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Mineral Land Assessment
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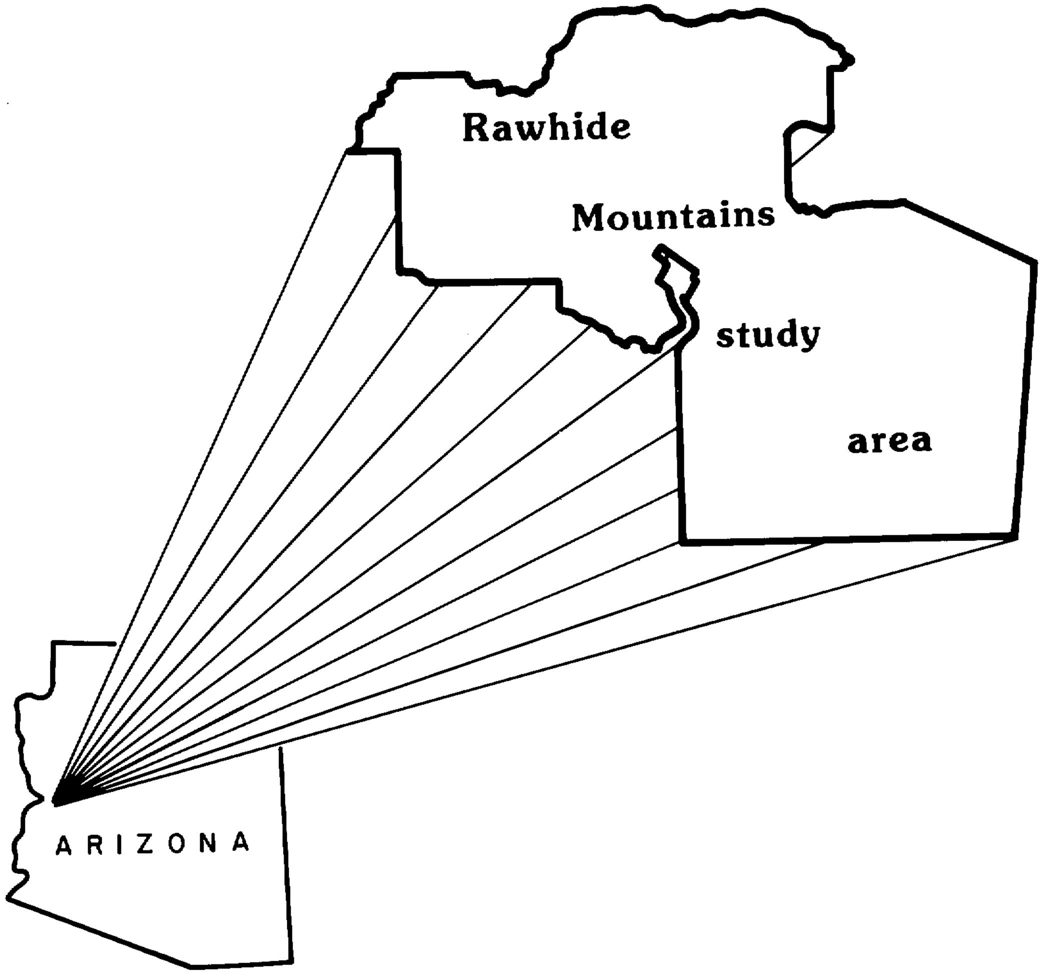
Mineral Resources of a Part of the Rawhide Mountains Wilderness Study Area (AZ-020-058A), La Paz and Mohave Counties, Arizona



BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL RESOURCES OF A PART OF THE RAWHIDE MOUNTAINS WILDERNESS STUDY AREA (AZ-020-058A), LA PAZ AND MOHAVE COUNTIES, ARIZONA

by

Steven E. Tuftin

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Intermountain Field Operations Center
Denver, Colorado

UNITED STATES DEPARTMENT OF THE INTERIOR
Manuel J. Lujan, Jr., Secretary

BUREAU OF MINES
T S Ary, Director

PREFACE

The Federal Land Policy and Management Act of 1976 (Public Law 94-579) 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 a part of the Rawhide Mountains Wilderness Study Area (AZ-020-058A), La Paz and Mohave Counties, Arizona.

This open-file report summarizes the results of a Bureau of Mines wilderness study. 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, CO 80225.

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UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

°C	degree Celsius
ft	foot
in.	inch
mi	mile
ppm	part per million
%	percent
oz/st	troy ounce per short ton (2,000 pounds)

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SUMMARY

In the Spring of 1987, the Bureau of Mines conducted a mineral investigation of 40,025 acres of the 55,320-acre Rawhide Mountains Wilderness Study Area, La Paz and Mohave Counties, Arizona, on land administered by the Bureau of Land Management. The Bureau of Mines studied that part of the Wilderness Study Area deemed preliminarily suitable for inclusion in the National Wilderness Preservation System. The mineral investigation was requested by the Bureau of Land Management and authorized by the Federal Land Policy and Management Act of 1976 (Public Law 94-579).

Most of the exposed rocks in the study area are Proterozoic- and Phanerozoic-age amphibolite-grade gneisses and mylonitic rocks that are part of a metamorphic core complex, and form the lower plate of a regional Tertiary-age detachment fault. Northwest-striking, northeast-dipping fault zones occur in lower plate rocks in the study area.

Mines and prospects are in the northern, central, and southern parts of the Rawhide Mountains study area. Gold, silver, and copper are commonly present.

Resources were determined for three areas: (1) a fault zone in the north-central part of the study area, (2) for parts of the Alamo mineral district inside the study area, and (3) for the Big Kimble Mine area, just outside the northern boundary of the study area. An inferred subeconomic resource of about 20,000 tons of 0.05 ounces gold per short ton of ore (oz/st gold), 0.01 oz/st silver, and 0.4% copper is estimated for a fault zone

in the north-central area. In the southeastern part of the Alamo mineral district, an adit has an inferred subeconomic resource of about 20,000 tons containing 0.02 oz/st gold and 0.05 oz/st silver. About 2,000 ft west of this adit, a northwest-striking fault zone has an inferred subeconomic resource of about 90,000 tons containing 0.05 oz/st gold, 0.2 oz/st silver, and 0.7% copper. In the southwestern part of the Alamo mineral district, the Bernard Mine area has an inferred subeconomic resource of about 400,000 tons containing 0.07 oz/st gold, 0.2 oz/st silver, and 0.4% copper.

In the Big Kimble Mine area, just outside the northern boundary of the study area, an inferred subeconomic resource of about 200,000 tons containing 0.02 oz/st gold, 0.04 oz/st silver, and 0.2% copper is estimated for the fault zone.

The fault zones in the study area, where exposed, are oxidized. Under these conditions silver and copper are commonly depleted in the oxidized portion of the fault zones and concentrated in a lower, sulfide zone. Drilling and geophysical work are needed to determine if additional resources are present at depth.

Copper prospects along the eastern edge of the study area near Alamo Lake are in Tertiary-age conglomerates and claystones that contain zones of hematite and thin seams of chrysocolla and malachite. These mineralized zones are adjacent to the Buckskin-Rawhide detachment fault. Copper concentrations in excess of 1% were determined in 6 samples from this area; however, the limited thickness and extent of the Tertiary strata do not favor development of commercial amounts of mineral resources.

Manganese oxides coat the surfaces of boulders and also form a matrix in Tertiary-age conglomerate along the western boundary of the study area. Only small outcrops of conglomerate extend into the study area. The manganese-bearing zones here are too thin and low grade to be commercial.

INTRODUCTION

In March, April, and May 1987, the Bureau of Mines, in a cooperative program with the U.S. Geological Survey (USGS), studied the mineral resources of a part of the Rawhide Mountains Wilderness Study Area (WSA), on lands administered by the Bureau of Land Management (BLM), Phoenix District Office, Arizona. The Rawhide Mountains WSA comprises 55,320 acres; the Bureau studied the 40,025 acres deemed preliminarily suitable by the BLM for inclusion in the National Wilderness Preservation System. "Study area," as used in this report, refers only to the smaller area. The Bureau surveys and studies mines, prospects, and mineralized areas to appraise reserves and identified subeconomic resources. The USGS assesses the potential for undiscovered mineral resources based on regional geological, geochemical, and geophysical surveys. This report presents the results of the Bureau of Mines study which was completed prior to the USGS investigation. The USGS will publish the results of its studies. A joint USGS-Bureau report, to be published by the USGS, will integrate and summarize the results of both surveys.

Geographic setting

The study area is in the Rawhide and Buckskin Mountains. The Bill Williams River cuts a steep-walled canyon through the center of the study area. Butler Valley lies to the south, and Reid Valley lies just outside the west-central part of the area, along the Bill Williams River. Alamo Lake State Park is adjacent to the northeastern part of the study area (fig. 1).

The study area is dissected by numerous steep-sided washes, and vegetation is sparse. The highest elevation is 3,927 ft on Buckskin, in the south-central part of the study area. The lowest elevation is approximately

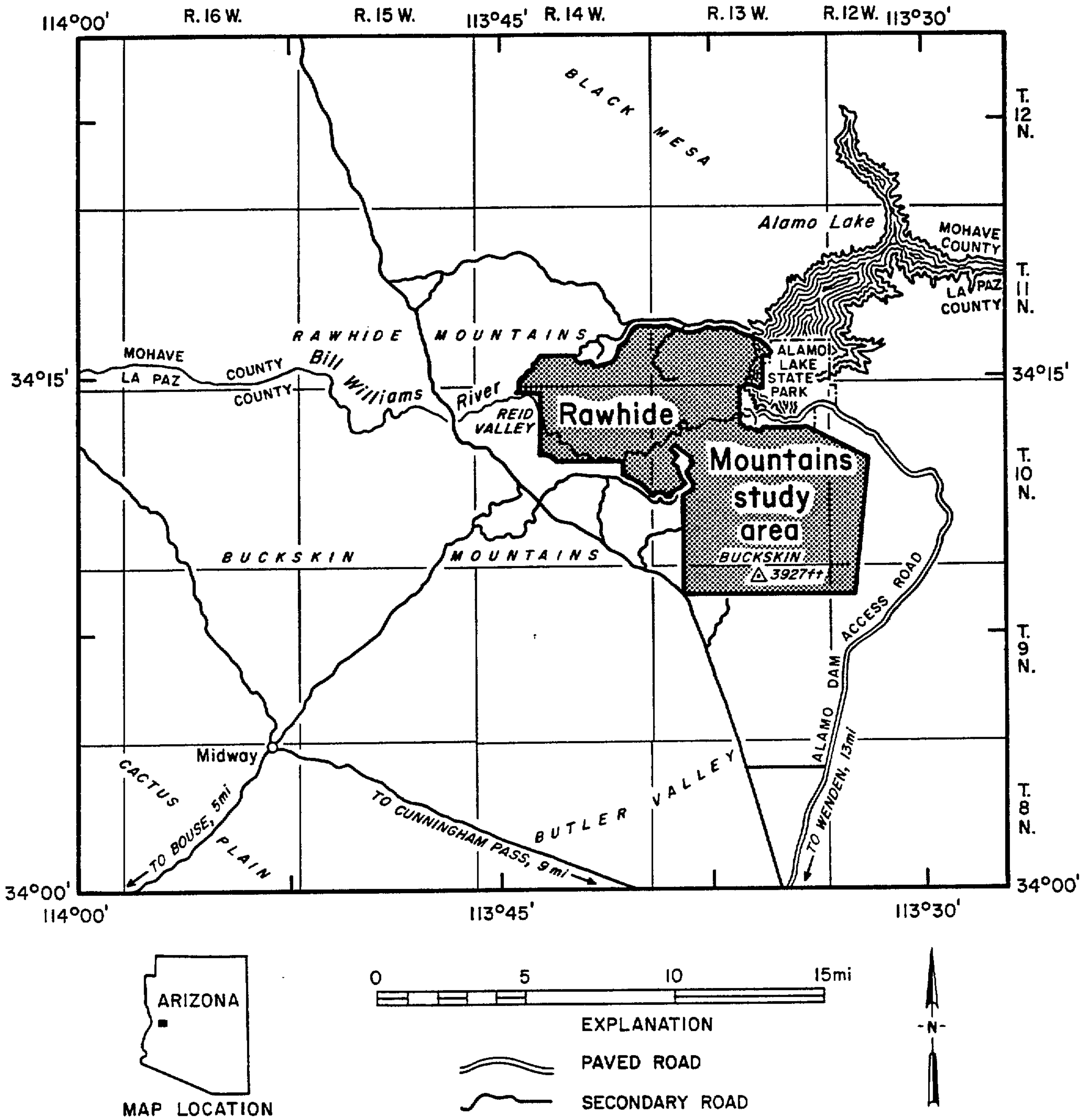


Figure 1.--Index map of the Rawhide Mountains study area, La Paz and Mohave Counties, Arizona.

880 ft along the Bill Williams River on the western boundary of the study area (pl. 1).

Access to the eastern side of the area is by the paved Alamo Dam access road. Secondary roads and jeep trails provide access to the western, northern, and southern parts of the area (fig. 1). The study area is about 25 mi north of U.S. Highway 60 at Wenden, Arizona.

Previous studies

The Late Cretaceous-Tertiary-age metamorphic and igneous complexes of west-central Arizona, which includes the study area, are described by Reynolds (1980). A model for hydrothermal mineralization that relates to detachment faulting in the Rawhide Mountains is discussed by Wilkins and others (1986). Structural controls of mineralization associated with Tertiary faults, including the Buckskin-Rawhide detachment fault, are described by Spencer and Welty (1986). Metallic mineral districts in the region are summarized by Keith and others (1983).

Methods of investigation

A literature search was made for minerals information pertinent to the study area. Bureau of Land Management records were checked for current mining claims and oil and gas leases and lease applications. A total of 32 field days was spent in examining the study area in March, April, and May 1987.

