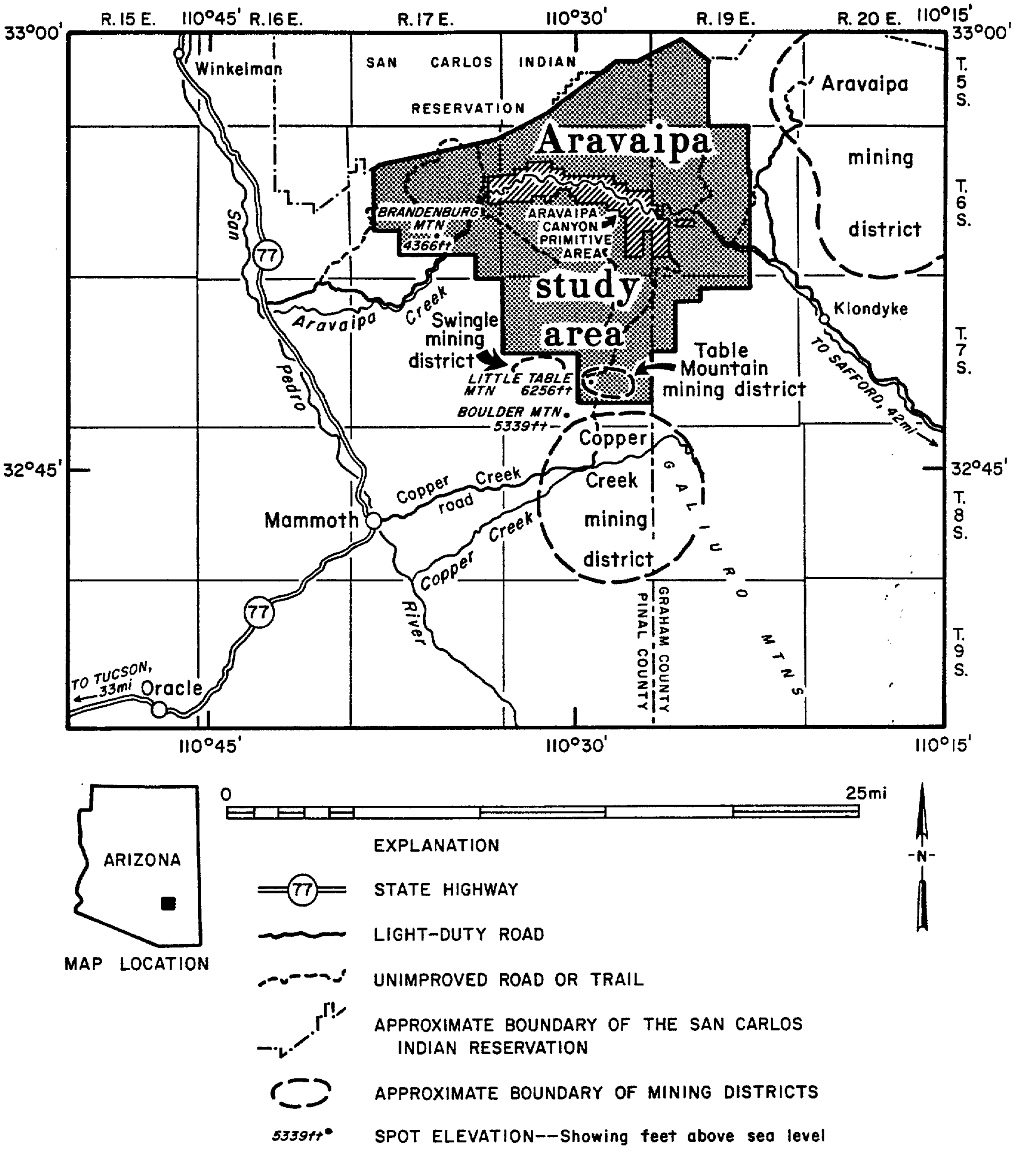



Figure 1.--Index and mining district map of the Aravaipa study area, Graham and Pinal Counties, Arizona.

of Aravaipa Canyon, the area consists of a level-topped tableland that slopes gently north and is deeply dissected by Wire Corral Draw, Virgus, Parsons, Oak Grove, and Turkey Creek Canyons (pl. 1). Farther south, the area loses the tableland character and becomes a west-northwest trending summit of fairly uniform elevation punctuated by a number of low but steep-sided knobs, the highest of which, Little Table Mountain, rises to an evelation of 6,254 ft. The lowest elevation in the area, 2,800 ft, is along the west-central boundary in Aravaipa Canyon. (See Simons, 1964, p. 4.)

The topographic contrast between the northern and southern parts of the study area, the division of which is Aravaipa Canyon, is directly related to the geologic makeup of each part. The topography north of Aravaipa Canyon is underlain by gently dipping rocks of greatly different erosional resistance which has resulted in a terrain of mesas, benches, and cliffs, whereas the topography south of Aravaipa Canyon is an assemblage of rocks whose uniformity of erosional resistance is expressed by the lack of any salient landforms. (See Simons, 1964, p. 4.)

## Previous investigations

A report by Simons (1964) summarizes geologic data in and near the study area and includes geologic maps of the eastern half. Geologic maps of the Brandenburg Mountain quadrangle, which includes the northwestern part of the study area, and Holy Joe Peak quadrangle, which includes the southwestern part, were done by Krieger (1968 a, b). Krieger, Johnson, and Bigsby (1979) reported on the mineral resources of the Aravaipa Canyon Instant Study Area. Creasey and others (1981) reported on the mineral resources of the Galiuro Wilderness and Contiguous Further Planning Areas south of the study area.

## Methods of investigation

A review of pertinent literature on geology, mineralization, and mining activity was completed prior to the field examination. Patented and unpatented mining claims, as recorded with the BLM and current as of May 1988, are shown on plate 1. Prospecting permits for the area, filed with the Arizona State Land Department, have expired and are no longer valid. The permits were issued for areas where Federal claims now exist. Oil and gas lease records were examined and leases as of May 1988 are shown on plate 1.

Two Bureau geologists spent 17 days conducting a field investigation of the study area. Accessible mine workings were surveyed by the compass-and-tape method and sampled. Detailed geologic mapping was completed in the vicinity of all mineral occurrences. A total of 116 samples was taken which included 100 rock-chip samples, 15 stream-sediment samples, and one panned-concentrate sample. All samples were analyzed by the inductively coupled plasma method (total digestion) for a suite of 24 elements and by fire assay/atomic absorption spectroscopy for gold. Twenty-five of those samples were then analyzed by fire assay/atomic absorption (with a higher detection limit). All analyses were done by Chemex Labs, Inc., Sparks, Nevada. (See Appendix A for detection limits.)

## Acknowledgments

The Bureau of Mines thanks Jeff Wurtz of Draco Mining, Tuscon, Arizona, for supplying geologic knowledge about the Table Mountain Mine. The cooperation of the Bureau of Land Management in Safford, Arizona, is greatly appreciated. Carl Almquist, of the Bureau of Mines, served as field assistant.

## GEOLOGIC SETTING

Although rocks in the study area range from Precambrian to Quaternary in age, Tertiary-age volcanics cover approximately 85% of the surface (pl. 2, fig. 2). Within the study area, Precambrian diabase, exposed at Brandenburg Mountain, and Precambrian Pinal Schist, exposed just south of Holy Joe Peak, represent small isolated outcrops. The middle to upper Cambrian Abrigo Formation, exposed west and north of Table Mountain and at Brandenburg Mountain, is also found in small, isolated outcrops. Devonian Martin Formation and Mississippian Escabrosa Limestone are exposed at the Table Mountain Mine, west of Table Mountain, and at Brandenburg Mountain. The most significant outcrop of Escabrosa Limestone in the study area is at the Table Mountain Mine, where erosion of the overlying volcanics has exposed a 508-ft-thick section. The limestone ranges from gray, fine-grained or lithographic, to gray, coarse-grained. It contains abundant light-gray chert in layers or irregular thick lenses. A massive body of jasperoid breccia, 25-100 ft thick, forms the upper part of Escabrosa Limestone at the mine area and is host to gold and base-metals. (See Simons, 1964, p. 26-28.)

Because mineralization is related to jasperoids it is important to understand their origins. The origin of the jasperoid breccia at the Table Mountain Mine is not totally understood. Simons (1964) refers to the origin as being supergene and states that at the Table Mountain Mine, in Copper Creek basin (4 mi south of the mine), and in the Aravaipa mining district (1-2 mi east of the northeast boundary of the study area), the upper part of the Escabrosa is a massive jasperoid-breccia body that must have formed a local stripped surface on which the younger rocks were deposited. Many jasperoid bodies have been mapped in the southeastern part of Arizona, lending credence to the idea of supergene origin. (See Simons, 1964, p. 26.)

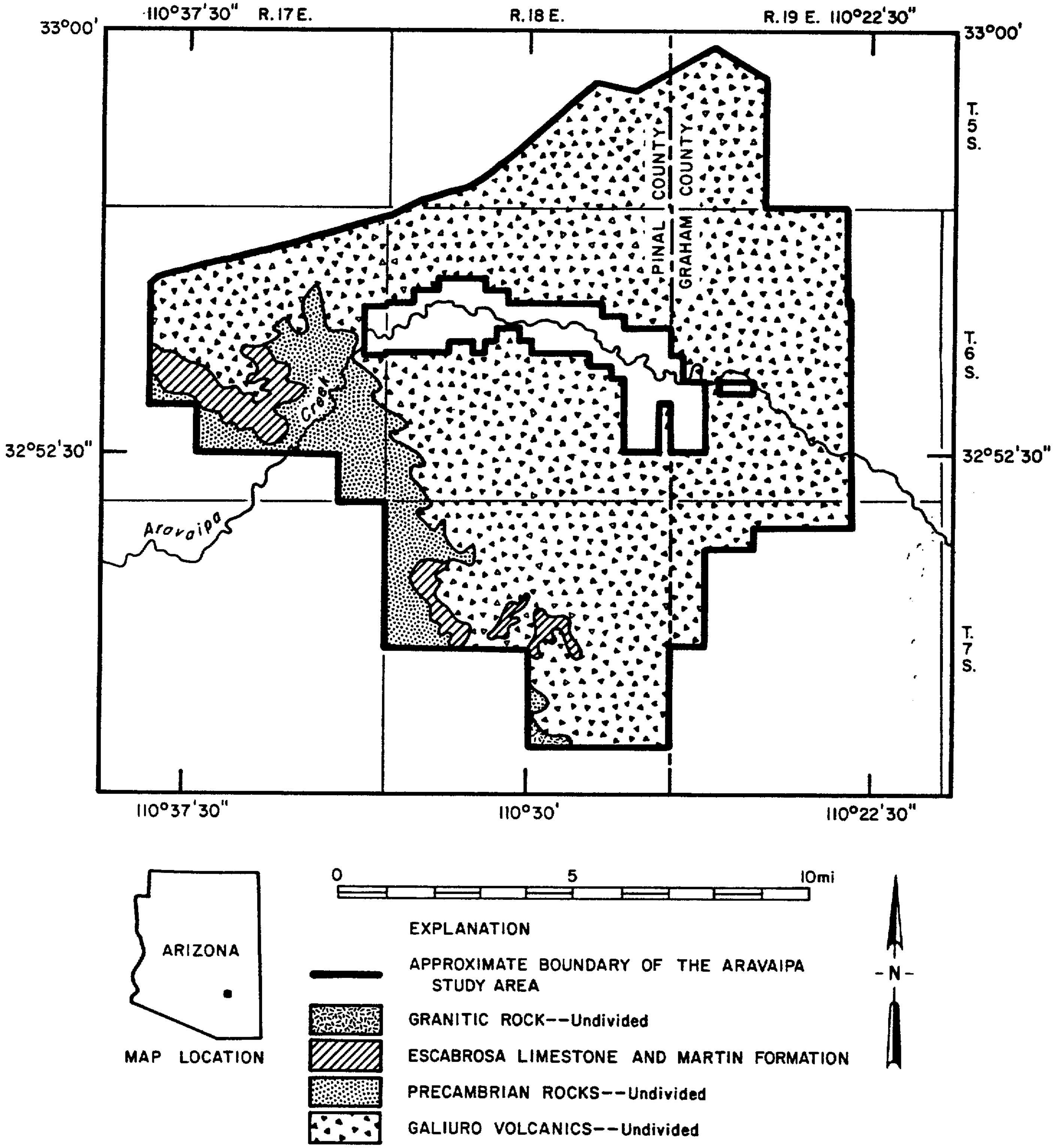



Figure 2.--Simplified geologic map of the Aravaipa study area showing extent of volcanic cover (modified from Simons 1964, and Krieger, 1968).