Two-hundred-sixteen rock samples were collected from mines, prospects, and outcrops in and near the study area. Gold content was determined by fire assay with an atomic absorption spectrometry finish; silver and copper were determined by atomic absorption spectrometry. Twenty-two of the samples were selected for multi-element analyses using inductively coupled plasma-atomic emission spectrometry. Samples were analysed by Chemex Labs, Inc., Sparks, Nevada. Assay data and analytical results are listed in figures 3A-B, 4B-C, 6A-D, tables 1-3, and appendix A.

Geologic setting

The Rawhide Mountains study area is in the Basin and Range physiographic province in west-central Arizona. Most of the rocks exposed in the study area are Proterozoic- and Phanerozoic-age amphibolite-grade gneisses that form the lower plate of a regional Tertiary-age fault (the Buckskin-Rawhide detachment fault). Deep-seated lower plate rocks were uplifted and mylonitized during middle-Tertiary crustal extension and faulting. These mylonitized lower plate rocks are referred to as a metamorphic core complex. (See Spencer and others, 1987; Reynolds, 1980.) Northwest-striking, northeast-dipping fault zones occur in these lower plate rocks throughout the study area. The Lincoln Ranch fault (pl. 1) is the largest of these structures, but it is not associated with identified mineral occurrences.

Upper plate rocks and the shear zone of the detachment fault have been removed by erosion over most of the study area. Small remnants of the Buckskin-Rawhide detachment fault and related upper plate rocks crop out along Alamo Lake and in the western part of the study area (Tosdal and others, U.S. Geological Survey, in press). Hematite with accessory chrysocolla form a matrix in conglomerate in small exposures of Tertiary rocks near Alamo Lake. Manganese oxides also form a matrix in Tertiary conglomerate along the western border of the study area.

Most major mineral deposits in the region are in upper plate rocks (outside the study area) along and near detachment faults. Hematite is typically deposited along a detachment fault or replaces calcareous strata in upper plate rocks near the fault. Favored sites for mineral deposition are generally along large synforms on a detachment surface (Spencer and others, 1987, p. 2-3).

MINING HISTORY

The study area includes most of the Alamo mineral district, and lies adjacent to the Cleopatra mineral district and the Lincoln Ranch mineral district (pl. 1).

The Alamo mineral district is in the central part of the study area. It includes nine patented claims (the Montana-Arizona group) that are excluded from the study area, the Mystery Hill group immediately east of these claims, and the Bernard Mine area in the southwestern part of the district (fig. 4A). The district is a past producer of copper, silver, gold, and minor lead. The claims forming the Montana-Arizona group were patented in July 1906. Mines and prospects in this group were worked intermittently until 1937, and produced approximately 170 tons of ore averaging 6% copper, 0.8 oz/st silver, and 0.1 oz/st gold (Keith, 1978, p. 114).

The Mystery Hill group includes numerous small workings inside the study area; they lie immediately east of the Montana-Arizona group. Keith (1978, p. 115) reports that the Mystery Hill group was first worked in the late 1800's, and sporadically through 1945, producing over 500 tons of ore averaging about 3% copper, 2 oz/st silver, 0.1 oz/st gold, and 0.5% lead.

The Bernard Mine area includes several prospect pits and small adits on a northwest-striking fault zone in the study area. This area was worked intermittently from 1912 to 1936, producing 138 tons of ore averaging about 1% copper, 0.1 oz/st silver, and 0.1 oz/st gold (Keith, 1978, p. 114).

The Kimble subdistrict of the Cleopatra mineral district is within 2 mi of the northwestern part of the study area (pl. 1). The Big Kimble Mine is in the southernmost part of the Kimble subdistrict, along the northern boundary of the study area (fig. 6A). The Kimble subdistrict has produced 50 tons of ore averaging 0.412 oz/st gold, 0.373 oz/st silver, and 0.14% copper (Spencer and Welty, 1985, p. 4).

The Lincoln Ranch mineral district is centered about 1 mi west of the study area (pl. 1). Almost all of the production in this district was from the Doyle Mine, an open-pit operation that was worked in the middle to late 1950's. The Doyle Mine produced approximately 70,000 long tons of ore averaging 15%-16% manganese (Keith, 1978, p. 114).

OIL AND GAS

Ryder (1983, p. C19-C20) includes the Rawhide Mountains study area in a cluster of wilderness study areas that have underlying rocks mostly of igneous and metamorphic origin. He rates this cluster as having a "low to zero" potential for containing petroleum.

About 80% of the Rawhide Mountains study area is covered by oil and gas leases and lease applications (fig. 2), however there has been no drilling for hydrocarbons in or near the study area.

GEOTHERMAL ENERGY

An area favorable for discovery and development of low-temperature (less than 50°C) geothermal waters is adjacent to the northeast part of the study area and extends about 15 mi further east (Witcher and others, 1982). This is based on one geothermal well about 12 mi east of the study area. There are no surface indications of hot water spring activity in the study area.

APPRAISAL OF SITES EXAMINED

Gold, silver, and copper occur in northwest-striking, northeast-dipping fault zones in lower plate rocks in the Rawhide Mountains study area.

Hematite and copper minerals occur in upper plate rocks adjacent to the Buckskin-Rawhide detachment fault west of Alamo Lake. Manganese oxides cement

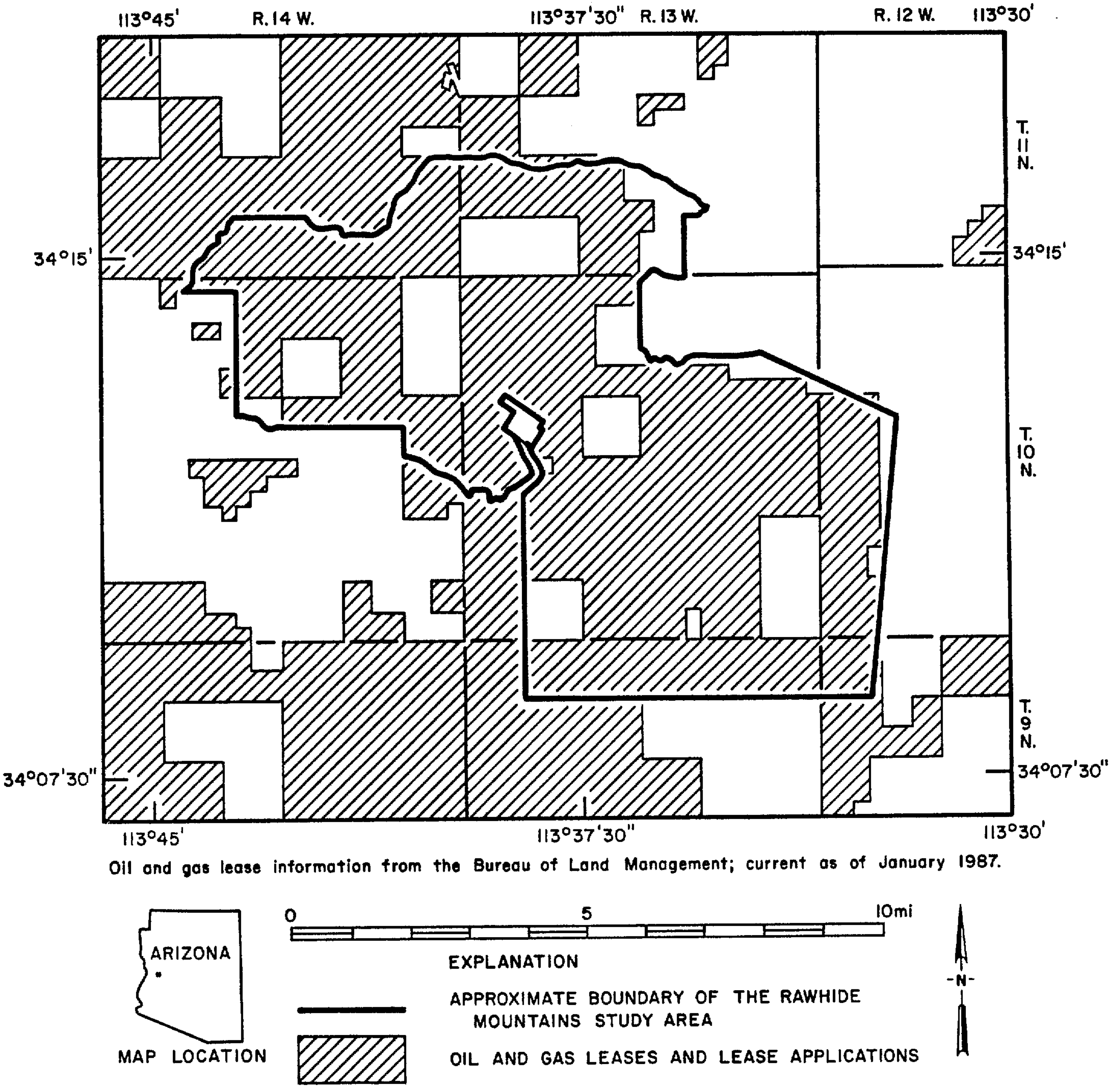


Figure 2.--Oil and gas leases and lease applications in and near the Rawhide Mountains study area.

upper plate-Tertiary conglomerate adjacent to the detachment fault along the western border of the study area.

Mineralization associated with northwest-striking faults

Gold, silver, and copper are found in oxidized portions of northwest-striking, northeast-dipping fault zones in lower plate rocks in the Rawhide Mountains study area. Fault zones in the study area are oxidized where exposed. Silver and copper are commonly depleted in the oxidized part of the fault zones and concentrated at the water table (zone of secondary sulfide enrichment). Drilling and geophysical work would be needed to determine if resources are present at depth.

A total of 730,000 tons of resources were determined for (1) selected structures in the north-central part of the study area, (2) parts of the Alamo mineral district in the west-central part of the study area, and for (3) the Big Kimble Mine area just outside the northern boundary of the study area. In this report, resources are classified using the methods outlined by the U.S. Bureau of Mines and U.S. Geological Survey (1980). These resources are summarized below.

Locality	Resources (short tons)	Gold (oz/st)	Silver (oz/st)	Copper (percent)
North-central area; eastern fault zone.	20,000	0.05	0.01	0.4
Alamo mineral district; Bernard Mine area.	400,000	.07	.2	.4
Alamo mineral district; adit in east-central part sec. 20 workings.	20,000	.02	.05	nil
Alamo mineral district; fault zone, sec. 20 workings.	90,000	.05	.2	.7
Big Kimble Mine area; outside, along northern boundary.	200,000	.02	.04	.2

Appendix B shows recent prices, production, and consumption statistics for metals that occur in the Rawhide Mountains study area.

North-central area

A small group of workings in the southern part of sec. 31, T. 11 N., R. 13 W. extends into the northern part of sec. 6, T. 10 N., R. 13 W., in the north-central part of the study area (pl. 1). The workings consist of an 18-ft-deep shaft, a 9-ft-long adit, and several pits and trenches on 5 northwest-trending fault zones in gneiss (figs. 3A and 3B).

Twenty-six samples were taken from workings and outcrops in this area (figs. 3A and 3B, nos. 33-58). Gold concentrations are very low to nil in all but one of these fault zones. The easternmost fault zone (fig. 3B, nos. 35 and 36; fig. 3A nos. 38-44) contains gold concentrations ranging from 0.002 oz/st to 0.205 oz/st. Silver and copper are associated with the gold but they typically occur in very low concentrations.

An inferred subeconomic resource of about 20,000 tons of 0.05 oz/st gold, 0.01 oz/st silver, and 0.4% copper is estimated for the eastern fault zone in the north-central area. This estimate assumes an average thickness of 1.3 ft, a depth of 225 ft, and a length of 450 ft for the mineralized part of the fault zone. Metal concentrations in the other fault zones in this vicinity are very low and do not constitute a resource.

Alamo mineral district

Spencer and Welty (1985, p. 5-7) define the Alamo mineral district to include the mineralized area in sec. 17-20, T. 10 N., R. 13 W., in the west-central part of the study area (pl. 1). Workings in these sections can be subdivided into smaller groups (fig. 4A). The patented Montana-Arizona claims in the western part of sec. 17 and the eastern part of sec. 18 are excluded from the study area. Workings east of these claims form the Mystery Hill group of unpatented claims. The Bernard Mine area includes numerous small workings in the northwestern quarter of sec. 19. The workings in sec. 20 will be referred to as the Section 20 workings.

The workings in the Alamo district were driven on several northwest-striking, northeast-dipping fault zones in gneiss, with scattered lenses of metasedimentary Paleozoic- or Mesozoic-age rock. Chrysocolla commonly coats fracture surfaces in the fault zones. Although several samples contained more than 1% copper, the concentrations are not expected to be significantly higher than 1% because the copper is in the mineral chrysocolla, which is a minor accessory mineral that only coats fractures in these structures.

Bernard Mine area

The Bernard Mine area is in the northwestern quarter of sec. 19, T. 10 N., R. 13 W. Workings include ten prospect pits and six small adits on a northwest-striking, northeast-dipping fault zone in gneiss (fig. 4A).

Twenty-eight samples were collected from mines and prospects in this area (fig. 4A, nos. 157-184, and table 1). The highest gold concentration found in the Rawhide Mountains study area is from a 1.3-ft-long chip sample taken across a silicified breccia zone with gouge in a 22-ft-long adit. This sample contained 0.3 oz/st gold (table 1; fig. 4A, no. 181). Seven samples from the fault zone had 0.1 oz/st gold or more. Sample 180 contained 2.05 oz/st silver. Two samples had copper in excess of 1% (table 1; nos. 179 and 180). The copper is present in the mineral chrysocolla, which forms thin seams and streaks in a breccia zone.

An inferred subeconomic resource of about 400,000 tons of 0.07 oz/st gold, 0.2 oz/st silver, and 0.4% copper is estimated for the fault zone in the Bernard Mine area by using an estimated mineralized length of 1,700 ft, a depth of 850 ft, and an average thickness of 2.5 ft for the fault zone.

The fault zone explored by mines and prospects in the Bernard Mine area has the highest concentration of gold found in this study. Silver and copper are present but they are of lesser importance.

Section 20 workings

Workings in the east-central part of sec. 20, T. 10 N., R. 13 W., and along a northwest-striking, northeast-dipping fault zone in the northwestern part of sec. 20, were sampled (figs. 4A and 4C, nos. 126-156).

Samples 126-150 (fig. 4C) are from an adit that includes approximately 800 ft of drifts and stopes. The adit was driven on a horizontal silicified zone in gneiss that contains lenses of fluorite and calcite crystals. The silicified zone ranges in thickness from 1 to 4 ft. Twenty-one of 25 samples taken from this adit contained gold, in concentrations ranging from 0.003 to 0.072 oz/st. Silver was detected in 22 samples, in concentrations ranging from 0.01 to 0.69 oz/st. One sample contained in excess of 1% copper. An inferred subeconomic resource of about 20,000 tons of 0.02 oz/st gold, and 0.05 oz/st silver, are estimated for this adit. Resource estimates are based on an estimated mineralized strike length of 345 ft, a width of 310 ft, and an average thickness of 2.1 ft.

Six samples were collected from prospects in a northwest-striking fault zone in the northwestern part of sec. 20 (fig. 4A, nos. 151-156). Gold was present in all of the samples, in concentrations ranging from 0.018 oz/st to 0.097 oz/st (table 1). Sample 152 contains more than 1% copper. An inferred subeconomic resource of about 90,000 tons of 0.05 oz/st gold, 0.2 oz/st silver, and 0.7% copper is estimated for this structure based on an estimated strike length of 800 ft, a depth of 400 ft, and an average thickness of 2.3 ft.

Mystery Hill group

Workings in the Mystery Hill group are inside the study area east of the Montana-Arizona claims in sec. 17 (fig. 4A). They include numerous pits, short adits, and shafts on predominantly northwest-trending, northeast-dipping fault zones in gneiss with scattered lenses of metasedimentary rock. Fifty-three samples were taken from workings and outcrops in this area (fig. 4A, nos. 70-100 and 104-125; table 1).

A fault zone that appears to extend from the Mystery Hill group into the Montana-Arizona claims was sampled, (fig. 4A, nos. 82-95). Samples 82-89 were collected from a 260-ft-long adit adjacent to the Montana-Arizona claims (fig. 4B). The adit exposes a partially silicified, brecciated zone in gneiss. Limonite and chrysocolla coat fracture surfaces and are disseminated in the rock. One sample from this adit contains 0.053 oz/st gold (fig. 4B, no. 84). The seven other samples from this adit contain only trace amounts of gold. Silver content ranges from 0.02 oz/st to 0.13 oz/st in samples from this adit. Two samples have copper in excess of 1% (fig. 4B, nos. 85 and 88).

The fault zones sampled in the Mystery Hill group typically contain very low gold and silver concentrations. Of the 53 samples collected, 4 samples contained at least 0.03 oz/st gold, 2 samples contained more than 0.5 oz/st silver, and 13 samples contained copper in excess of 1%. The highest gold concentration reported for any sample from the Mystery Hill group was 0.086 oz/st gold (fig. 4A, no. 125; table 1). This was a high-grade select sample from an outcrop of silicified gneiss in the far northern part of sec. 20. The higher gold concentrations apparently are randomly distributed in the fault zones. These parts of the zone are not visibly different from the samples that have little or no gold.

Metal concentrations in fault zones in the Mystery Hill group are low and mineralization is discontinuous, and therefore does not constitute a resource.

Montana-Arizona claims

Mines and prospects in the Montana-Arizona patented claim group are privately owned. At the request of the owner, analytical information relating to this area is held proprietary and cannot be released.

Buckskin area

Numerous prospect pits, and several small adits and shafts are in and near the southern part of the study area in the south-central part of sec. 4, and the north-central part of sec. 9, T. 9 N., R. 13 W., about 1 mi southwest of Buckskin (pl. 1). The workings are in seven 1- to 5-ft-wide fault zones in gneiss (fig. 5). The fault zones have a predominently northwest strike, and dip to the northeast, however one fault zone about 250 ft south of the study area strikes nearly east-west and dips to the north (fig. 5).

Twenty-nine samples were taken from mines and prospects in this area (fig. 5, nos. 188-216; table 2). Gold was detected in 3 of these samples, and silver was detected in 16.

Although three samples contained more than 1% copper, surface samples indicate that the average metal concentrations are too low and mineralization too discontinuous to constitute a resource.

Big Kimble Mine area

Workings at the Big Kimble Mine lie just outside the northwestern boundary of the study area in the north-central part of sec. 34, T. 11 N., R. 14 W. (pl. 1). Workings follow a northwest-trending, northeast-dipping fault zone in gneiss that was traced for about 1,000 ft (figs. 6A-6D). The fault zone is characterized by fractured and silicified gneiss, veins and lenses of quartz, breccia fragments, and gouge. Limonite and chrysocolla typically coat fracture surfaces in the fault zone.

Bulldozer cuts and a 4-ft-deep trench expose 265 ft of the fault zone (fig. 6B). Of 14 samples collected, 11 contained gold in concentrations ranging from 0.002 oz/st to 0.028 oz/st (fig. 6B, nos. 5-18).

A sample collected from the footwall of a fault zone at the collar of an inaccessible shaft contained 0.086 oz/st gold (fig. 6A, no. 19). This is the highest gold concentration in samples from the Big Kimble workings.

An adit was driven for 65 ft and drifted for 206 ft along the fault zone southeast of the shaft (fig. 6C). Each of the 6 samples collected from the fault contained gold, ranging in concentrations from 0.005 oz/st to 0.030 oz/st (fig. 6C, nos. 20-25).

A 180-ft-long adit below the 65-ft-long adit discussed above, was also driven along the same fault (fig. 6D). Each of the 5 samples from this adit contained gold, ranging in concentrations from 0.002 oz/st to 0.036 oz/st (fig. 6D, nos. 26-30).

An inferred subeconomic resource of about 200,000 tons of 0.02 oz/st gold, 0.04 oz/st silver, and 0.2% copper is estimated for the fault zone in the Big Kimble Mine area. This estimate assumes an average thickness of 3.3 ft, strike length of 1,000 ft, and depth of 500 ft. This resource is outside of the study area, but extensions of the resource project towards and may be present in the study area.

Mineralization associated with the Buckskin-Rawhide detachment fault

Copper occurs in upper plate, middle-Tertiary sedimentary rocks adjacent to the Buckskin-Rawhide detachment fault in the northeastern part of the study area near Alamo Lake. Manganese occurrences are in middle-Tertiary conglomerate adjacent to this fault along the southwestern border of the study area. These manganese occurrences are on the fringe of the Lincoln Ranch mineral district, centered about 1 mi west of the study area.

Alamo Lake area

Several prospect pits are in dark reddish-brown conglomerates and claystones on the western edge of Alamo Lake along the study area boundary (pl. 1). These sedimentary rocks are in the upper plate of the Buckskin-Rawhide detachment fault and occur as small and discontinuous outcrops. These strata have discontinuous mineralized zones along bedding planes or shear zones that are typically 3-5 ft thick, and contain abundant hematite and thin seams of chrysocolla and malachite. Eleven samples (nos. 59-69) were taken from prospects in this area (pl. 1). Gold was detected in four of these samples (table 3, nos. 62, and 66-68); concentrations in three of them are at or near the detection limit. Silver was detected in six samples, but only in trace amounts. Six samples contained copper in excess of 1% (table 3). Thin seams and coatings of chrysocolla occur along fracture surfaces at these sample sites, and although some of the copper concentrations are more than 1%, the limited thickness and extent of the Tertiary strata in this area does not favor mineral concentrations in economic amounts.

The mineralized zones in the Alamo Lake area are of limited extent, and the gold and silver concentrations are low. A mineral resource is not identified in this area.

Lincoln Ranch mineral district

The Lincoln Ranch mineral district lies predominantly in sec. 36, T. 10 N., R. 14 W., about 1 mi southwest of the study area (pl. 1). Manganese was mined by open-pit operations in this district, with almost all of the production coming from the Doyle Mine (Keith, 1978, p. 114). The best grade mined (averaging 15%-16% manganese) was closely associated with shear zones along the Buckskin-Rawhide detachment fault. The manganese occurs as oxide minerals coating grains and clasts, and on fracture surfaces in sheared Tertiary-age sandstones and conglomerates (Welty and others, 1985, p. 15). Keith (1978, p. 19) estimates 200,000 tons or more of manganese-bearing material, averaging 3 to 10% manganese may remain at the previously operated mines.

Manganese occurrences along the southwestern study area boundary are on the eastern fringe of the Lincoln Ranch mineral district in secs. 29 and 30, T. 10 N., R. 13 W. Several prospect pits expose Tertiary conglomerate with manganiferous lenses that range in thickness from 3 ft to 7 ft (pl. 1, nos. 185-187). The conglomerate consists of quartz and granite boulders from 2 in. to 8 in. in diameter. Manganese-oxides coat the surface of the boulders and are a matrix in the conglomerate.

Three selected chip samples were taken from prospects near the study area boundary (pl. 1, nos. 185-187); all samples contained more than 1% manganese (table 3). These occurrences could not exceed 3% manganese because there is a high ratio of gangue to manganese oxides. At least 25% manganese is required to be ore-grade (Jones, 1985, p. 485).

Only small outcrops of Tertiary sedimentary rocks extend into the study area (pl. 1). It is unlikely that any development of the manganese-bearing conglomerate would occur in the study area because the manganese-bearing strata are thin, the Tertiary strata in this area are of limited extent, and there is a high ratio of gangue minerals to manganese.

CONCLUSIONS

Gold, silver, and copper concentrations are in northwest-striking, northeast-dipping fault zones in portions of the northern, central, and southern parts of the Rawhide Mountains study area.

An estimated total of 730,000 tons of resources was determined for structures in and near the north-central part of the study area, and for parts of the Alamo mineral district inside the study area. An inferred subeconomic resource of about 20,000 tons of 0.05 oz/st gold, 0.01 oz/st silver, and 0.4% copper is estimated for the easternmost fault zone in the north-central area. In the Alamo mineral district, the Bernard Mine area has an inferred subeconomic resource of about 400,000 tons of 0.07 oz/st gold, 0.2 oz/st silver, and 0.4% copper. An adit near the center of sec. 20, T. 10 N., R. 13 W., has an inferred subeconomic resource of about 20,000 tons of 0.02 oz/st gold and 0.5 oz/st silver. Farther west in sec. 20, a northwest-striking fault zone has an inferred subeconomic resource of about 90,000 tons of 0.05 oz/st gold, 0.2 oz/st silver, and 0.7% copper. Outside the study area, an inferred subeconomic resource of about 200,000 tons of 0.02 oz/st gold, 0.04 oz/st silver, and 0.2% copper was estimated for the fault zone in the Big Kimble Mine area. Extensions of the resources project towards and some may be present in the study area.

The exposed parts of the veins are too thin and low grade to be economically mined on a large scale at the present time or in the foreseeable future. Fault zones in the study area are oxidized where exposed. Silver and copper are commonly depleted in the oxidized portion of the fault zones in this environment and concentrated in a lower sulfide zone at the water table. Drilling and geophysical work would be needed to determine if additional resources are present at depth.

Along the northeastern border of the study area, Tertiary sedimentary rocks adjacent to shear zones of the Buckskin-Rawhide detachment fault contain copper concentrations; however, the limited thickness and extent of the mineralized strata in this area do not favor economic development.

Manganese concentrations along the western border of the study area are in conglomerates adjacent to shear zones of the detachment fault. Economic development of manganese in the study area is not likely because only small outcrops of Tertiary strata extend into the study area, and the manganese-bearing zones are thin, short, and low grade.

REFERENCES

Jones, T. S., 1985, Manganese, in Mineral facts and problems: U.S. Bureau of Mines Bulletin 675, p. 483-498.

Keith, S. B., 1978, Index of mining properties in Yuma County, Arizona: Arizona Bureau of Geology and Mineral Technology Bulletin 192, 185 p.

Keith, S. B., Gest, D. E., DeWitt, Ed, Toll, N. W., and Everson, B. A., 1983, Metallic mineral districts and production in Arizona: Arizona Bureau of Geology and Mineral Technology Bulletin 194, 58 pages, 1 map, scale 1:1,000,000.

Reynolds, S. J., 1980, Geologic framework of west-central Arizona, in Jenney, J. P., and Stone, Claudia, (eds.), Studies in western Arizona: Arizona Geological Society Digest, v. 12, p. 1-16.

Ryder, R. T., 1983, Petroleum potential of wilderness lands in Arizona, in Miller, B. W., ed., Petroleum potential of wilderness lands in the western United States: U.S. Geological Survey Circular 902A-P, p. C1-C22.

Spencer, J. E., and Welty, J. W., 1985, Reconnaissance geology of mineralized areas in parts of the Buckskin, Rawhide, McCracken, and northeast Harcuvar Mountains, western Arizona: Arizona Bureau of Geology and Mineral Technology Open-File Report 85-6, 31 p.

______1986, Possible controls of base- and precious-metal mineralization associated with Tertiary detachment faults in the lower Colorado River trough, Arizona and California: Geology, v. 14, no. 3, p. 195-198.

Spencer, J. E., Wilkins, Joe, and DeWitt, E. H., 1987, Mineral deposits associated with core complexes, detachment faults, and related phenomena, in Theobald, P. K, Billone, M. A., Detra, P. S., and Vassalluzzo, C. A., Summary of a workshop on the search for unconventional ore deposits in Arizona: U.S. Geological Survey Open-File Report 87-498, p. 2-3.

Tosdal, R. M., Bryant, Bruce, Hill, R. H., Hanna, W. F., Knepper, D. H., Jr., Jones, S. L., Oliver, K. S., and Tuftin, S. E., 1989, Mineral resources of the Rawhide Mountains Wilderness Study Area: U.S. Geological Survey Bulletin (in press).

U.S. Bureau of Mines and U.S. Geological Survey, 1980, Principles of a resource/reserve classification for minerals: U.S. Geological Survey Circular 831, 5 p.

Welty, J. W., Spencer, J. E., Allen, G. B., Reynolds, S. J., and Trapp, R. A., 1985, Geology and production of Middle Tertiary mineral districts in Arizona: Arizona Bureau of Geology and Mineral Technology Open-File Report 85-1, 88 p.