Another possibility is that the jasperoid-breccia body is localized along a fault zone. A northwest-trending fault is present along the east side of the jasperoid breccia at the mine area. Channelways created by the fault could have provided the conduit system through which silica-bearing solutions reached the limestone. A prerequisite for this idea is a deep-seated silica source.

A minor amount of the Cretaceous Glory Hole Volcanics is exposed in the extreme southern part of the study area. The Copper Creek pluton, 4 mi south of the Table Mountain Mine, was emplaced after the Glory Hole volcanics (Krieger, 1968a).

Lying unconformably on the jasperoid breccia is the Tertiary-age Galiuro Volcanics. The volcanics comprise 12 different units which include andesite, directly overlying the jasperoid breccia, tuff, and conglomerate. The entire section of Galiuro Volcanics is not exposed at any one locality in the study area and the lenticular nature of several of the major units within the formation precludes any precise measurement of thickness. Local minimum thicknesses are 700 ft at the extreme northern part of the study area, 1,000 ft in Aravaipa Canyon on the western boundary, 750 ft in Oak Grove Canyon near the center, and 1,250 ft on the southwest side of Little Table Mountain. The sum of the maximum thicknesses of the principal units exposed between Ash Creek, at the northernmost boundary, and the base formation at the southernmost boundary, is approximately 5,500 ft (Simons, 1964, p. 69).

The general region of the study area was uplifted in late Tertiary by a fault or group of faults along the west flank of the Galiuro Mountains. There were probably two periods of deformation, one older and one younger than the volcanics; most of the structural features of the region belong to the most recent period. Steeply dipping normal faults are the characteristic structures. No folding or faulting younger than the later sequence of valley fill in Aravaipa Canyon has been recognized. The Galiuro Volcanics are cut by few faults. A westerly-trending fault lies just north of Holy Joe Peak and a northwesterly trending fault at the Table Mountain Mine, follows an andesite-limestone contact (pl. 2). (See Simons, 1964, p. 104-114.)

Although there is one oil and gas lease in the east-central part of the Aravaipa Primitive Area (pl. 1), no oil and or gas wells have been drilled in the study area. The study area has no geologic attributes of an oil-and-gas-producing area based on known and interpreted distribution of reservoir rocks, hydrocarbon source beds, geologic history, and stratigraphic and structural features favorable for oil and gas accumulation. Ryder (1983, p. C19) rates the area as having zero to low hydrocarbon potential because any hydrocarbons originally trapped in Paleozoic rocks beneath the Tertiary volcanics escaped during ensuing phases of faulting and volcanism.

## MINING DISTRICTS AND HISTORY

The earliest mining activity recorded in the region of the study area was in 1863 when high-grade silver-lead ore was mined from the Bluebird vein in the Copper Creek mining district. The northern part of the Copper Creek district (Bunker Hill district) is 1 to 2 mi south of the southern study area boundary (fig. 1) (Simons, 1964, p. 132).

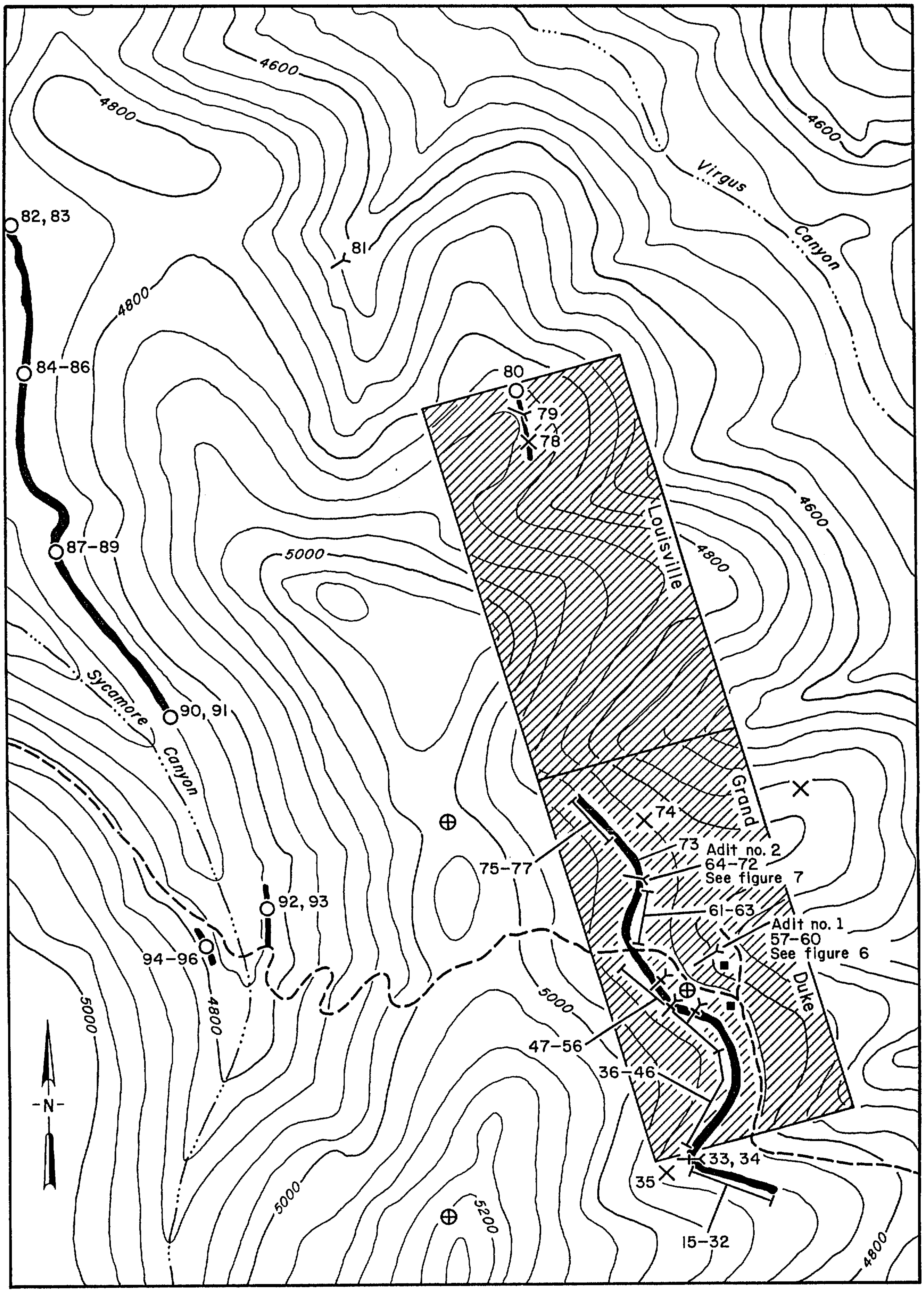
Mineral deposits in the district are associated with breccia-pipe structures. The breccia-pipes are essentially vertical, circular or elliptical cylinders of breccia, lithologically identical to the wall rocks, either Copper Creek Granodiorite or Glory Hole Volcanics. Ore minerals are mainly chalcopyrite and molybdenite which, for the most part, are interstitial to the fragments. Pyrite is widely distributed in the pipes, and tourmaline is present in a few. The breccias appear to have formed in place, but their origin is conjectural. Alteration and mineralization of the breccias may be related to method of the intrusion of a biotite latite porphyry facies of the Copper Creek Granodiorite. These deposits are not similar to mineral occurrences in the study area. (See Simons, 1964, p. 2.)

Complete production figures are not available for the Copper Creek district, however, between 1905 and 1975, 27,300,000 lbs copper, 1,000 oz gold, 5,770,000 lbs lead, 4,150,000 lbs molybdenum, and 190,000 oz silver were produced from 483,010 tons of ore (Keith and others, 1983, p. 20-21).

The Aravaipa mining district, established in about 1870, is 1 to 2 mi east of the northeastern study area boundary (fig. 1). The mineral deposits of the district are quartz-sulfide bodies along low-angle faults, quartz-specularite-fluorite-sulfide aggregates along steeply dipping breccia reefs, or narrow quartz-sulfide fissure fillings along faults in volcanic rocks. The common sulfide minerals are galena, sphalerite, chalcopyrite, and pyrite, and gangue minerals are quartz (sometimes amethyst), specularite, and fluorite. Mineralization may have taken place during emplacement of the early Tertiary Santa Teresa Granite. Production from the Aravaipa district from 1901 to 1971 is recorded as 1,906,000 lbs copper, 4,400 oz gold, 34,492,000 lbs lead, 363,000 oz silver, and 27,863,000 lbs zinc, from 282,000 tons of ore (Keith and others, 1983, p. 16-17). These deposits do not resemble mineral occurrences in the study area. (See Simons, 1964, p. 2.)

The Swingle mining district is just outside the western boundary of the study area (fig. 1). Not much is known about the district and no production data are available. Keith and others (1983) describe the occurrences as mid-Tertiary veins of manganese with or without barium, lead, and silver, in Tertiary volcanic rocks. No other data are available about these occurrences.

The Table Mountain mining district is in the southern part of the study area (fig. 1). The district was first prospected for gold in the late 1870's. Base and precious metals occur localized in a massive jasperoid-breccia body in the upper part of the Escabrosa Limestone. Development work totalled 2,000 ft of adits and drifts from which about 100,000 tons of ore containing 7-9% copper and $4 per ton (price of gold in 1900) in gold was mined (Simons, 1964, p. 150). Production from 1875 to 1974 is estimated at 16,000,000 lbs copper and 19,000 oz gold (Keith and others, 1983, p. 50-51). Since 1959, four mining companies have conducted exploration work in the district. Duval Corporation explored the area with one underground and one surface drill hole in 1960. In 1968, Newmont Exploration Ltd. drilled one vertical core hole from the surface. In 1983, Superior Oil Company drilled three holes, totalling 2,863 ft, at the Table Mountain Mine (fig. 3). The objective of the drilling was to locate replacement mineralization in favorable host beds of the Escabrosa and Martin Formations. Because of the typical irregularity of replacement bodies, drilling was designed not only to penetrate the stratigraphy, but also to maximize the possibility of locating steep feeder structures for jasperoid emplacement; the feeders could then be traced downdip to potential mineralization. All three holes penetrated a similar sequence of Escabrosa Limestone, Martin Formation, and bottomed in the Abrigo Formation. No significant mineralization or conduits for jasperoid emplacement were intersected. Currently, Draco Mining of Tucson, Arizona, holds a claim block surrounding the Table Mountain Mine.