Wilkins, Joe, Jr., Beane, R. E., and Heidrick, T. L., 1986, Mineralization related to detachment faults: a model, in Beatty, Barbara, and Wilkinson, P. A. K., (eds.), Frontiers in geology and ore deposits of Arizona and the southwest: Arizona Geological Society Digest, v. 16, p. 108-117.

Witcher, J. C., Stone, Claudia, and Hahman, W. R., Sr., 1982, Geothermal resources of Arizona: Arizona Bureau of Geology and Mineral Technology, map, scale 1:500,000.

EXPLANATION OF SYMBOLS FOR FIGURES 3-13

APPROXIMATE BOUNDARY OF THE RAWHIDE MOUNTAINS STUDY AREA

SAMPLE LOCALITY--Showing sample number(s)

OUTCROP--Showing sample number

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

FAULT OR SHEAR ZONE--Showing strike and dip


VERTICAL FAULT--Dashed where approximate


OPENCUT


PIT

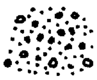

TRENCH

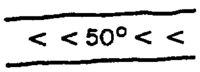
PILLAR


SHAFT

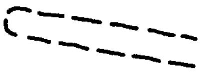

SHAFT EXTENDING THROUGH LEVEL

STOPED ABOVE--Showing height in feet


RUBBLE



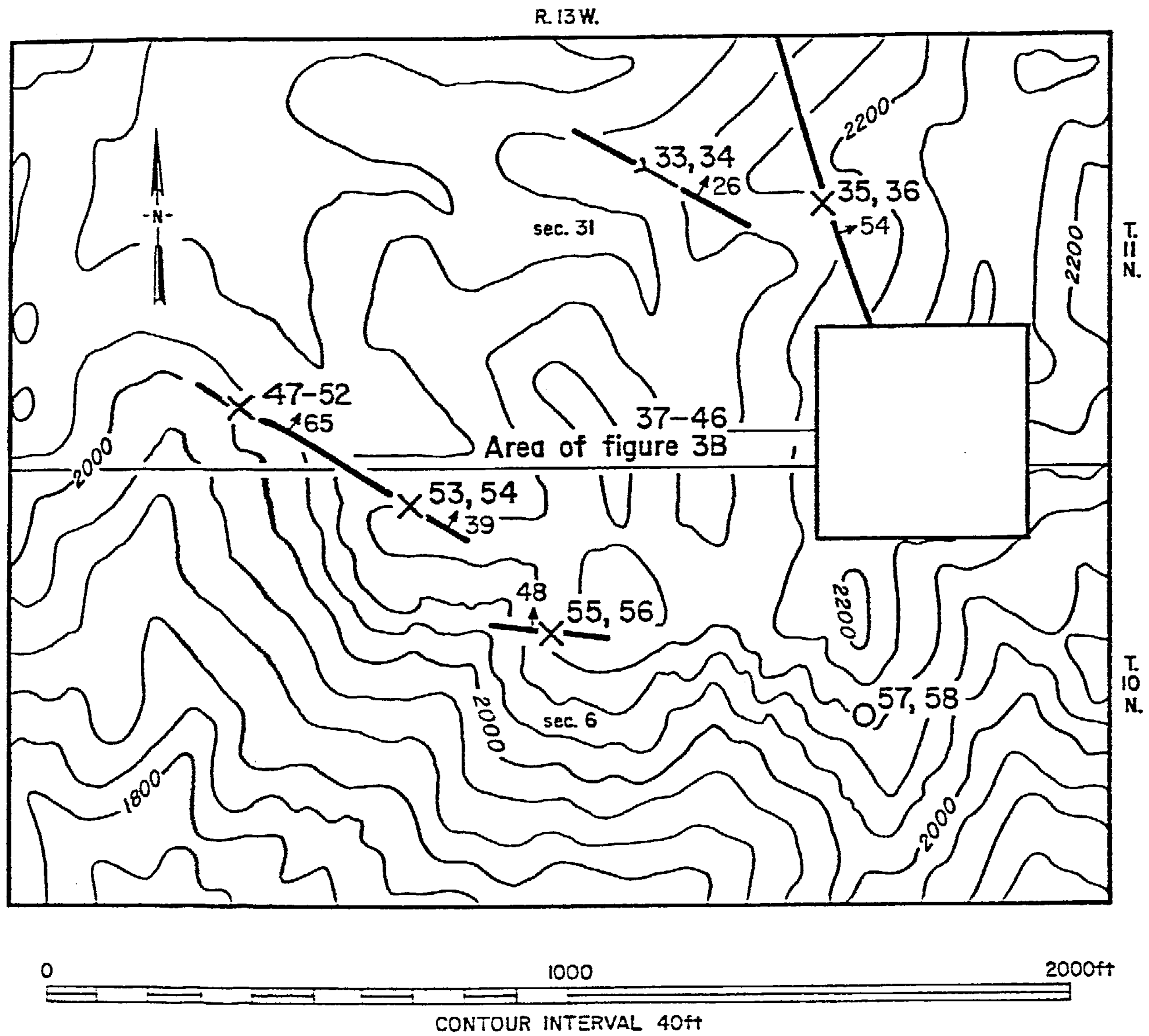
INCLINED WORKINGS--Showing degree of inclination; chevrons pointing down


UNDERGROUND WORKING SHOWN DASHED ON SURFACE MAP

EXPLANATION OF SYMBOLS FOR FIGURES 3-13--Continued

SURFACE OPENINGS--Showing sample number(s); symbol may represent more than one working

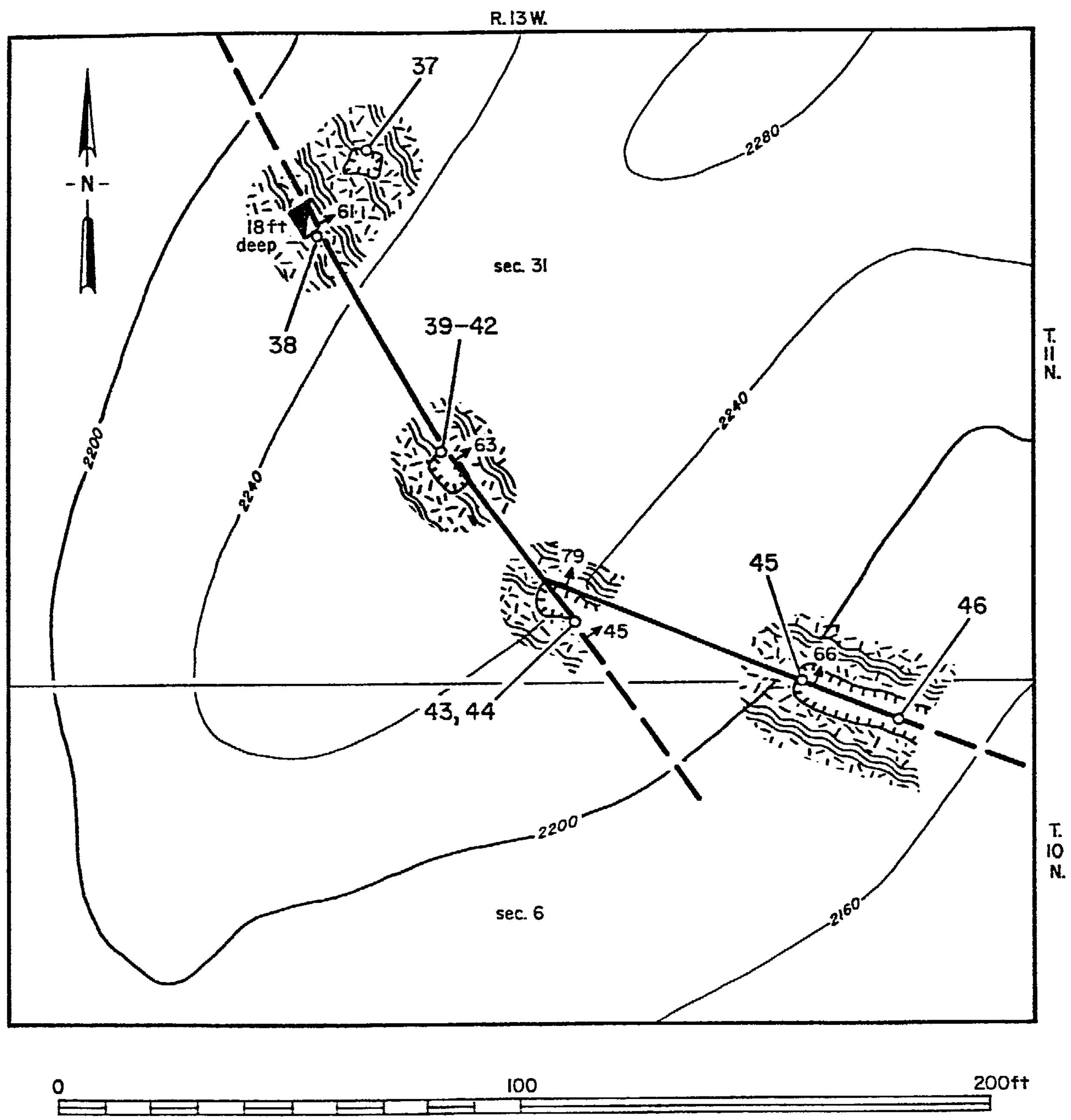
91	Shaft
33,34	Adit
165	Inacessible adit
5-18	Trench
70,71	Prospect pit
2240	TOPOGRAPHIC CONTOUR--Showing elevation in feet above sea level
	PATENTED MINING CLAIMS
	GNEISS



[---, assayed for but not detected; >, greater than; lower detection limits: Gold, 0.002 oz/st; silver, 0.01 oz/st.]

Sample no.	Chip length (ft)	Gold oz/st	Silver oz/st	Copper ppm	Remarks
33	0.6	0.007	---	1,600	Limonite-stained fault gouge, breccia fragments of gneiss and quartz.
34	1.5	.007	0.01	1,900	Footwall; quartz vein and silicified gneiss; limonite, manganese oxides, and minor chrysocolla coat fractures.
35	.3	.180	.02	900	Quartz vein, inclusions of silicified, brecciated gneiss, trace of chrysocolla.
36	2.0	.009	---	285	Silicified, chloritized gneiss.
47	5.0	---	.03	6,700	Shear zone in diorite; limonite coats fracture surfaces.
48	.5	.003	.23	>10,000	Quartz-chrysocolla vein (about 70% chrysocolla).
49	2.0	.006	.07	5,500	Shear zone in diorite; 2-in.-thick quartz vein; limonite and trace of chrysocolla coat fracture surfaces.
50	2.0	---	---	5,400	Shear zone in diorite; 2-in.-thick zone of brecciated quartz, chrysocolla, manganese oxides, and barite.
51	4.0	---	---	640	Silicified zone in diorite; quartz veinlets throughout.
52	4.0	---	.01	380	Diorite; highly fractured; limonite coats fracture surfaces.
53	1.5	---	.03	3,850	Silicified gneiss; vuggy quartz vein; earthy hematite and trace of chrysocolla in vugs.
54	1.0	---	.02	10,000	Brecciated gneiss; quartz vein with vugs containing manganese oxides and hematite.
55	4.0	---	.01	2,250	Chloritized gneiss; limonite and minor chrysocolla coats fracuture surfaces.
56	3.5	.003	.13	850	Silicified gneiss; 1.5-ft-thick quartz vein; vugs in quartz contain manganese oxides, hematite, and quartz crystals.
57	select	---	---	16	Gneiss; areas of silicification, sparse thin quartz veins.
58	1.0	---	---	27	Quartz vein, inclusions of silicified, brecciated gneiss.

Figure 3A.--Localities and data for samples 33-36, and 47-58, in the north-central part of the Rawhide Mountains study area.



[—, assayed for but not detected; lower detection limits: Gold, 0.002 oz/st; silver, 0.01 oz/st.]

Sample no.	Chip length (ft)	Gold	Silver	Copper	Remarks
		oz/st		ppm	
37	6.0	—	—	15	Fractured chloritic gneiss; limonite coats fracture surfaces.
38	4.0	0.035	0.01	7,800	Shear zone; 0.5-ft-thick gouge zone containing gneiss clasts; minor chrysocolla on fracture surfaces.
39	.7	.205	.04	780	Footwall; quartz vein; silicified gneiss clasts; small vugs with hematite; trace of chrysocolla.
40	.5	.021	.02	1,300	Fault gouge, contains about 30% gneiss and quartz clasts; slight limonite stain.
41	1.0	.037	.02	565	Quartz vein, silicified gneiss clasts; small vugs of hematite, trace of chrysocolla.
42	1.0	.008	—	3,800	Gneiss, highly fractured, chloritic alteration.
43	1.0	.135	.03	935	Footwall; quartz vein; silicified gneiss clasts; limonite coats fracture surfaces.
44	1.0	.002	—	3,050	Silicified gneiss; quartz veins, highly fractured; trace of chrysocolla on fracture surfaces.
45	2.0	.079	.01	3,330	Quartz vein (1.8 ft-thick), fault gouge (0.2 ft-thick); limonite and trace of chrysocolla coat fracture surfaces.
46	1.5	.089	.03	4,250	Brecciated chloritized gneiss; quartz veins.

Figure 3B.--Localities and data for samples 37-46, in the north-central part of the Rawhide Mountains study area.