CONTOUR INTERVAL 40ft

0 1000 2000ft

EXPLANATION

| | | | |
|---|---|---|---|
| Louisville | PATENTED MINING CLAIM--Showing claim name | | JASPEROID BRECCIA OUTCROP |
| O82,83 | LOCALITY OF SAMPLED OUTCROP--Showing sample number(s) | 15-32 | SAMPLE LOCALITY--Showing sample number(s) |
| | SURFACE OPENINGS--Showing sample number(s) | ⊕ | DRILL HOLE |
| —<64-72 | Adit | ■ ■ | RUINS |
| —+<33,34 | Inaccessible adit | | JEEP TRAIL |
| X 35 | Prospect pit | | INTERMITTENT STREAM |
| 5000 | TOPOGRAPHIC CONTOUR--Showing elevation in feet above sea level | | |

Figure 3.--Table Mountain Mine area showing workings, patented mining claims, jasperoid breccia outcrop, and sample localities 15-96.

## APPRAISAL OF SITES EXAMINED

Base and precious metals are associated with a massive jasperoid-breccia body at the Table Mountain Mine in the southern part of the study area. The jasperoid-breccia body extends into the study area, and with the exception of a few scattered prospect pits, all the workings in the study area are associated with the jasperoid breccia. Barite, copper, gold, lead, and zinc, are present in the jasperoid samples.

### Table Mountain Mine

Although the Table Mountain Mine is on patented land, a thorough description of the geology and mineralization at the mine is given because it is completely surrounded by BLM land and the mineralization extends into the study area. Similar occurrences may be beneath the Galiuro Volcanics in the study area.

The Table Mountain Mine is on the west side of Virgus Canyon, in the extreme southern part of the study area (fig. 3) (pl. 1). Most of the workings are on the Grand Duke and Louisville patented claims, owned by Margaret Zellers, of Newport Beach, California. Draco Gold Mining Co. of Tuscon, Arizona, has a block of 40 unpatented claims surrounding the patented claims.

Rocks at the Table Mountain Mine are cherty to dolomitic, gently dipping, Mississippian Escabrosa Limestone, overlain by the flat-lying lower andesite unit of the Oligocene Galiuro Volcanics. The northern end of the eastern contact between limestone and andesite appears to be a fault; the remaining contacts are depositional. In the mine area, erosion of the andesite has exposed the limestone. Thomssen and Barber (1958, p. 12-14) reported that the exposed section of the Escabrosa Limestone at the mine is 508 ft thick and consider it to be the lower part of the formation. A massive body of gray to mottled red, brown, and white jasperoid breccia is found between the limestone and andesite. The jasperoid breccia crops out on the east and west sides of a narrow, north-trending spur ridge of Little Table Mountain.

Two possible origins for the jasperoid breccia are proposed. Simons (1964) suggests that the origin of the jasperoid breccia is supergene. Erosion of cherty limestone combined with silica solution along an unconformity may have formed the jasperoid breccia. The other possibility is that the jasperoid breccia is localized along a fault zone. Simons (1964) mapped a fault along the eastern edge of the eastern outcrop of jasperoid. Channelways may have been created by the fault allowing siliceous fluids from an unknown deep-seated silica source to migrate through the limestone.

Although the origin of the jasperoid breccia is not totally understood, base- and precious-metal mineralization is thought to be post-jasperoid formation and pre-andesite. Mineralization within the jasperoid breccia is very localized at the mine area. If jasperoid formation and mineralization were simultaneous, the entire jasperoid body should be more evenly mineralized. This is not the case. For example, the jasperoid on the west side of the ridge is barren. Oxidation within the jasperoid breccia is complete; no sulfides are visible. Total oxidation would indicate that the jasperoid breccia was in an oxidizing environment for some length of time before the andesite was deposited on it. The overlying andesite has not been shown to be mineralized.

The overall shape of the jasperoid breccia is lenticular, although in many places it is elongated along a vertical axis. At the mine area the jasperoid breccia is about 25-50 ft thick and can be traced horizontally for more than 1,500 ft. On the west side of the ridge the jasperoid breccia is up to 100 ft thick and can be traced for about 2,000 ft. The jasperoid breccia has sharp contacts with the limestone and andesite. No gradation of jasperoid into either the limestone or andesite was observed.

The jasperoid breccia is composed primarily of iron-oxide-stained silica, and fragments of chert (fig. 4). The jasperoid is strongly brecciated and recemented by quartz. Vugs containing drusy quartz are present but not commonly abundant. At the Table Mountain Mine, and for a distance of 600 ft northwest and 200 ft southeast of the mine, the jasperoid breccia contains irregular concentrations of minerals in pods, along fracture surfaces, and as coatings on weathered surfaces. The secondary copper minerals azurite, chrysocolla, conichalcite, and malachite, as well as barite, calcite and wulfenite, are common locally at the mine area. Extremely thin, flaky, free-milling gold occurs in the jasperoid breccia at the mine (fig. 5); the gold occurs mostly in the oxidized material, but is also found encrusting spongy limonitic blades in vugs, and in the silicified matrix of the jasperoid. No gold was observed in brecciated chert fragments.

Workings at the Table Mountain Mine consist of two accessible adits, four caved adits, and several prospect pits, all on the Louisville and Grand Duke patented claims (fig. 3). The longest accessible adit, (no. 1), 556 ft long, was driven beneath the jasperoid breccia and is entirely in barren Escabrosa Limestone; no mineralization or significant geologic structures were found (fig. 6). Four samples of iron-stained limestone were taken in the adit, but they contained no unusual concentrations of any metals (fig. 6). The adit was probably driven for exploration and haulage and was intended to intersect the jasperoid at depth. Calculations based on the distance to and slope angle

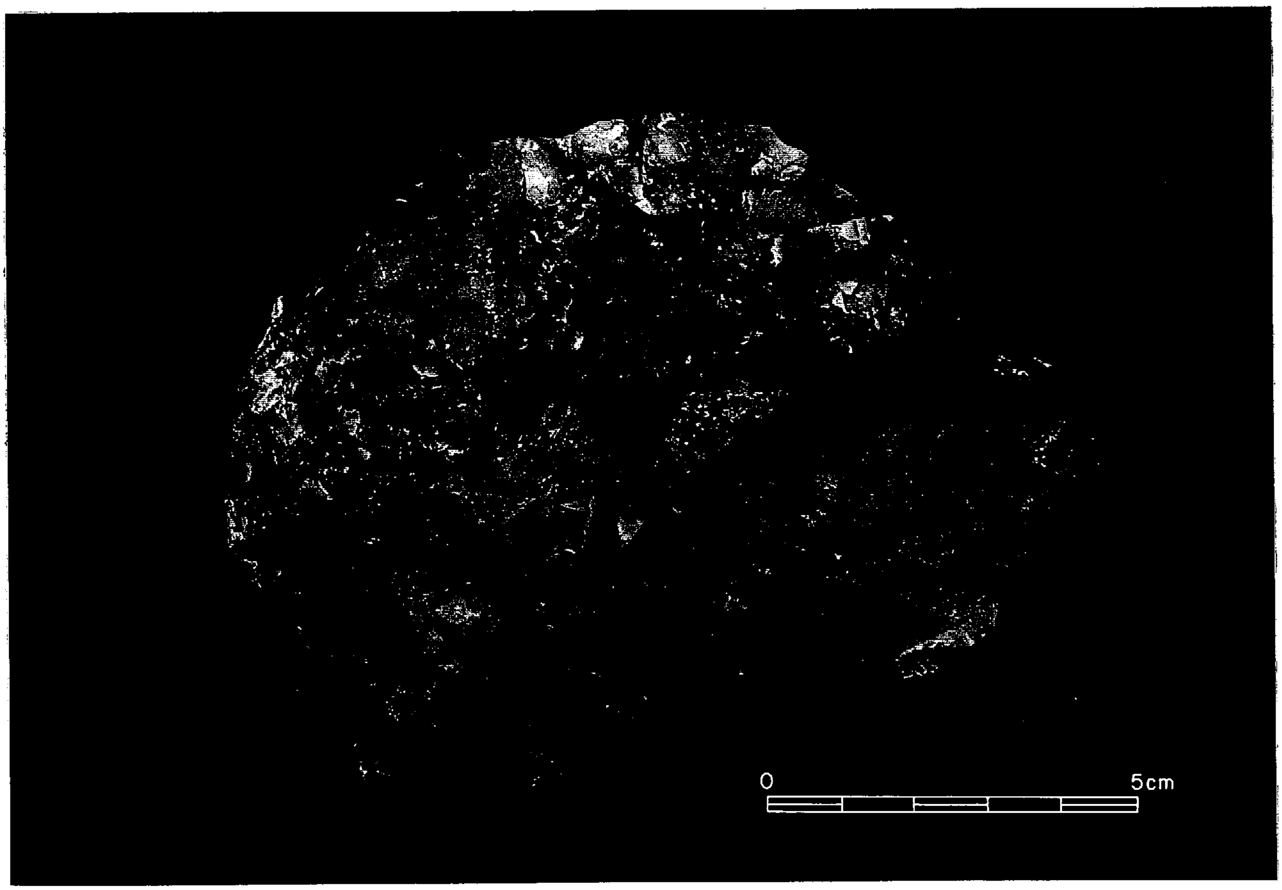



Figure 4.--Photograph of jasperoid breccia found throughout Table Mountain Mine area.

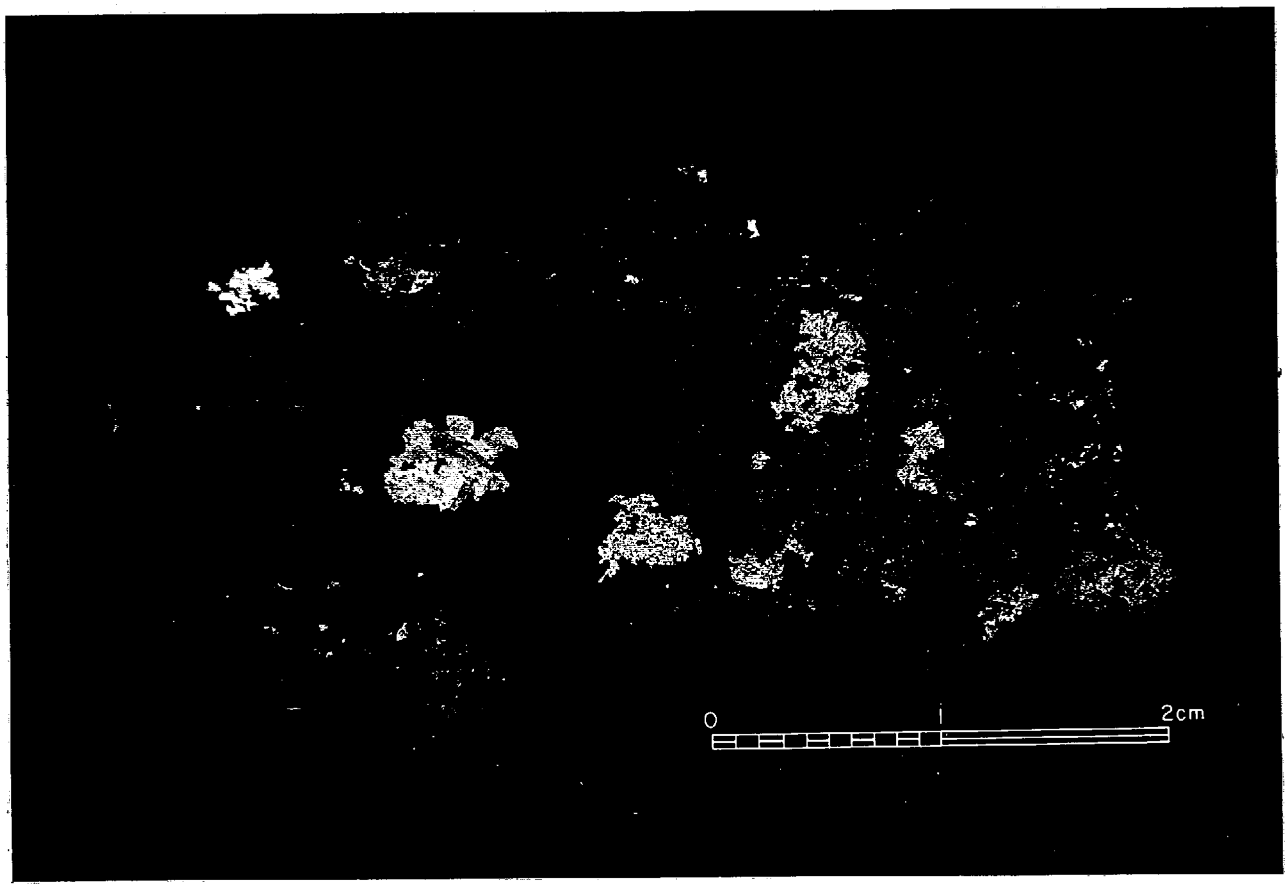
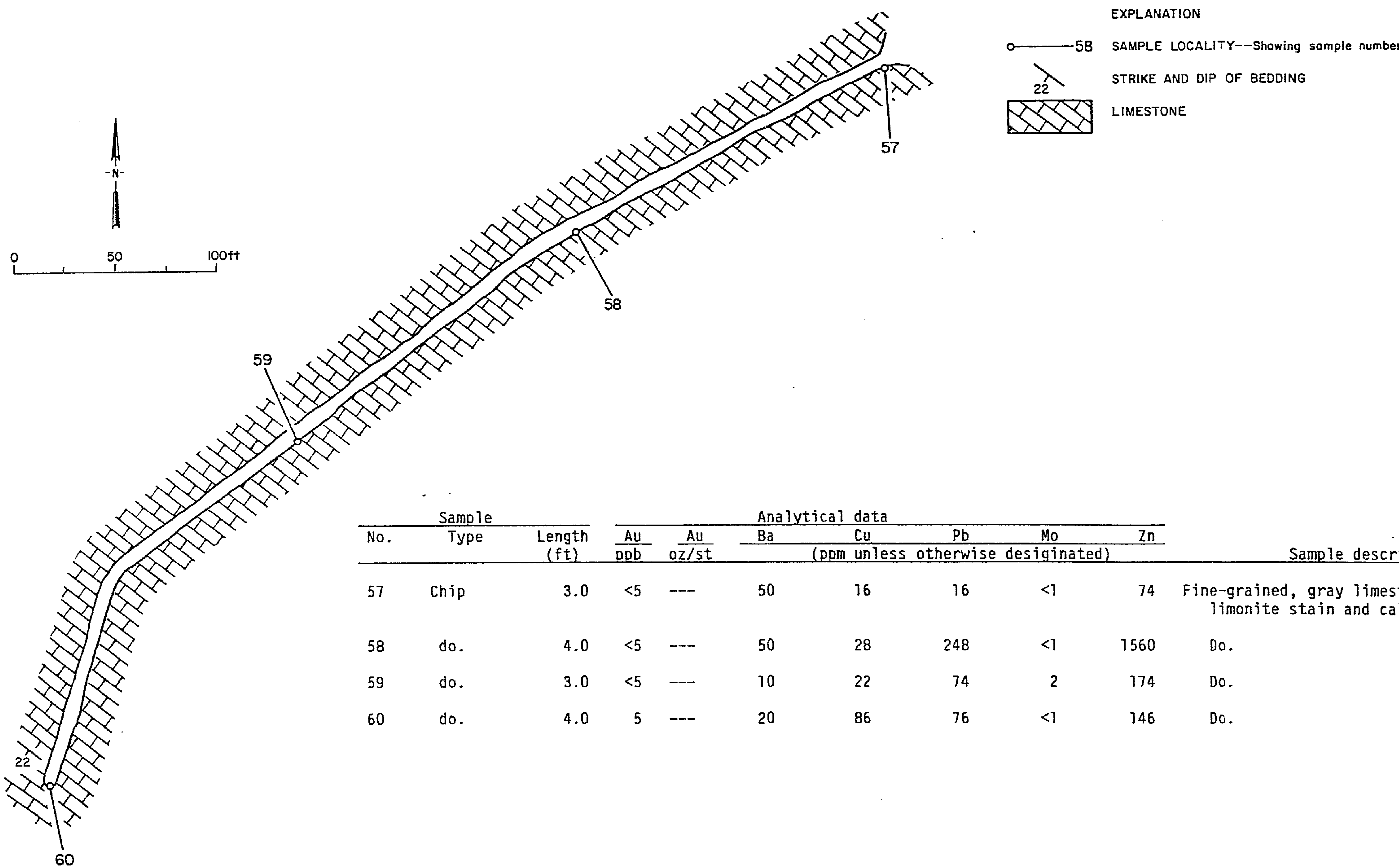



Figure 5.--Photograph of gold found at the Table Mountain mine.




| Sample No. | Type | Length (ft) | Au ppb | Au oz/st | Ba | Cu | Pb | Mo | Zn | Sample description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Analytical data | | (ppm unless otherwise desiginated) | | | | | |
| 57 | Chip | 3.0 | <5 | --- | 50 | 16 | 16 | <1 | 74 | Fine-grained, gray limestone with minor limonite stain and calcite stringers. |
| 58 | do. | 4.0 | <5 | --- | 50 | 28 | 248 | <1 | 1560 | Do. |
| 59 | do. | 3.0 | <5 | --- | 10 | 22 | 74 | 2 | 174 | Do. |
| 60 | do. | 4.0 | 5 | --- | 20 | 86 | 76 | <1 | 146 | Do. |

Figure 6.--Adit no. 1 at the Table Mountain mine showing sample localities 57-60.

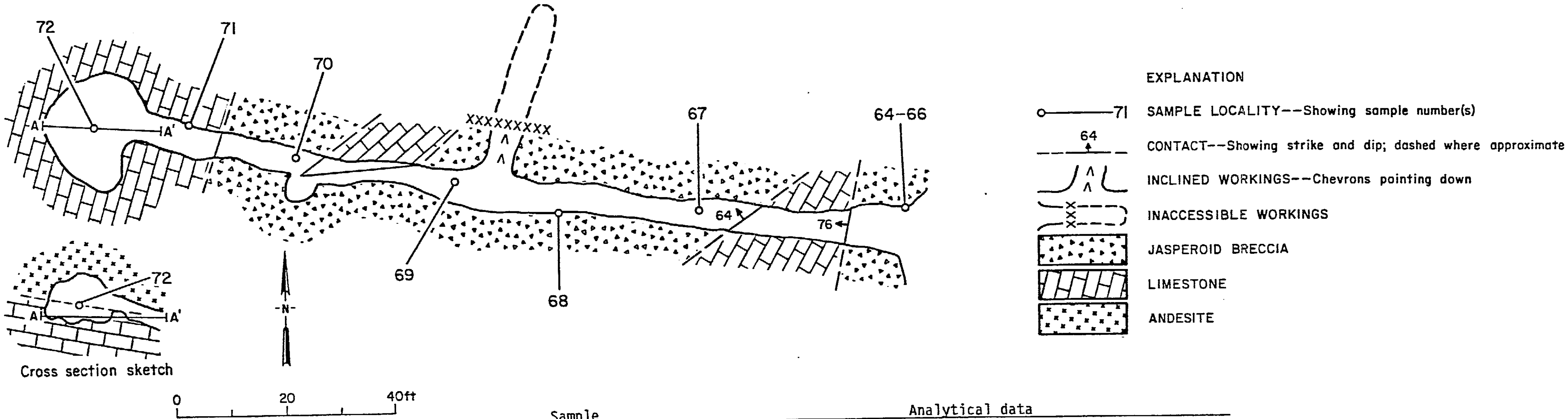
of the jasperoid breccia at the mine upslope show the adit should have intersected the jasperoid at depth, if the jasperoid extended downward. It appears, from this calculation, that the jasperoid breccia at the mine area is lenticular in nature and not more than 25 to 50 ft thick.

The other accessible adit (no. 2), driven into jasperoid breccia, is about 155 ft long (fig. 7). The adit passes through about 125 ft of jasperoid breccia into limestone along the contact with the overlying andesite. The jasperoid breccia at this location is along the fault mapped by Simon (1964) and may be the conduit responsible for mineral location.

Three contacts were mapped in the adit and nine samples were taken (fig. 7). Samples from the adit contain as much as 0.034 oz gold/st, 1,970 ppm barium, 3.07% copper, 1.33% lead, and 3.81% zinc. All samples from adit no. 2 contain notable concentrations of gold.

The most significant gold concentrations within the jasperoid breccia occur on the Grand Duke patented claim. The sample with the highest gold concentration (no. 54) (1.074 oz/st), a select sample of chips from a rock containing visible gold, was expected to be higher than the other samples. The second highest gold concentration (sample 52), was from a sample taken in place from a fracture filled with thoroughly oxidized material in jasperoid breccia. Although no gold was visible, the sample contained 0.309 oz/st.

Gold and base-metal distribution in the jasperoid breccia are inconsistent, thereby making resource calculations difficult. Individual resource estimates were made on four separate segments of jasperoid breccia at the Table Mountain Mine. Although the jasperoid-breccia body is continuous on the surface, separate estimates were made to define the deposit. These segments are labeled A, B, C, and D, on fig. 8. The weighted average of




| Sample No. | Sample Type | Length (ft) | Au ppb | Au oz/st | Ba | Cu | Pb | Mo | Zn | Sample description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Analytical data (ppm unless otherwise designated) | | | | | |
| 64 | Chip | 3.5 | --- | 0.008 | 450 | 3.48% | 1.21% | 21 | 4.59% | Red to white jasperoid breccia with abundant limonite and malachite stain and stringers. |
| 65 | do. | 6.0 | --- | .008 | 860 | 2.70% | 7460 | 334 | 3.81% | Do. |
| 66 | do. | 6.0 | --- | .034 | 190 | 2360 | 1.33% | 18 | 1345 | Do. |
| 67 | do. | 4.2 | --- | .018 | 560 | 361 | 364 | 6 | 1.70% | Weathered limestone with gouge in boxwork structure. |
| 68 | do. | 5.4 | --- | .004 | 450 | 3.07% | 2580 | 11 | 2.97% | Red to white jasperoid breccia with chrysocolla and small vugs filled with quartz crystals, minor limonite stain. |
| 69 | do. | 3.8 | --- | .012 | 1000 | 121 | 2420 | 8 | 1.77% | Fine-grained limestone, limonite stain along fractures. |
| 70 | do. | 4.0 | --- | .006 | 60 | 1255 | 7480 | 10 | 1.91% | Do. |
| 71 | do. | 6.3 | 50 | --- | 780 | 36 | 396 | 3 | 2.03% | Limestone breccia with gouge, secondary quartz crystals in vugs. |
| 72 | do. | .5 | 155 | --- | 1970 | 67 | 132 | 2 | 736 | Sample across andesite/limestone contact; minor limonite stain. |

Figure 7.--Adit no. 2 at the Table Mountain mine showing sample localities 64-72.