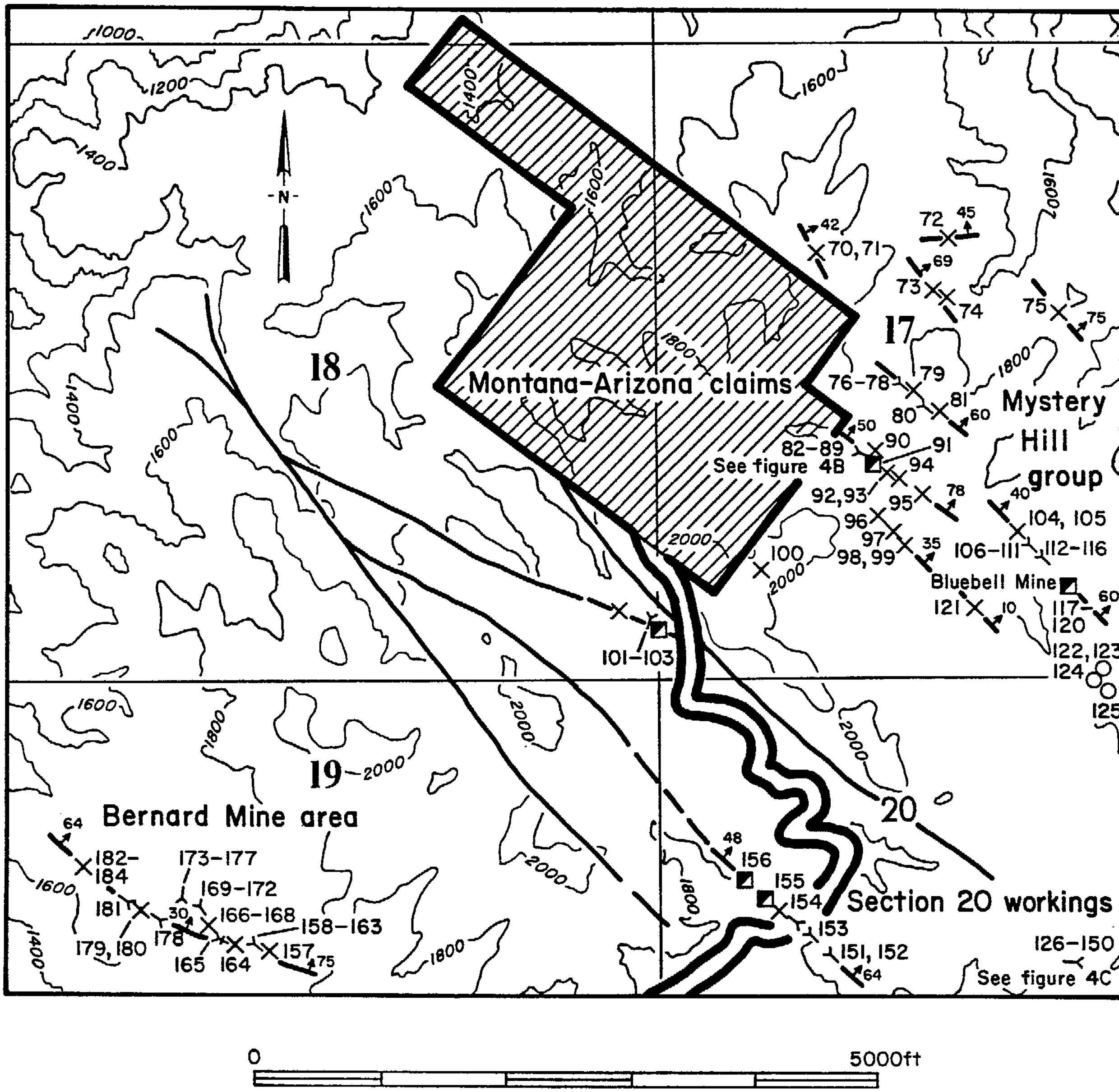
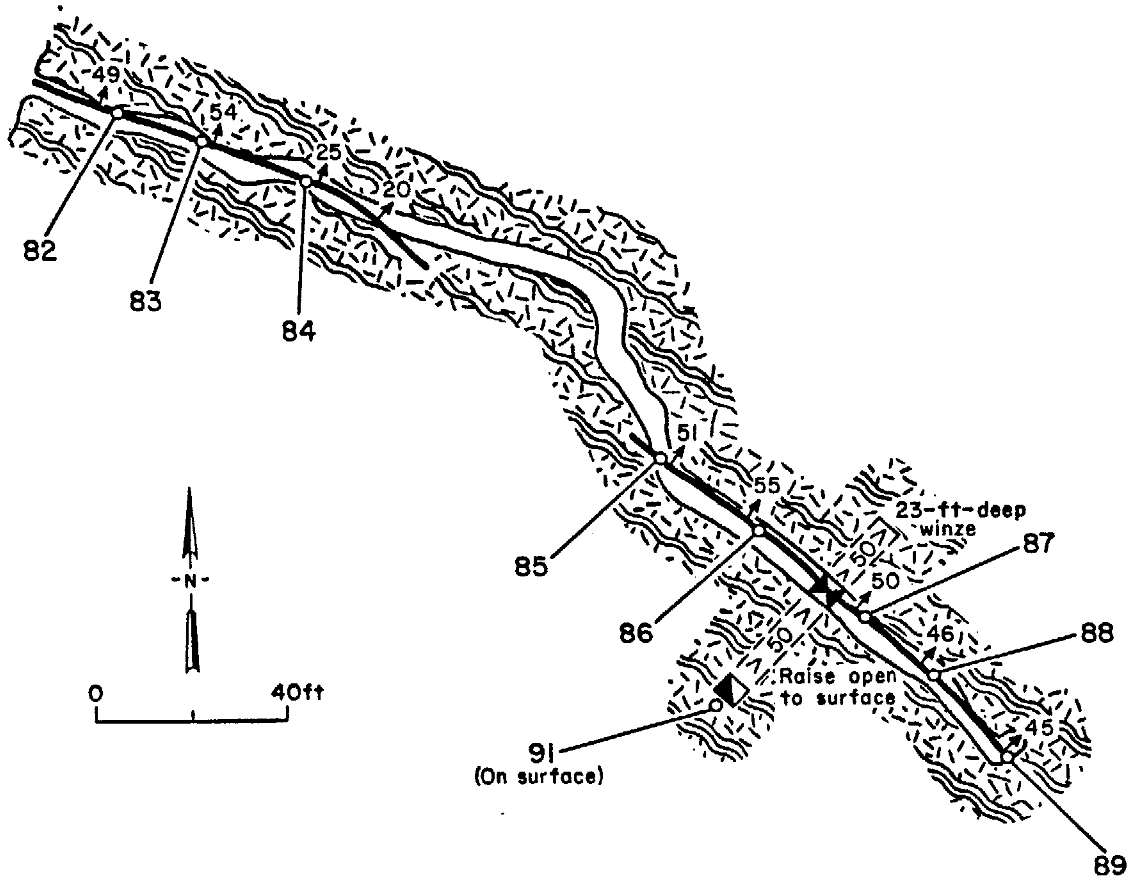


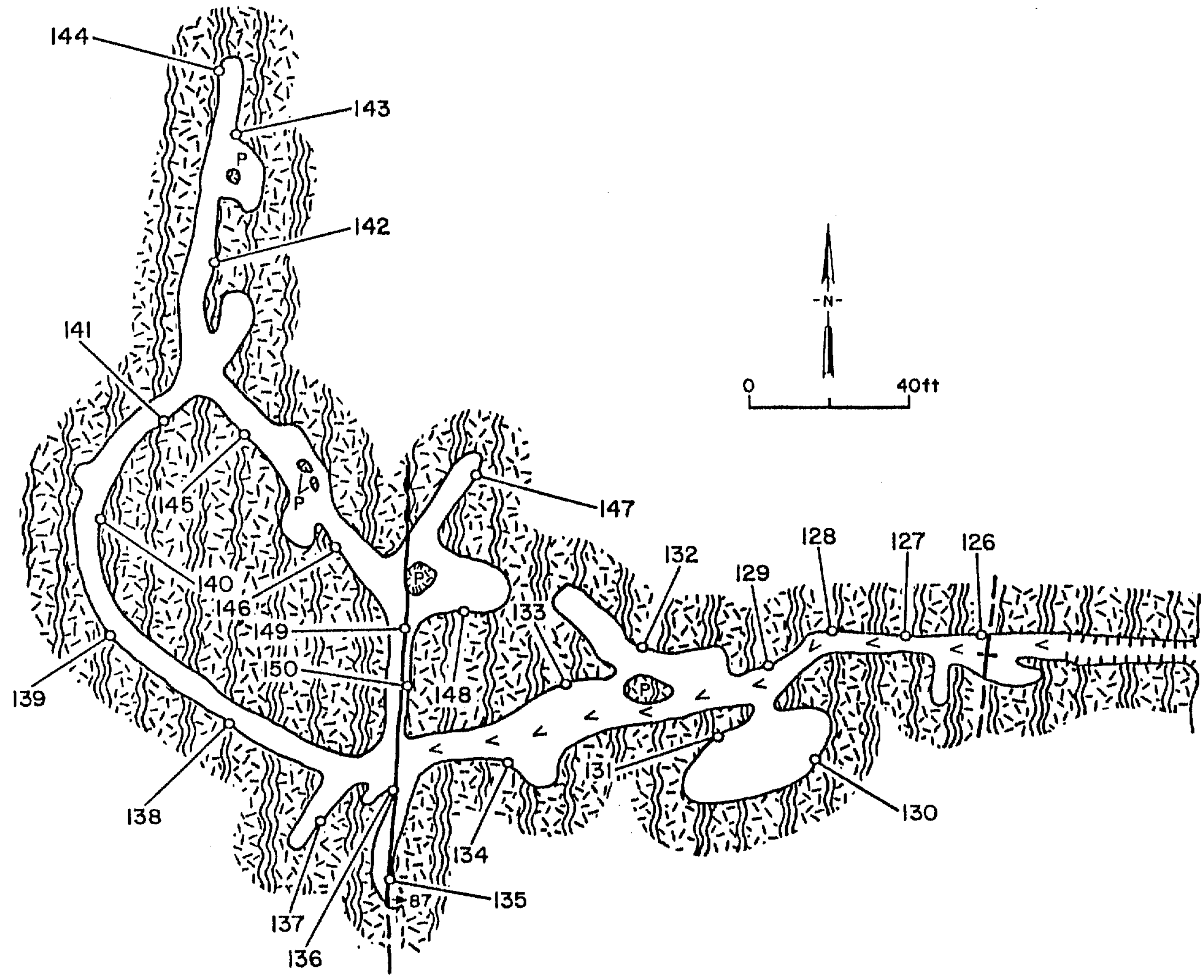
Figure 4A.--Sample sites 70-184 in the Alamo mineral district, Rawhide Mountains study area.



[---, assayed for but not detected; >, greater than; lower detection limits: Gold, 0.002 oz/st; silver, 0.01 oz/st.]

Sample no.	Chip length (ft)	Gold oz/st	Silver oz/st	Copper ppm	Remarks
82	0.5	0.002	0.09	6,200	Silicified breccia zone; contains remnant clasts, abundant limonite, minor chrysocolla.
83	1.0	---	.02	2,850	Silicified breccia zone; abundant limonite.
84	3.0	.053	.13	200	Shear zone in gneiss; trace of chrysocolla on fracture surfaces.
85	2.0	.005	.04	>10,000	Brecciated gneiss, partly silicified; 3-in.-thick zone of hematite-impregnated gouge.
86	3.0	.002	.09	4,900	Brecciated gneiss; 6-in.-thick silicified zone with thin seams of chrysocolla; limonite coats fracture surfaces.
87	1.5	---	.08	8,350	Brecciated gneiss; silicified areas with disseminated chrysocolla.
88	1.0	.003	.04	>10,000	Brecciated gneiss; silicified zone heavily impregnated with chrysocolla.
89	5.0	.003	.02	3,200	Brecciated gneiss; 3-in.-thick seam of limonitic gouge.

Figure 4B.--Adit showing localities and data for samples 82-89, in the Mystery Hill Mine area, Rawhide Mountains study area.



[----, assayed for but not detected; >, greater than; lower detection limits: Gold, 0.002 oz/st; silver, 0.01 oz/st.]

Sample no.	Chip length (ft)	Gold (oz/st)	Silver (oz/st)	Copper ppm	Remarks
126	4.0	0.017	0.19	1,500	Silicified gneiss; small spots of chrysocolla, small lenses of fluorite.
127	4.0	.036	.34	>10,000	Replacement zone in gneiss; fluorite crystals in pods and lenses, quartz, small spots of chrysocolla.
128	3.0	.019	.09	680	Do.
129	2.5	.020	.32	54	Do.
130	2.0	.045	.06	8,500	Do.
131	3.0	.047	.32	74	Replacement zone in gneiss; fluorite, calcite, quartz.
132	2.5	.016	.06	375	Silicified zone in gneiss; some fluorite.
133	2.5	.072	.11	4,300	Fluorite-quartz zone in gneiss; minor spots of chrysocolla.
134	1.5	.013	.43	505	Fluorite-quartz zone in gneiss.
135	1.0	----	.01	90	Unaltered gneiss; thin seams of calcite.
136	2.0	.019	.69	54	Lens of fluorite crystals in gneiss.
137	1.0	.003	.69	107	Gneiss, 4-in.-thick fluorite zone.
138	2.0	----	----	7	Silicified gneiss.
139	2.0	----	----	7	Do.
140	1.0	.020	.04	490	Zone of vuggy calcite crystals in gneiss.
141	1.5	.032	.04	293	Banded fluorite-calcite zone in gneiss.
142	2.0	.003	.02	88	Banded calcite zone in gneiss.
143	2.0	.036	.10	80	Banded fluorite zone in gneiss; very vuggy.
144	2.5	.007	.03	222	Banded calcite-fluorite zone in gneiss; some silicified zones.
145	1.5	.020	.58	132	Do.
146	2.0	.016	.19	138	Do.
147	3.0	.020	.05	185	Silicified gneiss; fluorite, some calcite in lenses.
148	1.5	.016	.14	98	Banded fluorite-calcite zone in gneiss.
149	1.5	----	----	32	Altered gneiss; soft, highly fractured.
150	2.0	.023	.17	77	Banded fluorite zone in gneiss; some silicified bands and thin calcite seams.

Figure 4C.--Adit showing localities and data for samples 126-150, in the Alamo mineral district, Rawhide Mountains study area.