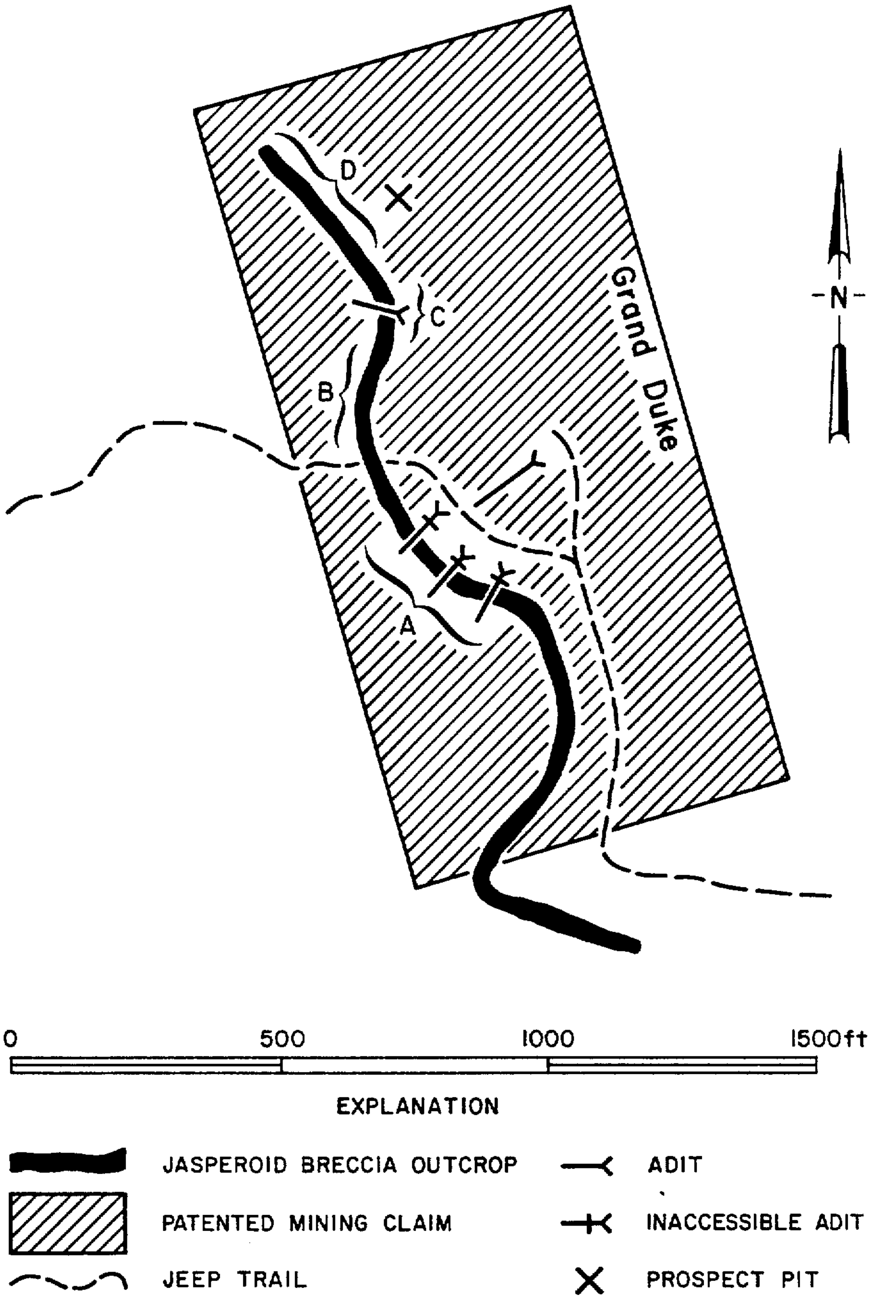



Figure 8.--Map of jasperoid breccia body at the Table Mountain mine.

samples was used to estimate the resources in each segment. Each segment was then weighted to the other segments in order to estimate total tonnage and average grade. A tonnage factor of 12.0 $ft^3$/st was used. Complete thickness of the jasperoid is not reflected in the calculations because its cliff-forming nature made sampling the entire thickness impossible. The estimates are a minimum of tonnage of material present.

For estimating indicated resources in segment A, the jasperoid breccia was estimated to be about 200 ft in length and 105 ft wide. Indicated resources, based on seven samples with a mineralized thickness of 3.8 ft, are approximately 10,000 st at an average grade of 0.053 oz gold/st.

In segment B, the jasperoid breccia was estimated to be about 143 ft in length and 71 ft wide. Indicated resources, based on a mineralized thickness of 8.8 ft are approximately 10,500 st with an average grade of 0.040 oz gold/st.

Estimation of resources in segment C are based on exposures in adit No. 2 in the jasperoid breccia. The jasperoid breccia was estimated to be about 150 ft in length and 75 ft wide. Indicated resources, based on a mineralized thickness of 4.3 ft are approximately 5,500 st with an average grade of 0.010 oz gold/st.

In segment D, the jasperoid was estimated to be about 150 ft in length and 75 ft wide. Indicated resources, based on a mineralized thickness of 7.2 ft are approximately 9,500 st with an average grade of 0.021 oz gold/st.

The weighted average of each segment was then used in the calculations for total grade and tonnage. An indicated resource of about 35,500 st of jasperoid breccia with an average grade of 0.034 oz gold/st was identified at the Table Mountain Mine. With a current gold price of $440.00 per oz, the value of the inplace resource is about $530,000.

Samples at the mine contained up to 0.81% barium, 3.78% copper, 2.17% lead, and 4.59% zinc. Based on the inconsistent and sporadic concentrations of these minerals, no resources of these minerals were identified.

The average domestic mining grade for a large tonnage, low grade gold deposit is 0.085 oz/st (U.S. Bureau of Mines, Minerals Availability Field Office, Denver, Colorado, oral communication, Aug. 1988). The gold resources at the Table Mountain Mine are considered subecomomic because of the small tonnages defined and generally low overall grade. Additional exploration at the mine could possibly help define larger tonnages of higher grade material and make the resources economic.

## Other prospects and mineralized areas

Two areas of prospecting and one area containing altered rocks were located. A geological reconnaissance did not indicate evidence of mineralization in any of these areas.

A prospect adit, shaft, and prospect pit were found in the extreme northern part of the study area (pl. 1, table 1, samples 1-4). The shaft and pit were apparently dug by rockhounds in search of geodes. Fragments of the geodes and whole geodes can be found in the rhyolite-obsidian member of the Galiuro Volcanics. The geodes are not unique and would not be commercially attractive.

One prospect adit and a pit were found on the south side of Brandenburg Mountain, near the west-central study area boundary (pl. 1, samples 5-7). The workings were dug in granite. Analytical data did not show any significant concentrations of base or precious metals in or near the adit (table 1, samples 5-7).

On the south slope of Little Table Mountain, within the study area, is an area of extremely oxidized Glory Hole Volcanics. This area is between the Copper Creek porphyry pluton and the Table Mountain Mine. The oxidation may be an indicator of hydrothermal activity extending from the Copper Creek pluton to the Table Mountain Mine. Two of the four samples taken of the oxidized volcanic rocks contained gold above the detection limit of 5 ppb (pl. 1, table 1, samples 11-14); no resource was identified.

### Stream-sediment data

Sixteen stream-sediment samples were taken to determine if other deposits similar to the one at the Table Mountain Mine may exist elsewhere in the study area (pl. 1, table 2). Samples were taken in drainages near the Table Mountain Mine to compare to samples from other drainages in the area. Except for the samples taken in Virgus Canyon, below the Table Mountain Mine, all samples were taken from areas underlain by thick sequences of Galiuro Volcanics and analyses display few geochemical concentrations suggestive of mineral deposits or mineral-forming processes. Several samples do contain enrichments in single elements, such as barium and tungsten, but these anomalous samples cannot be related to geologic structures, alteration, or mineral propsects, and by themselves are not indicative of mineral deposits. In general, the concentration of elements in the samples is normal for the geologic terranes from which they were derived, and the concentrations of most of the elements is low.

## CONCLUSIONS

Approximately 85% of the Aravaipa study area is covered by thick accumulations of volcanic rocks which are devoid of near-surface mineral occurrences. Erosion in the volcanics has exposed a section of Escabrosa

Limestone at the Table Mountain Mine area where a massive jasperoid-breccia body forms the upper part of the limestone section. Barium, copper, gold, lead, and zinc are localized in the jasperoid breccia. Geologic and analytical data indicate that an identified subeconomic resource of approximately 35,500 short tons of material averaging 0.034 oz gold/st is present at the Table Mountain Mine area in the extreme southern part of the study area. The inplace value of this resource is about $530,000. These data also suggest that geologic conditions are favorable for resources similar to the one at the Table Mountain Mine to exist beneath the Galiuro Volcanics, in an area of about 3,000 acres surrounding the mine (fig. 9). The study area north of Aravaipa Canyon is devoid of near-surface mineral occurrences but may have occurrences of base and precious metals at depth. The entire study area has geologic characteristics unfavorable for the formation and accumulation of petroleum and natural gas. No anomalously high concentrations of any element were found in the stream-sediment samples pointing to unknown areas of mineralization.

## RECOMMENDATIONS FOR FURTHER STUDY

Several drill holes would be needed at the Table Mountain Mine to further define the nature and distribution of the jasperoid occurrence. Additional drilling could help explain the origin of the jasperoid as well as define base- and precious-metal resources. Areas where Escabrosa Limestone crops out, such as on the west side of Table Mountain, would have to be drilled to determine if any jasperoid may be in the subsurface.

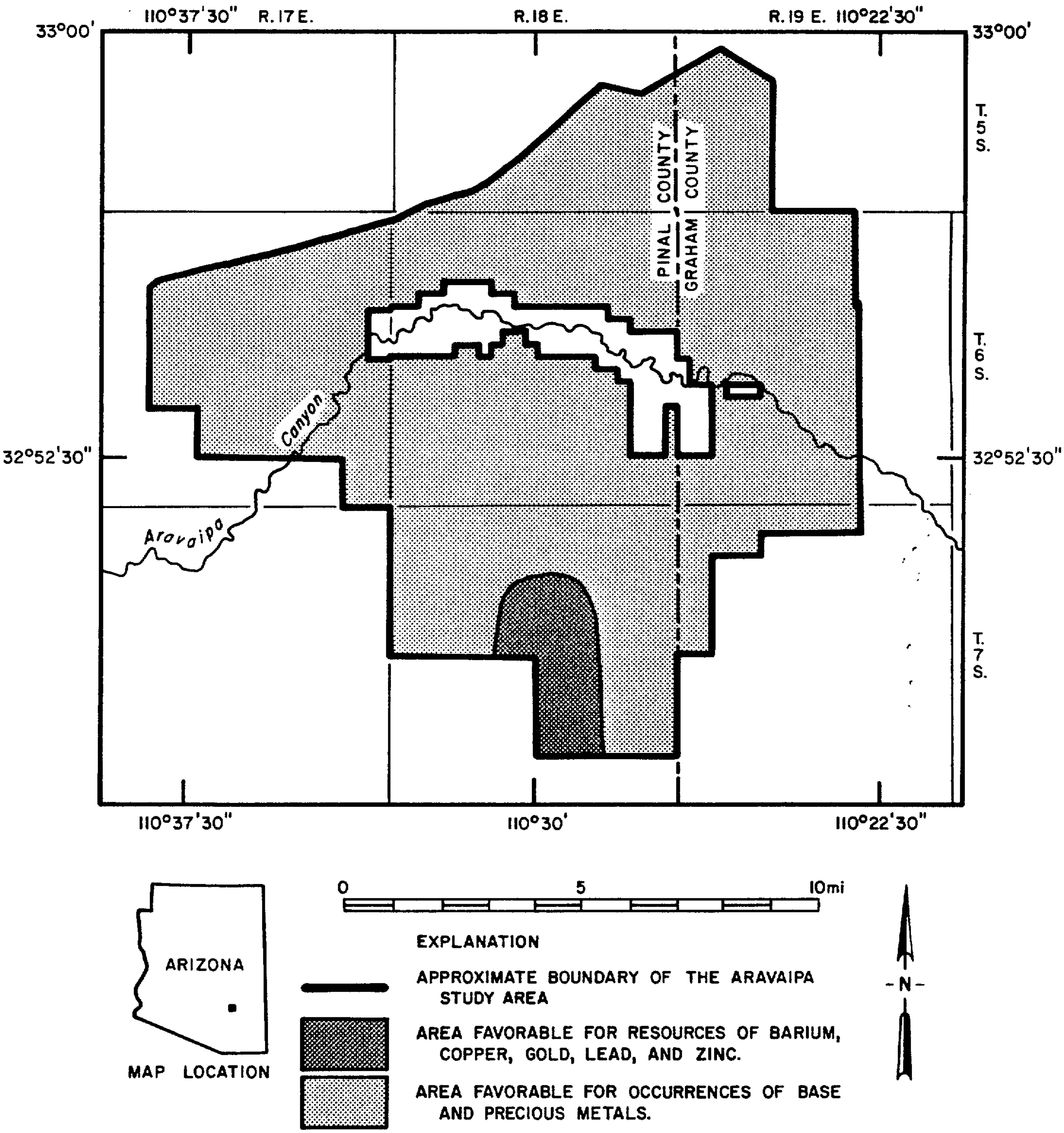



Figure 9.--Mineral resource map of the Aravaipa study area, Graham and Pinal Counties, Arizona.

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APPENDIX A--Analytical limits, Chemex Laboratories, Sparks, Nevada (gold was determined by fire assay/atomic absorption, all other by inductively coupled plasma analysis-total digestion). All values reported in ppm, except gold, which is in ppb.

| Element | Dectection limit |
|---|---|
| Ag | 0.5 |
| Al | .01 |
| Au | 5.0 |
| Ba | 1.0 |
| Be | .5 |
| Bi | 2.0 |
| Ca | .01 |
| Cd | .5 |
| Co | 1.0 |
| Cr | 1.0 |
| Cu | 1.0 |
| Fe | .01 |
| K | .01 |
| Mg | .01 |
| Mo | 1.0 |
| Mn | 1.0 |
| Na | .01 |
| Ni | 1.0 |
| P | 10.0 |
| Pb | 2.0 |
| Sr | 1.0 |
| Ti | .01 |
| V | 1.0 |
| W | 10.0 |
| Zn | 1.0 |

Table 1.--Analytical data and description of samples not shown on figures 6 and 7 from in and near the Aravaipa study area, Graham and Pinal Counties, Arizona.

[Au was determined by the fire assay/atomic absorption method; all other elements were determined by the inductively coupled plasma method. ---, not applicable; <, less than, >, greater than; Au, gold; Ba, barium; Cu, copper; Pb, lead; Mo, molybdenum; Zn, zinc.]

| Sample | | | Analytical data | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Au ppb | Au oz/st | Ba | Cu | Pb | Mo | Zn | Sample description |
| | | | | | (ppm unless otherwise desiginated) | | | | | |
| 1 | Chip | 2.0 | <5 | --- | 30 | 3 | 30 | 3 | 80 | 58-ft-deep shaft in Rhyolite-obsidian member of the Galiuro Volcanics; no minerals seen. |
| 2 | do. | 5.0 | <5 | --- | 30 | 81 | 54 | 2 | 92 | Very weathered outcrop of limonite-stained rhyolite-obsidian; no minerals seen. |
| 3 | do. | 2.5 | <5 | --- | 90 | 59 | 16 | <1 | 72 | 60-ft-long prospect adit along andesite-rhyolite contact; very weathered andesite and rhyolite. |
| 4 | do. | 4.0 | <5 | --- | 300 | 21 | 26 | <1 | 70 | Do. |
| 5 | do. | 2.3 | 15 | --- | 450 | 26 | 6 | <1 | 37 | 125-ft-long adit in granite; calcite with chlorite alteration in N. 80° W. fault, vertical dip. |
| 6 | do. | 1.5 | <5 | --- | 790 | 23 | 4 | <1 | 35 | 130-ft-long adit in granite; calcite, limonite-stained gouge in N. 65° E., 74° S. dipping fault. |
| 7 | do. | 1.2 | <5 | --- | 730 | 42 | <2 | <1 | 64 | Do. |
| 8 | do. | 4.0 | <5 | --- | 5940 | 176 | 14 | <1 | 44 | 30-ft-long prospect adit in quartzite; azurite, chrysocolla, and limonite in north-trending, vertical dipping fault. |
| 9 | Select | --- | <5 | --- | 80 | 25 | 20 | <1 | 16 | Outcrop of Abrigo Formation; limonite-stained quartzite. |
| 10 | Chip | 2.0 | <5 | --- | 50 | 12 | 14 | <1 | 21 | Outcrop of cherty Escabrosa Limestone. |
| 11 | do. | 12.0 | <5 | --- | 350 | 16 | 22 | <1 | 20 | Outcrop of brecciated andesite; heavy iron-oxide stained, vuggy, baked andesite. |
| 12 | do. | 12.0 | 20 | --- | 630 | 25 | 22 | 2 | 29 | Do. |
| 13 | do. | 6.0 | <5 | --- | 800 | 27 | 40 | 3 | 20 | Do. |
| 14 | do. | 8.0 | 10 | --- | 380 | 24 | 24 | 2 | 35 | Do. |

Table 1.--Analytical data and description of samples not shown on figures 6 and 7 from in and near the Aravaipa study area, Graham and Pinal Counties, Arizona--Continued

| Sample No. | Sample Type | Sample Length (ft) | Au ppb | Au oz/st | Ba | Cu | Pb | Mo | Zn | Sample description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | (ppm unless otherwise desiginated) | | | | | |
| 15 | Chip | 7.0 | <5 | --- | 120 | 36 | 116 | 2 | 56 | 14-ft-thick jasperoid breccia outcrop; sample is upper 7 ft of outcrop; vuggy, limonite-stained, white to pink jasperoid breccia. |
| 16 | do. | 7.0 | <5 | --- | 190 | 68 | 272 | 3 | 218 | Same description as No. 15, lower 7 ft. |
| 17 | do. | 6.0 | <5 | --- | 200 | 10 | 286 | 11 | 22 | 12-ft-thick jasperoid breccia outcrop; sample is upper 6 ft of outcrop; white to pink jasperoid breccia. |
| 18 | do. | 6.0 | <5 | --- | 120 | 19 | 138 | 1 | 35 | Same description as No. 17, lower 6 ft, more limonite stain than No. 17. |
| 19 | do. | 6.0 | <5 | --- | 140 | 16 | 64 | 8 | 45 | 22-ft-thick jasperoid breccia outcrop; sample is upper 6 ft of outcrop; white to red, mottled jasperoid breccia. |
| 20 | do. | 16.0 | <5 | --- | 150 | 12 | 138 | 4 | 19 | Same description as No. 19; lower 16 ft of outcrop. |
| 21 | do. | 13.0 | <5 | --- | 130 | 10 | 574 | 24 | 32 | 33-ft thick japseroid breccia outcrop; sample is lower 13 ft of outcrop; white to red, mottled jasperoid breccia with minor malachite stain and some small quartz crystals in vugs. |
| 22 | do. | 7.0 | <5 | --- | 50 | 9 | 122 | 11 | 18 | Same outcrop location as No. 21; sample is next 7 ft above No. 21; white to red, mottled jasperoid breccia, no malachite stain. |
| 23 | do. | 7.0 | <5 | --- | 130 | 13 | 574 | 24 | 32 | Same outcrop location as No. 21; sample is next 7 ft above No. 22; white to red, mottled jasperoid breccia. |
| 24 | do. | 6.0 | <5 | --- | 290 | 10 | 224 | 29 | 16 | Same outcrop location as No. 21; sample is next 6 ft above No. 23; same description as No. 23. |
| 25 | do. | 8.0 | <5 | --- | 90 | 10 | 100 | 18 | 14 | 31-ft thick jasperoid breccia outcrop; sample is upper 8 ft of outcrop; white to red, mottled jasperoid breccia. |
| 26 | do. | 12.0 | <5 | --- | 190 | 13 | 150 | 4 | 22 | Same sample description as No. 25; next 12 ft of outcrop. |
| 27 | do. | 11.0 | <5 | --- | 210 | 29 | 304 | 13 | 28 | Same sample description No. 25; next 11 ft of outcrop. |

Table 1.--Analytical data and description of samples not shown on figures 6 and 7 from in and near the Aravaipa study area, Graham and Pinal Counties, Arizona--Continued

| Sample | | | Analytical data | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Au ppb | Au oz/st | Ba (ppm unless otherwise designated) | Cu | Pb | Mo | Zn | Sample description |
| 28 | Chip | 15.0 | 35 | --- | 50 | 2920 | 406 | 3 | 106 | 61-ft thick jasperoid breccia outcrop; sample is upper 15 ft of outcrop; vuggy, chrysocolla-stained jasperoid breccia, some small quartz veinlets. |
| 29 | do. | 12.0 | <5 | --- | 130 | 51 | 270 | 13 | 25 | Same sample location as No. 28; next 12 ft of outcrop; white to red jasperoid breccia, no chrysololla. |
| 30 | do. | 11.0 | <5 | --- | 60 | 22 | 140 | 2 | 21 | Same sample location as No. 28; next 11 ft of outcrop; same sample description as No. 29. |
| 31 | do. | 11.0 | 15 | --- | 100 | 27 | 278 | 14 | 47 | Same sample location as No. 28; next 11 ft of outcrop; same sample description as No. 30. |
| 32 | do. | 12.0 | <5 | --- | 90 | 13 | 302 | 7 | 125 | Same location as No. 28; next 12 ft of outcrop; same sample description as No. 31. |
| 33 | do. | 4.5 | <5 | --- | 80 | 43 | 198 | 3 | 37 | Horizontal sample of jasperoid breccia at portal of caved adit; minor chrysocolla and limonite stain. |
| 34 | do. | 5.0 | <5 | --- | 150 | 63 | 530 | 7 | 59 | Do. |
| 35 | Select | --- | <5 | --- | 960 | 42 | 12 | <1 | 91 | Prospect pit in andesite; sample is pink to gray fine-grained andesite; no mineralization seen. |
| 36 | Chip | 7.0 | <5 | --- | 80 | 188 | 144 | 3 | 260 | 14-ft-thick jasperoid breccia outcrop; upper 7 ft of mottled red to white jasperoid breccia outcrop. |
| 37 | do. | 7.0 | <5 | --- | 110 | 39 | 98 | 6 | 104 | Same sample location as No. 36; next 7 ft of outcrop. |
| 38 | do. | 10.0 | <5 | --- | 600 | 72 | 134 | 36 | 74 | 22-ft-thick jasperoid breccia outcrop; upper 10 ft of mottled red to white jasperoid breccia. |
| 39 | do. | 12.0 | <5 | --- | 310 | 28 | 164 | 3 | 55 | Same sample location as No. 38; next 12 ft of outcrop; same sample description as No. 38. |
| 40 | do. | 8.0 | 110 | --- | 1230 | 1255 | 1185 | 45 | 465 | 8-ft-thick jasperoid breccia outcrop; iron-oxide stain. |
| 41 | do. | 8.0 | 10 | --- | 300 | 139 | 374 | 15 | 166 | 13-ft-thick jasperoid breccia outcrop; upper 8 ft of outcrop; iron oxide stain. |
| 42 | do. | 5.0 | <5 | --- | 90 | 104 | 340 | 4 | 538 | Same location as No. 38; lower 5 ft; same sample description. |