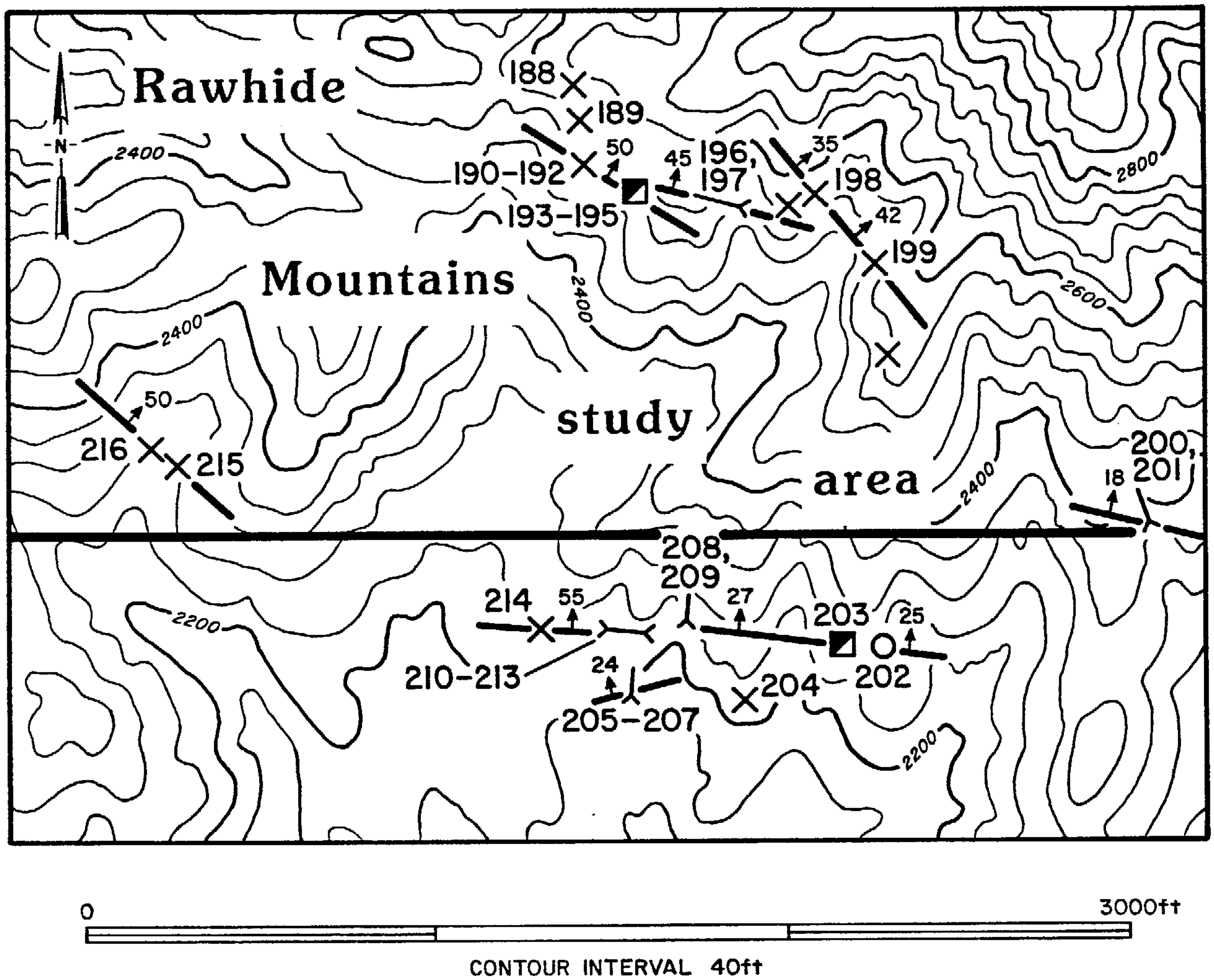
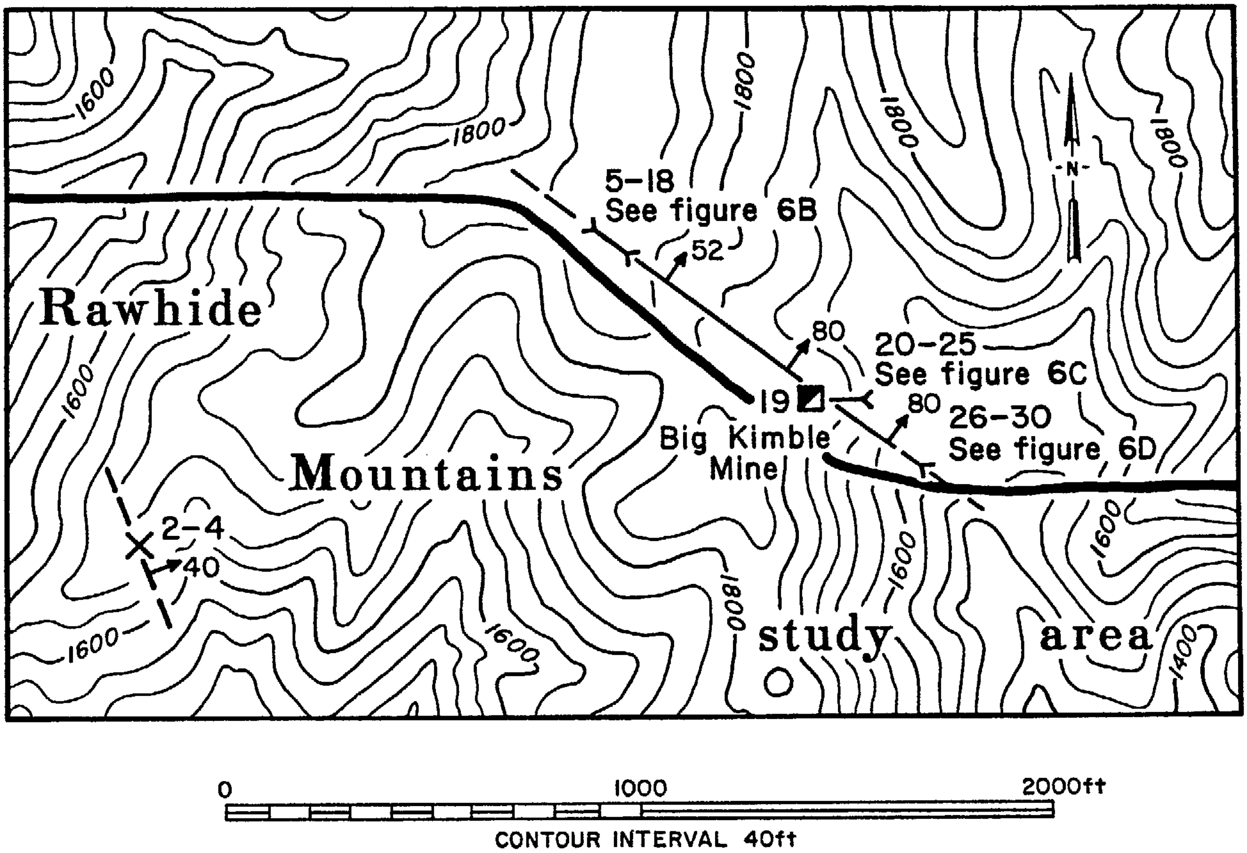


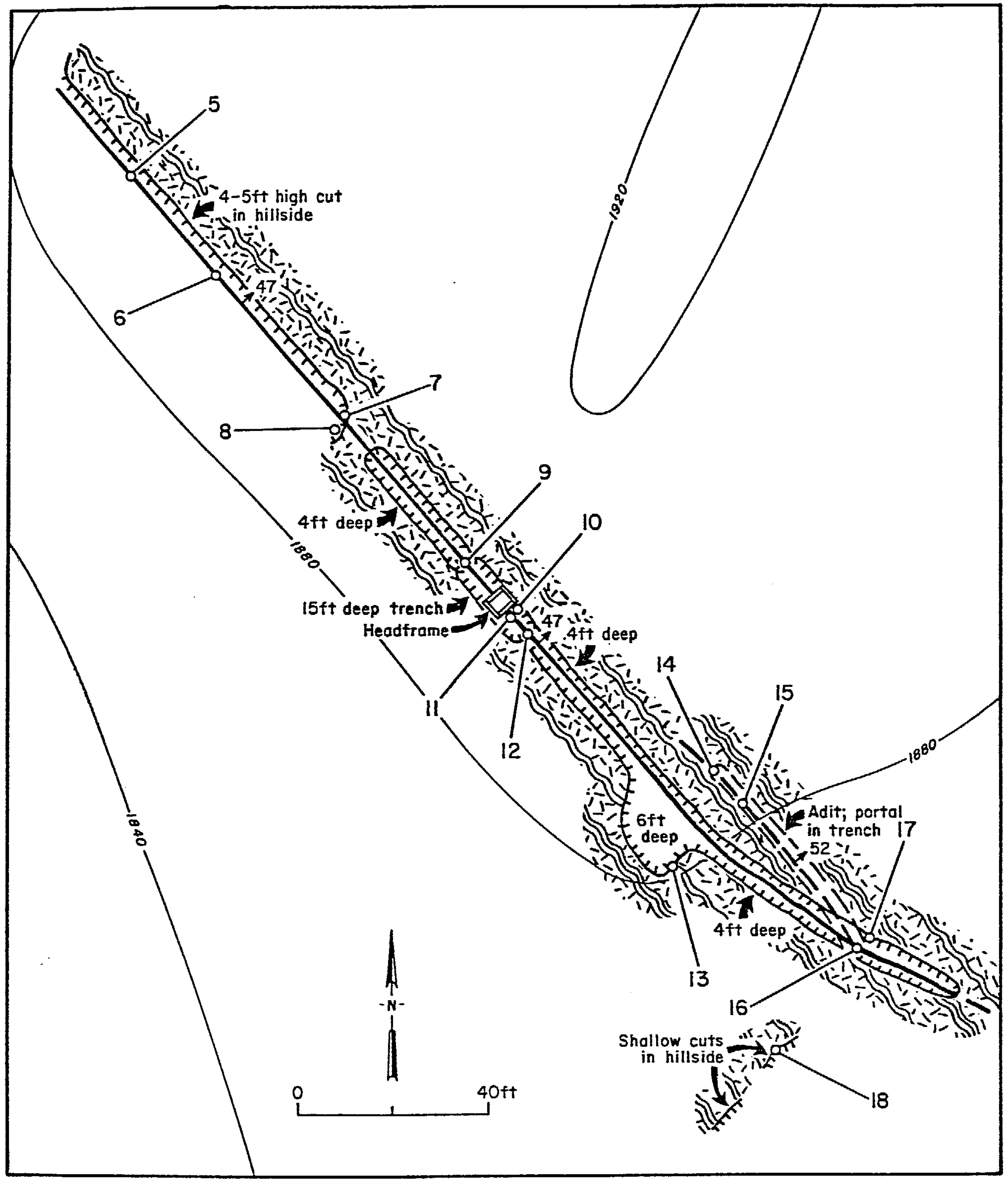
Figure 5.--Sample sites 188-216, Buckskin area, in and near the Rawhide Mountains study area.



[---, assayed for but not detected; lower detection limits: Gold, 0.002 oz/st; silver, 0.01 oz/st.]

Sample no.	Chip length (ft)	Gold oz/st	Silver oz/st	Copper ppm	Remarks
2	5.0	---	---	370	Brecciated gneiss; limonite coats fractures.
3	2.0	0.009	0.02	130	Brecciated quartz and silicified gneiss; limonite coats fractures.
4	5.0	.002	.01	1,180	Chloritized biotite gneiss; quartz veinlets.
19	2.5	.086	.03	4,850	Footwall; brecciated gneiss and quartz; hematite and minor chrysocolla coat fractures.

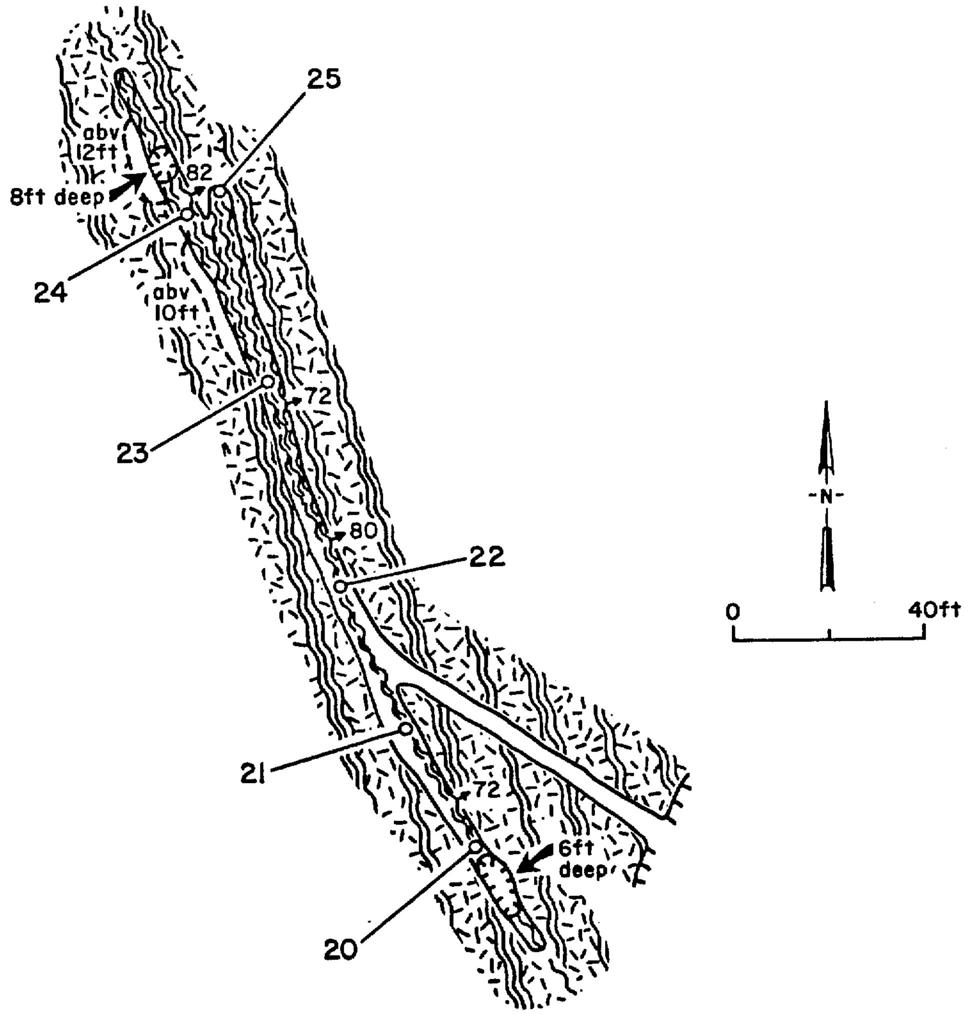
Figure 6A.--Big Kimble Mine area, showing sample localities 2-30 and data for samples 2-4, 19.