Table 1.--Analytical data and description of samples not shown on figures 6 and 7 from in and near the Aravaipa study area, Graham and Pinal Counties, Arizona--Continued

| Sample No. | Sample Type | Length (ft) | Au ppb | Au oz/st | Ba | Cu | Pb | Mo | Zn | Sample description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | (ppm unless otherwise desiginated) | | | | | |
| 43 | Chip | 10.0 | <5 | --- | 60 | 58 | 334 | 11 | 273 | 12-ft-thick jasperoid breccia outcrop; sample is upper 10 ft of outcrop; limonite-stained, vuggy, red to white jasperoid breccia. |
| 44 | do. | 2.0 | 10 | --- | 140 | 45 | 636 | 4 | 483 | Same description as No. 43; lower 2 ft of outcrop; sample includes contact with limestone. |
| 45 | do. | 6.5 | <5 | --- | 140 | 60 | 196 | 3 | 130 | 6.5-ft-thick jasperoid breccia outcrop; limonite-stained red to white jasperoid breccia. |
| 46 | do. | 4.0 | <5 | --- | 760 | 22 | 82 | 12 | 97 | 4-ft-long sample across start of a prospect adit; limonite-stained red to white jasperoid breccia. |
| 47 | do. | 5.0 | 40 | --- | 780 | 5930 | 1250 | 73 | 6380 | 5-ft-sample down left rib of caved adit at the portal; sample contains chrysocolla-stained red to white jasperoid breccia. |
| 48 | do. | 1.2 | 2900 | 0.082 | 1050 | 4340 | 1.67% | 279 | 3.93% | Small pod of massive white barite with chrysocolla stain and small yellow wulfenite blades. |
| 49 | do. | 4.2 | 3200 | .092 | 4710 | 3.78% | 2.17% | 28 | 1.16% | Small pod of chrysocolla with yellow granular wulfenite. |
| 50 | do. | 1.5 | 40 | --- | 1270 | 2.61% | 188 | 1 | 4590 | 1.5-ft-andesite dike intruding jasperoid breccia; chrysocolla and limonite stain. |
| 51 | do. | 5.0 | 840 | .024 | 830 | 1.16% | 872 | 39 | 1210 | Abundant chrysocolla stain, minor gouge, limonite stain, red to white jasperoid breccia. |
| 52 | do. | 1.8 | --- | 0.309 | 170 | 2.15% | 2130 | 150 | 650 | 3-5 in. vein of bright red iron oxide and yellow granular wulfenite; vein strikes S.85° W. and dips 34° S.; in japseroid breccia. |
| 53 | do. | 7.5 | 30 | --- | 110 | 79 | 208 | 8 | 1150 | Sample taken horizontally across portal of caved adit; red to white jasperoid breccia. |
| 54 | Select | --- | --- | 1.074 | 5030 | 1.52% | 2550 | 59 | 572 | Sample composed of chips from rock containing visible gold; rock is very limonitic, vuggy, with copper oxide stain. |
| 55 | do. | --- | 2500 | --- | 5230 | 3.01% | 3000 | 43 | 4410 | Sample is from 25-30 ton stock pile. Rock is chrysocolla-stained jasperoid breccia. |
| 56 | do. | --- | 3550 | --- | 5170 | 4450 | 9830 | 87 | 2610 | Sample is from 50-ton stock pile. Rock is limonitic, vuggy, granular, jasperoid breccia. |

Table 1.--Analytical data and description of samples not shown on figures 6 and 7 from in and near the Aravaipa study area, Graham and Pinal Counties, Arizona--Continued

| Sample | | | Analytical data | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Au ppb | Au oz/st | Ba | Cu | Pb | Mo | Zn | | Sample description |
| | | | | | (ppm unless otherwise desiginated) | | | | | | |
| 61 | Chip | 7.5 | 300 | --- | 300 | 267 | 3440 | 19 | 783 | | 13-ft-thick jasperoid outcrop; upper 7 ft of outcrop; red to brown jasperoid breccia with minor copper oxide stain and coatings of wulfenite. |
| 62 | do. | 6.0 | 530 | --- | 1290 | 152 | 5470 | 282 | 430 | | Same description as No. 61; lower 6 ft of outcrop. |
| 63 | do. | 10.0 | 1800 | --- | 5710 | 102 | 1.79% | 2420 | 332 | | Red to brown jasperoid breccia with minor wulfenite coatings, copper oxide stain, and minor barite. |
| 73 | do. | 7.0 | --- | 0.062 | 1540 | 2660 | 7250 | 36 | 1.09% | | 7-ft-thick jasperoid breccia outcrop; minor wulfenite coatings along fractures. |
| 74 | do. | 6.0 | --- | .066 | 8140 | 1975 | 3210 | 24 | 938 | | Prospect adit in jasperoid breccia; minor barite chrysocolla and limonite stain. |
| 75 | do. | 8.0 | --- | .030 | 930 | 2.16% | 5460 | 24 | 4500 | | 17-ft-thick jasperoid breccia outcrop; sample is lower 8 ft of outcrop; azurite, chrysocolla, hematite, and wulfenite coatings along fractures. |
| 76 | do. | 9.0 | --- | .020 | 490 | 763 | 2380 | 17 | 1680 | | Same description as No. 75; upper 9 ft of outcrop. |
| 77 | do. | 6.0 | 620 | --- | 130 | 241 | 384 | 18 | 653 | | 6-ft-thick jasperoid breccia outcrop; minor copper oxide and limonite stain. |
| 78 | do. | 4.5 | 10 | --- | 20 | 8100 | 614 | 7 | 4200 | | Prospect pit; chrysocolla- and limonite-stained jasperoid breccia; sample includes limestone-andesite contact. |
| 79 | do. | 7.0 | 35 | --- | 560 | 286 | 1945 | 52 | 4660 | | Prospect adit; jasperoid breccia with chrysocolla, and limonite along fracture surfaces. |
| 80 | do. | 15.0 | <5 | --- | 410 | 32 | 64 | 1 | 110 | | 15-ft-thick outcrop of jasperoid breccia; limonite stain. |
| 81 | do. | 4.5 | <5 | --- | 10 | 7 | 18 | <1 | 101 | | 65-ft-long adit in limestone; no mineralization seen. |
| 82 | do. | 10.0 | <5 | --- | 50 | 201 | 96 | 10 | 173 | | Sample is upper 10 ft of 60-ft-thick jasperoid breccia outcrop; small quartz crystals in vugs. |
| 83 | do. | 20.0 | <5 | --- | 90 | 269 | 164 | 1 | 182 | | Sample is next 20 ft below No. 82; same description as No. 82. |

Table 1.--Analytical data and description of samples not shown on figures 6 and 7 from in and near the Aravaipa study area, Graham and Pinal Counties, Arizona--Continued

| Sample No. | Sample Type | Sample Length (ft) | Au ppb | Au oz/st | Ba | Cu | Pb | Mo | Zn | Sample description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | (ppm unless otherwise designated) | | | | | |
| 84 | Chip | 14.0 | <5 | --- | 30 | 25 | 12 | 16 | 82 | Sample is upper 14 ft of 100-ft-thick jasperoid breccia outcrop; abundant limonite stain and small vugs lined with secondary quartz crystals. |
| 85 | do. | 6.0 | <5 | --- | 50 | 79 | 280 | 15 | 279 | Sample is next 6 ft below No. 84; same sample description as No. 84. |
| 86 | do. | 12.0 | <5 | --- | 60 | 35 | 30 | 11 | 28 | Sample is bottom 12 ft of outcrop at sample location 85; same description as No. 85. |
| 87 | do. | 12.0 | <5 | --- | 130 | 52 | 60 | 2 | 45 | Sample is upper 12 ft of 100-ft-thick jasperoid breccia; limonite stain. |
| 88 | do. | 20.0 | <5 | --- | 50 | 80 | 46 | 11 | 27 | Sample is next 20 ft below No. 87; same description as No. 87. |
| 89 | do. | 9.0 | <5 | --- | 150 | 80 | 296 | 2 | 86 | Sample is bottom 9 ft of outcrop at location 87; same sample description as No. 87. |
| 90 | do. | 20.0 | <5 | --- | 120 | 38 | 32 | 2 | 32 | Sample is upper 20 ft of 100-ft-thick jasperoid breccia; limonite stain. |
| 91 | do. | 14.0 | <5 | --- | 90 | 105 | 52 | 11 | 54 | Sample is next 14 ft below No. 90; same sample description. |
| 92 | do. | 15.0 | 25 | --- | 140 | 61 | 52 | 2 | 77 | Sample is from upper 15 ft of a 30-ft-thick jasperoid breccia outcrop; abundant limonite stain. |
| 93 | do. | 15.0 | <5 | --- | 40 | 68 | 38 | 1 | 44 | Sample is bottom 15 ft of jasperoid breccia outcrop; same sample description as No. 92. |
| 94 | do. | 10.0 | 110 | --- | 600 | 71 | 548 | 15 | 1535 | Sample is upper 10 ft of 30-ft-thick jasperoid breccia outcrop; minor limonite stain and small vugs lined with small secondary quartz crystals. |
| 95 | do. | 10.0 | 25 | --- | 250 | 74 | 404 | 5 | 268 | Sample is next 10 ft below No. 94; same sample description as No. 94. |
| 96 | do. | 10.0 | 10 | --- | 360 | 89 | 632 | 5 | 325 | Sample is bottom 10 ft of outcrop at location 94; same sample description as No. 94. |
| 97 | do. | 4.5 | <5 | --- | 60 | 13 | 38 | 9 | 373 | Sample is from jasperoid breccia exposed in prospect pit; limonite stain, upper 4.5 ft of 9 ft outcrop. |

Table 1.--Analytical data and description of samples not shown on figures 6 and 7 from in and near the Aravaipa study area, Graham and Pinal Counties, Arizona--Continued

| Sample | | | Analytical data | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Type | Length (ft) | Au ppb | Au oz/st | Ba | Cu | Pb | Mo | Zn | Sample description |
| | | | | | (ppm unless otherwise desiginated) | | | | | |
| 98 | Chip | 4.5 | <5 | --- | 140 | 10 | 84 | 1 | 111 | Sample is lower 4.5 ft of outcrop in No. 97; same sample description as No. 97. |
| 99 | do. | 6.0 | <5 | --- | 410 | 22 | 50 | <1 | 38 | Sample is upper 6 ft of 12-ft-thick jasperoid breccia outcrop; abundant limonite stain. |
| 100 | do. | 6.0 | <5 | --- | 100 | 13 | 30 | 1 | 29 | Sample is lower 6 ft of outcrop at location 99; same sample description as No. 99. |

Table 2.--Analytical data and description of stream-sediment samples from in and near the Aravaipa study area, Graham and Pinal Counties, Arizona.

[---, not detected; <, less than.]

| No. | Sample type | Analyatical data | | | | | | | Sample location |
|---|---|---|---|---|---|---|---|---|---|
| | | Au ppb | Ag ppm | Ba | Cu | Pb | Mo | Zn | |
| | | | | (ppm unless otherwise desiginated) | | | | | |
| SS1 | Stream sediment | --- | 0.5 | 550 | 51 | 24 | <1 | 95 | Horse Camp Creek |
| SS2 | do. | --- | .5 | 550 | 64 | 22 | <1 | 255 | Booger Canyon. |
| SS3 | do. | --- | .5 | 700 | 34 | 64 | 10 | 177 | Deer Creek. |
| SS4 | do. | --- | .5 | 740 | 55 | 68 | 1 | 154 | Bear Canyon. |
| SS5 | do. | --- | .5 | 260 | 21 | 12 | <1 | 79 | Buzan Canyon. |
| SS6 | do. | --- | .5 | 310 | 44 | 2 | <1 | 136 | Oak Creek Canyon. |
| SS7 | do. | --- | 1.5 | 140 | 10 | 18 | <1 | 468 | Holy Joe Canyon. |
| SS8 | do. | --- | .5 | 640 | 61 | 28 | 1 | 121 | Upper Oak Creek Canyon. |
| SS9 | do. | --- | .5 | 500 | 48 | 24 | <1 | 103 | Bear Springs Canyon. |
| SS10 | do. | --- | .5 | 680 | 52 | 22 | <1 | 228 | Oak Grove Canyon. |
| SS11 | do. | --- | 3.5 | 940 | 60 | 16 | <1 | 124 | Parsons Canyon. |
| SS12 | do. | --- | .5 | 1370 | 183 | 190 | 1 | 350 | Virgus Canyon. |
| SS13 | do. | --- | .5 | 1160 | 65 | 18 | 1 | 115 | Virgus Canyon. |
| SS14 | do. | --- | .5 | 920 | 80 | 24 | <1 | 165 | Sycamore Canyon. |
| SS15 | do. | --- | .5 | 940 | 61 | 26 | 1 | 136 | Saddle Canyon. |
| PC1 | Panned-concentrate | --- | 1.0 | 2710 | 241 | 430 | <1 | 652 | Virgus Canyon. |

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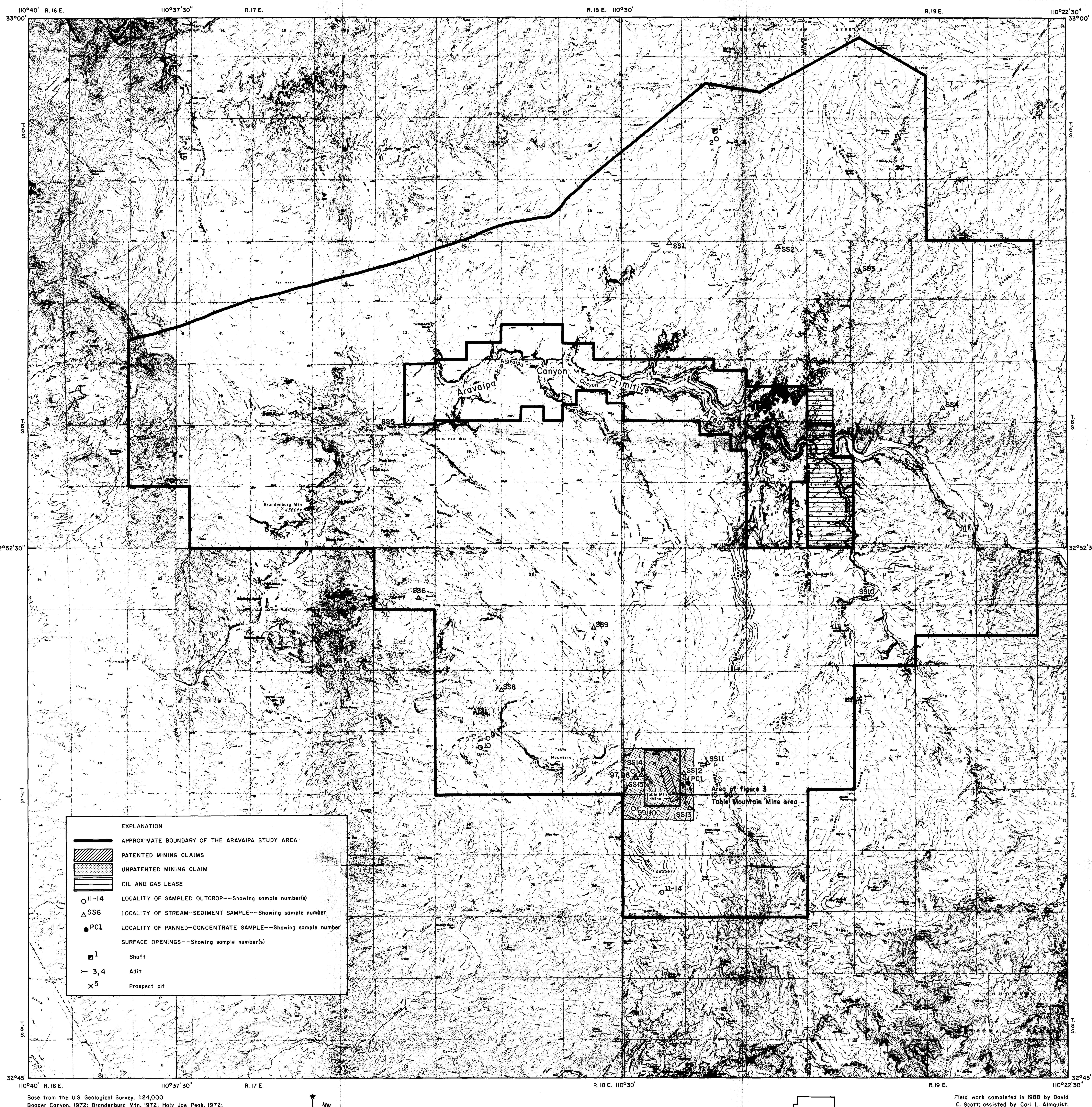
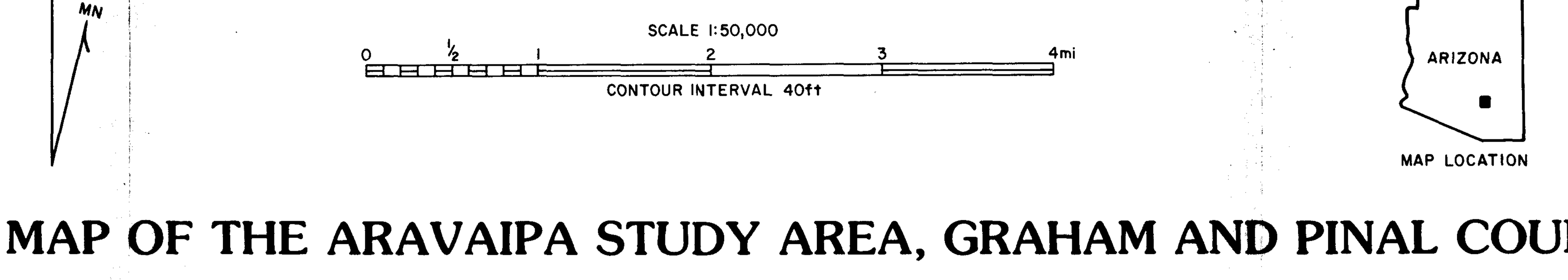
PLATE 1




Base from the U.S. Geological Survey, 1:24,000
Booger Canyon, 1972; Brandenburg Mtn, 1972; Holy Joe Peak, 1972;
Lookout Mtn, 1972; Oak Grove Canyon, 1972; and Saddle Mtn, 1972.




Field work completed in 1988 by David C. Scott; assisted by Carl L. Almquist.

# MINE AND PROSPECT MAP OF THE ARAVAIPA STUDY AREA, GRAHAM AND PINAL COUNTIES, ARIZONA

BY

DAVID C. SCOTT, U.S. BUREAU OF MINES

1988

DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

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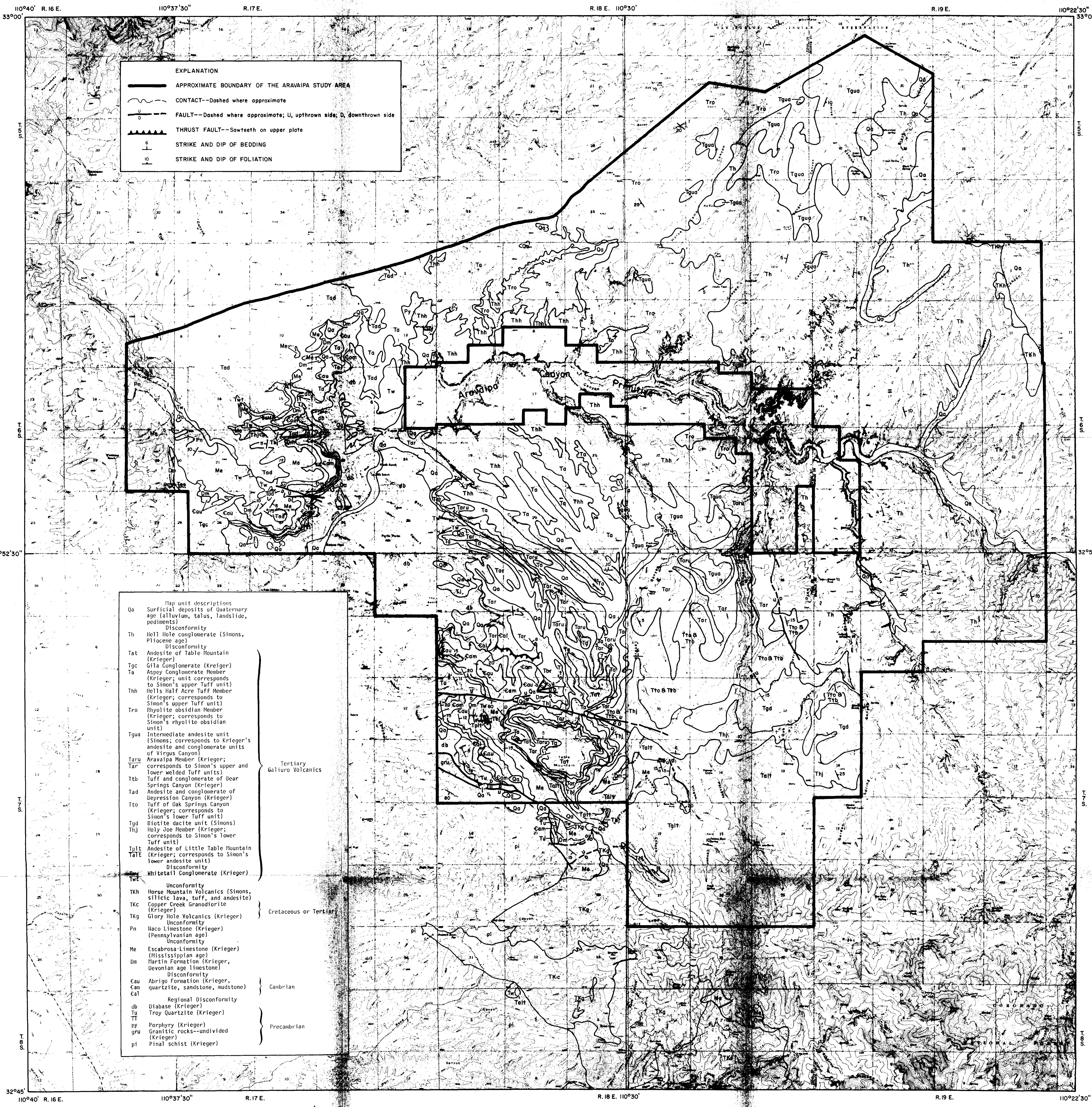
MLA 38-88
PLATE 2




Base from the U.S. Geological Survey, 1:24,000
Booger Canyon, 1972; Brandenburg Mtn, 1972; Holy Joe Peak, 1972;
Lookout Mtn, 1972; Oak Grove Canyon, 1972; and Saddle Mtn, 1972.

MN

SCALE 1:50,000
0 1/2 1 2 3 4mi
CONTOUR INTERVAL 40ft

MAP LOCATION

Geology adapted from Krieger, M.H., 1968, and Simons, F.S., 1964.

# GEOLOGIC MAP OF THE ARAVAIPA STUDY AREA, GRAHAM AND PINAL COUNTIES, ARIZONA

COMPILED BY

DAVID C. SCOTT, U.S. BUREAU OF MINES

1988