[---, assayed for but not detected; lower detection limit: Gold, 0.002 oz/st.]

Sample no.	Chip length (ft)	Gold oz/st	Silver oz/st	Copper ppm	Remarks
5	3.0	0.008	0.05	790	Footwall; brecciated quartz, hematite coats fractures.
6	3.5	.009	.01	1,000	Hanging-wall; brecciated quartz.
7	3.5	.015	.04	3,950	Hanging-wall; brecciated quartz and gneiss, gouge; traces of chrysocolla.
8	3.5	.028	.06	1,350	Footwall; brecciated quartz; chrysocolla and hematite coat fracture surfaces.
9	4.5	.005	.13	1,800	Brecciated gneiss and quartz, gouge; traces of chrysocolla along fractures.
10	1.0	---	.02	3,050	Hanging-wall; silicified gneiss; traces of chrysocolla on fracture surfaces.
11	2.0	.009	.07	1,300	Footwall; quartz vein, moderately fractured, traces of chrysocolla.
12	4.0	.005	.07	2,900	Brecciated gneiss and quartz, gouge; minor chrysocolla.
13	5.0	.026	.06	4,880	Footwall; brecciated, silicified gneiss; chrysocolla coats fracture surfaces.
14	2.5	---	.03	575	Brecciated quartz and gneiss; hematite coats fracture surfaces.
15	1.0	.022	.12	405	Footwall; brecciated quartz and gneiss; hematite coats fracture surfaces.
16	4.0	---	.02	1,850	Hanging-wall; brecciated, silicified gneiss; thin quartz veins.
17	4.0	.002	.02	325	Hanging-wall; brecciated, silicified gneiss and quartz veins; minor gouge.
18	5.0	.016	.04	3,280	Fracture zone in silicified gneiss; 7-in.-thick quartz vein.

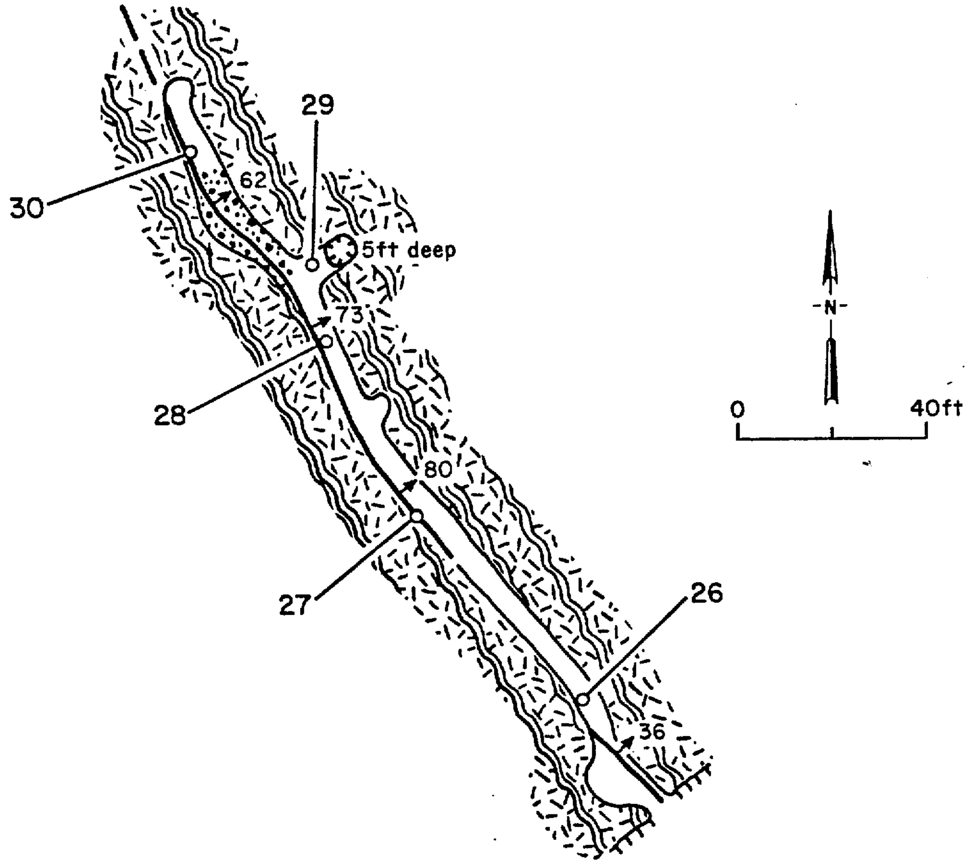
Figure 6B.--Upper prospect at the Big Kimble Mine, showing localities and data for samples 5-18.



[---, assayed for but not detected; lower detection limit: Silver, 0.01 oz/st.]

Sample no.	Chip length (ft)	Gold oz/st	Silver oz/st	Copper ppm	Remarks
20	2.5	0.009	0.08	2,900	Brecciated gneiss, gouge; traces of chrysocolla and limonite.
21	4.5	.010	.02	4,900	Do.
22	4.0	.030	---	2,300	Brecciated gneiss, gouge; manganese oxides coat fracture surfaces.
23	5.0	.008	.03	3,000	Brecciated gneiss; limonite and traces of chrysocolla coat fracture surfaces.
24	4.0	.013	.04	2,400	Brecciated gneiss; 1.5-ft-thick quartz vein; streaks of chrysocolla in quartz.
25	3.5	.005	.04	2,800	Brecciated gneiss; gouge and red hematite in matrix; minor chrysocolla.

Figure 6C.--Upper adit at the Big Kimble Mine, showing localities and data for samples 20-25.



Sample no.	Chip length (ft)	Gold oz/st	Silver oz/st	Copper ppm	Remarks
26	3.0	0.002	0.01	500	Brecciated gneiss; limonite coats fracture surfaces.
27	4.0	.002	.01	610	Brecciated gneiss; gouge.
28	4.0	.011	.08	1,750	Brecciated gneiss; gouge; minor limonite coats fracture surfaces.
29	3.5	.036	.08	3,150	Brecciated gneiss; areas of silicification; minor chrysocolla.
30	4.0	.002	.01	330	Brecciated gneiss; minor limonite on fracture surfaces.

Figure 6D.--Lower adit at the Big Kimble Mine, showing localities and data for samples 26-30.

Table 1.--Data for samples 70-81, 90-125, and 151-184, from the Alamo mineral district, Rawhide Mountains study area, La Paz County, Arizona.

[---, assayed for but not detected; >, greater than; lower detection limits: Gold, 0.002 oz/st; silver, 0.01 oz/st.]

Sample no.	Chip length (ft)	Gold (oz/st)	Silver (oz/st)	Copper (ppm)	Remarks
70	1.0	0.004	0.27	>10,000	Quartz vein impregnated with limonite; chrysocolla coats fracture surfaces.
71	1.0	.030	.06	>10,000	Shear zone in gneiss; quartz lens to 4 in. thick; chrysocolla and limonite coat fracture surfaces.
72	4.0	---	---	29	Brecciated gneiss; 3-in.-thick quartz lens.
73	3.0	---	---	500	Shear zone in gneiss, silicified; numerous vugs with quartz and fluorite crystals.
74	1.5	.002	.04	>10,000	Silicified brecciated gneiss; vugs contain chrysocolla; 2-in.-thick vein of specular hematite.
75	1.0	.008	.01	10,000	Silicified brecciated gneiss; local barite; chrysocolla coats fracture surfaces.
76	1.5	---	.03	4,050	Quartz veins, silicified fault gouge; quartz crystals line vugs and seams; limonite coats fracture surfaces.
77	.5	---	.01	880	Silicified brecciated gneiss; quartz crystals line vugs; trace of chrysocolla on fracture surfaces.
78	1.0	---	.03	2,900	Do.
79	1.0	---	.05	2,250	Quartz vein impregnated with limonite; trace of chrysocolla on fracture surfaces.
80	3.0	.002	1.30	>10,000	Shear zone in gneiss; 3-in.-thick silicified hematite lens; limonite and chrysocolla coat fracture surfaces.

Table 1.--Data for samples 70-81, 90-125, and 151-184, from the Alamo mineral district, Rawhide Mountains study area, La Paz County, Arizona--Continued

Sample no.	Chip length (ft)	Gold (oz/st)	Silver (oz/st)	Copper (ppm)	Remarks
81	1.0	0.002	0.18	>10,000	Silicified brecciated gneiss; quartz impregnated with limonite, thin seams of chrysocolla.
90	2.5	---	.03	3,500	Shear zone in gneiss, partly silicified; limonite and trace of chrysocolla coat fracture surfaces.
91	4.0	.021	.05	9,200	Brecciated gneiss, partly silicified; limonite and chrysocolla coat fracture surfaces.
92	4.0	.002	.05	6,100	Shear zone in gneiss; limonite and traces of chrysocolla coat some fracture surfaces.
93	5.0	---	.01	2,500	Shear zone in gneiss; some silicified zones; limonite coats some fracture surfaces.
94	1.5	---	.09	>10,000	Silicified brecciated gneiss; limonite, seams of chrysocolla and malachite.
95	4.0	---	.18	>10,000	Silicified gneiss; quartz veins; chrysocolla disseminated in quartz; limonite coats fracture surfaces.
96	1.5	---	.01	435	Fractured gneiss; quartz and fluorite crystals on fracture surfaces.
97	2.0	.004	.02	192	Brecciated gneiss; partly silicified gouge; quartz and fluorite coat fracture surfaces.
98	3.0	.002	.01	33	Brecciated gneiss.
99	2.5	.014	.03	122	Quartz-fluorite vein.
100	2.5	.030	.03	1,300	Brecciated gneiss; limonite coats fracture surfaces.

Table 1.--Data for samples 70-81, 90-125, and 151-184, from the Alamo mineral district, Rawhide Mountains study area, La Paz County, Arizona--Continued

Sample no.	Chip length (ft)	Gold (oz/st)	Silver (oz/st)	Copper (ppm)	Remarks
101	3.0	0.070	0.09	>10,000	Silicified, brecciated gneiss; chrysocolla and limonite coat fracture surfaces.
102	5.0	.082	.09	2,650	Quartz vein, gouge; abundant hematite and a trace of chrysocolla coat fracture surfaces.
103	2.0	.007	.05	690	Silicified gneiss; limonite coats fracture surfaces.
104	1.5	---	.19	>10,000	Silicified gneiss; limonite-rich zones, thin seams of chrysocolla.
105	1.0	---	.08	>10,000	Brecciated gneiss; 2-in.-thick quartz vein; quartz stained by disseminated limonite and malachite.
106	1.5	.003	.06	1,700	Silicified porous gouge; seam of quartz crystals and minor disseminations of limonite.
107	1.5	.003	.19	2,850	Silicified brecciated gneiss, gouge; limonite coats fracture surfaces.
108	3.0	.005	.09	3,550	Silicified gouge; gneiss clasts; disseminated hematite.
109	3.0	.005	.73	2,850	Shear zone in gneiss, partly silicified; small vugs containing limonite and minor chrysocolla.
110	4.0	---	.16	3,350	Gneiss, partly hematitic and silicified.
111	2.0	.012	.26	3,400	Silicified zone in gneiss; numerous vugs filled with earthy hematite and small quartz crystals; minor chrysocolla.
112	1.0	.023	.23	>10,000	Quartz vein with gouge; areas of quartz impregnated with limonite; chrysocolla coats fracture surfaces.

Table 1.--Data for samples 70-81, 90-125, and 151-184, from the Alamo mineral district, Rawhide Mountains study area, La Paz County, Arizona--Continued

Sample no.	Chip length (ft)	Gold oz/st	Silver oz/st	Copper ppm	Remarks
113	3.0	0.002	0.18	>10,000	Shear zone in gneiss; silicified zones, seams and spots of chrysocolla.
114	2.5	---	.19	9,600	Silicified gneiss, highly fractured; limonite and chrysocolla coat fracture surfaces.
115	3.0	---	.10	>10,000	Silicified gneiss, highly fractured; abundant seams and coatings of chrysocolla and hematite.
116	3.0	---	.10	>10,000	Silicified gneiss; 3-in.-thick thick zone of disseminated chrysocolla.
117	1.0	---	.10	8,000	Quartz vein; vuggy, impregnated with hematite, fluorite, thin seams of chrysocolla.
118	2.5	.005	.06	3,950	Silicified zone in gneiss; small quartz and fluorite crystals coat fractures; thin seams of chrysocolla.
119	2.0	.003	---	3,100	Silicified zone in gneiss; limonite coats fracture surfaces.
120	2.5	.045	.02	3,650	Silicified gneiss, hematitic; manganese-oxide and trace of chrysocolla coat fracture surfaces.
121	1.0	.008	.15	455	Quartz-barite vein in gneiss.
122	2.0	.008	.06	2,300	Silicified brecciated gneiss; trace of chrysocolla on fracture surfaces.
123	3.0	.004	.28	8,700	Silicified gneiss; malachite coats fracture surfaces.

Table 1.--Data for samples 70-81, 90-125, and 151-184, from the Alamo mineral district, Rawhide Mountains study area, La Paz County, Arizona--Continued

Sample no.	Chip length (ft)	Gold oz/st	Silver oz/st	Copper ppm	Remarks
124	4.0	0.020	---	155	Shear zone in gneiss; disseminated hematite, thin seams of gouge.
125	select	.086	0.10	6,200	Silicified zone in gneiss; barite, traces of chrysocolla on fracture surfaces.
151	3.0	.018	.33	3,700	Shear zone in gneiss; quartz veins as thick as 8 in.; disseminated chrysocolla in quartz.
152	3.0	.056	.06	>10,000	Shear zone in gneiss; lens of fluorite as thick as 8 in.; chrysocolla coats fractures and is disseminated in gneiss.
153	1.5	.097	.11	5,700	Shear zone in gneiss; 8-in. thick quartz vein; limonite in small vugs, disseminated chrysocolla in quartz.
154	2.0	.073	.25	5,950	Shear zone; silicified, brecciated gneiss; quartz vein, gouge, minor fluorite and chrysocolla.
155	2.5	.084	.24	6,400	Brecciated gneiss; quartz veins; chrysocolla coats fracture surfaces.
156	2.0	.023	.34	8,200	Brecciated gneiss; silicified zones as thick as 6 in.; traces of chrysocolla on fracture surfaces.
157	2.0	.005	.21	1,400	Shear zone in gneiss; trace of chrysocolla on fracture surfaces.
158	.5	.270	.09	940	Quartz vein; limonite in vugs and on fractures; traces of chrysocolla disseminated in quartz.
159	3.0	.125	.09	3,600	Breccia zone in gneiss; limonite and hematite impregnated clay matrix.

Table 1.--Data for samples 70-81, 90-125, and 151-184, from the Alamo mineral district, Rawhide Mountains study area, La Paz County, Arizona--Continued

Sample no.	Chip length (ft)	Gold (oz/st)	Silver (oz/st)	Copper (ppm)	Remarks
160	3.0	0.105	0.10	5,350	Breccia zone in gneiss; numerous small vugs contain limonite.
161	2.0	.062	.09	3,350	Breccia zone in gneiss; sugary silica cement; limonite and trace of chrysocolla coat fracture surfaces.
162	3.0	---	.01	5,800	Shear zone in gneiss; minor limonite and a trace of chrysocolla on fracture surfaces.
163	3.5	.053	.07	3,400	Breccia zone, partly silicified; trace of chrysocolla.
164	1.0	.009	.13	4,300	Breccia zone; minor limonite and chrysocolla on fractures.
165	2.5	.041	.07	1,580	Silicified brecciated gneiss; trace of chrysocolla on fracture surfaces.
166	3.5	.130	.07	6,500	Shear zone in gneiss; trace of chrysocolla on fracture surfaces.
167	2.5	.042	.51	4,600	Silicified breccia zone in gneiss; 6-in.-thick zone of black calcite; trace of chrysocolla on fractures.
168	2.0	.017	.12	2,700	Silicified brecciated gneiss; trace of limonite and chrysocolla on fracture surfaces.
169	2.5	.048	.09	5,000	Brecciated gneiss; partly silicified; 1-ft-thick zone of black calcite matrix.
170	1.0	.069	.08	3,850	Brecciated gneiss; gouge, black calcite matrix.
171	4.0	.034	.29	2,280	Breccia zone in gneiss; black calcite matrix; small pockets of limonite, trace of chrysocolla.

Table 1.--Data for samples 70-81, 90-125, and 151-184, from the Alamo mineral district, Rawhide Mountains study area, La Paz County, Arizona--Continued

Sample no.	Chip length (ft)	Gold oz/st	Silver oz/st	Copper ppm	Remarks
172	2.5	0.024	0.05	2,300	Breccia zone in gneiss; black calcite matrix; trace of chrysocolla on fracture surfaces.
173	4.0	.009	.06	1,130	Shear zone in gneiss; silicified zone as thick as 1 ft; black calcite matrix, minor limonite coating on fractures.
174	3.0	.002	.04	1,000	Shear zone in gneiss; some silicified zones.
175	2.5	---	.01	28	Fractured gneiss.
176	1.5	.013	.03	253	Shear zone in gneiss; limonite coats fracture surfaces.
177	3.5	.002	---	44	Fractured gneiss.
178	2.5	.031	.02	1,050	Black calcite vein; gneiss clasts; siliceous pods, purple fluorite, limonite.
179	3.0	.155	.65	>10,000	Silicified breccia zone in gneiss; black calcite matrix; streaks and seams of chrysocolla.
180	1.0	.105	2.05	>10,000	Black calcite vein; streaks of chrysocolla.
181	1.3	.300	.15	3,750	Silicified breccia zone in gneiss; 4-in.-thick zone of fault gouge.
182	5.0	.055	.08	2,500	Silicified breccia zone in gneiss; trace of chrysocolla and limonite on fracture surfaces.
183	2.0	.035	.05	1,650	Shear zone; mostly altered to clay.
184	2.0	.034	.06	2,330	Silicified, brecciated gneiss; abundant fluorite, minor chrysocolla, limonite.

Table 2.--Data for samples 188-216 from prospects in the Buckskin area, Rawhide Mountains study area, La Paz County, Arizona.

[---, assayed for but not detected; >, greater than; lower detection limits: Gold, 0.002 oz/st; silver, 0.01 oz/st.]

Sample no.	Chip length (ft)	Gold (oz/st)	Silver (oz/st)	Copper (ppm)	Remarks
188	5.0	---	0.01	5,100	Shear zone in gneiss; trace of chrysocolla on fracture surfaces.
189	2.0	---	---	4,250	Breccia zone in gneiss; trace of chrysocolla on fractures.
190	1.0	---	.01	775	Breccia zone in gneiss.
191	2.0	---	---	3,380	Breccia zone in gneiss; limonitic clay matrix; disseminated chrysocolla in spots.
192	1.0	0.014	.06	>10,000	Silicified, brecciated gneiss and gouge; disseminated chrysocolla.
193	6.0	---	.01	7,700	Shear zone in gneiss; silicified, hematitic, traces of chrysocolla.
194	3.0	---	---	4,300	Shear zone in gneiss; vein quartz, hematite-stained clay, chrysocolla coating fracture surfaces.
195	3.0	---	.01	>10,000	Silicified, brecciated gneiss; hematite and chrysocolla coat fracture surfaces.
196	2.0	.003	.01	5,700	Silicified, brecciated gneiss; thin chrysocolla veinlets.
197	5.0	---	---	6,000	Shear zone in gneiss; 1-ft-thick zone of chrysocolla veinlets in quartz.
198	1.0	---	---	6,800	Breccia zone in gneiss; chrysocolla and limonite coat fracture surfaces.

Table 2.--Data for samples 188-216 from prospects in the Buckskin area, Rawhide Mountains study area, La Paz County, Arizona--Continued

Sample no.	Chip length (ft)	Gold (oz/st)	Silver (oz/st)	Copper (ppm)	Remarks
199	1.5	0.006	---	9,650	Quartz vein, inclusions of limonite; thin seams of chrysocolla.
200	5.0	---	---	2,400	Shear zone in gneiss; several quartz veins as thick as 3 in.; trace of chrysocolla on fractures.
201	3.0	---	---	1,900	Shear zone in gneiss.
202	1.5	---	---	3,050	Quartz vein, vuggy; hematite, trace of chrysocolla on fracture surfaces.
203	3.5	---	0.01	4,400	Quartz vein; silicified gneiss; vugs with quartz crystals and limonite, a trace of chrysocolla.
204	1.0	---	.02	9,350	Silicified gneiss; quartz vein; chrysocolla coats fracture surfaces.
205	2.5	---	.02	9,150	Quartz vein; limonite and chrysocolla coat fracture surfaces.
206	2.5	---	---	455	Silicified gneiss; quartz vein; minor limonite inclusions in quartz.
207	1.0	---	---	6,000	Silicified gneiss, highly fractured; thin limonite veinlets, traces of chrysocolla.
208	1.0	---	---	7,000	Quartz vein; inclusions of hematite, limonite and chrysocolla.
209	3.0	---	.02	6,800	Silicified gneiss; quartz vein; limonite and trace of chrysocolla coat fractures.

Table 2.--Data for samples 188-216 from prospects in the Buckskin area, Rawhide Mountains study area, La Paz County, Arizona--Continued

Sample no.	Chip length (ft)	Gold (oz/st)	Silver (oz/st)	Copper (ppm)	Remarks
210	2.0	---	0.01	290	Quartz veins in silicified gneiss; limonite coats fracture surfaces.
211	.5	---	.01	>10,000	Quartz vein; disseminated chrysocolla and limonite.
212	.6	---	.03	2,300	Quartz vein; silicified gneiss; trace of chrysocolla.
213	1.0	---	.01	5,000	Quartz vein; silicified gneiss; limonite and trace of chrysocolla coat fracture surfaces.
214	.5	---	---	3,880	Quartz vein; chrysocolla coats fracture surfaces.
215	1.0	---	.01	7,750	Silicified gneiss; limonite and chrysocolla coat fracture surfaces.
216	1.0	---	.06	7,700	Do.

Table 3.--Data for samples 1, 31-32, 59-69, and 185-187, from miscellaneous mines and prospects in the Rawhide Mountains study area, La Paz and Mohave Counties, Arizona.

[---, assayed for but not detected; >, greater than; lower detection limits: Gold, 0.002 oz/st; silver, 0.01 oz/st.]

Sample no.	Chip length (ft)	Gold (oz/st)	Silver (oz/st)	Copper (ppm)	Remarks
1	1.0	---	0.01	17	Mudstone impregnated with manganese oxides. Manganese 5,350 ppm (0.5%).
31	3.0	0.008	.05	1,800	Brecciated gneiss; limonite-stained gouge matrix.
32	3.0	.003	.06	1,650	Do.
59	4.0	---	---	>10,000	Claystone and conglomerate impregnated with hematite; thin seams of chrysocolla and malachite.
60	4.0	---	---	>10,000	Conglomerate impregnated with hematite; chrysocolla coats fracture surfaces.
61	2.0	---	.02	>10,000	Claystone impregnated with hematite; chrysocolla in thin seams.
62	3.5	.003	---	335	Breccia zone impregnated with hematite; some silicified layers.
63	3.8	---	.02	>10,000	Claystone with chrysocolla veinlets; hematite coats fracture surfaces.
64	2.0	---	.01	10,000	Claystone, silicified to earthy; impregnated with hematite; chrysocolla coats fracture surfaces.
65	8.0	---	---	1,400	Claystone impregnated with hematite.
66	1.0	.014	.08	>10,000	Silicified claystone; lens of chrysocolla and malachite.

Table 3.--Data for samples 1, 31-32, 59-69, and 185-187, from miscellaneous mines and prospects in the Rawhide Mountains study area, La Paz and Mohave Counties, Arizona--Continued

Sample no.	Chip length (ft)	Gold (oz/st)	Silver (oz/st)	Copper (ppm)	Remarks
67	1.5	0.002	0.03	>10,000	Silicified claystone; lens of chrysocolla and malachite.
68	4.0	.002	.02	5,500	Claystone, fractured; traces of chrysocolla and malachite coat fracture surfaces.
69	select	----	---	420	Silicified, limonite-stained claystone.
185	select	----	---	135	Quartz-granite conglomerate; matrix of manganese-oxides; estimate 5% manganese; assays >1% manganese.
186	select	----	.01	250	Quartz-granite conglomerate; matrix of manganese-oxides; manganese zone about 7 ft thick; assays >1% manganese.
187	select	----	.01	160	Quartz-granite conglomerate; matrix of manganese-oxides; manganese zone about 3 ft thick; assays >1% manganese.

APPENDIX A--Results and lower detection limits of multi-element analyses for selected samples from the Rawhide Mountains study area, La Paz and Mohave Counties, Arizona.

[---, assayed for but not detected; >, greater than.]

Element

Sample No.	Al %	Ag ppm	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm	K %	La ppm
3	0.30	0.4	---	650	---	---	2.11	---	1	65	129	0.62	---	---	0.10	---
9	.72	4.6	---	130	---	---	1.97	1.0	1	118	1,932	.71	10	---	.17	---
25	.71	1.2	55	280	---	4	.26	2.0	8	81	3,340	2.65	---	---	.11	---
29	1.08	2.8	5	230	---	44	3.34	12.0	8	176	3,580	2.21	10	---	.12	---
53	.48	.6	25	40	0.5	---	1.33	---	29	114	3,876	9.16	---	---	.03	10
64	1.08	.2	75	160	1.0	2	.08	.5	32	69	>9,999	9.35	---	---	.22	---
74	.47	1.0	---	800	.5	---	.09	---	20	87	>9,999	7.63	---	---	.03	---
88	1.63	.4	15	2,240	.5	---	1.34	1.0	19	66	>9,999	8.57	10	---	.15	20
101	1.20	4.2	25	50	---	---	2.02	4.0	12	68	9,830	5.35	20	---	.09	20
111	.59	42.0	45	50	.5	---	.32	---	8	120	3,220	6.39	---	---	.04	10
115	.59	1.4	10	30	.5	---	.15	.5	32	33	>9,999	6.57	---	---	.07	20
117	1.79	3.8	---	4,860	1.0	2	7.08	1.0	6	50	425	1.33	30	---	1.22	---
118	.93	4.0	---	270	.5	---	.91	.5	48	190	8,168	6.48	10	---	.09	---
127	3.12	9.0	5	740	.5	14	13.07	1.5	10	45	>9,999	2.89	40	---	.78	---
148	.69	4.2	---	120	.5	4	14.20	15.5	1	115	121	.35	40	---	.53	---
154	2.04	7.6	25	540	1.0	---	8.50	5.0	9	56	6,126	3.98	30	---	1.51	---
160	1.20	3.4	80	200	.5	---	1.83	14.0	14	68	5,094	3.29	10	1	.48	20
171	.69	8.0	145	30	.5	4	13.98	>99.9	11	51	2,255	1.99	40	---	.03	---
184	1.06	1.0	---	50	.5	14	7.37	11.0	13	69	2,435	1.85	20	---	.15	---
193	1.67	.2	5	30	.5	---	1.73	---	14	97	7,553	3.89	10	---	.08	10
200	1.16	.2	---	2,430	---	---	1.80	---	14	108	2,219	2.47	10	---	.04	10
205	1.01	.4	10	20	.5	---	.82	---	9	138	9,393	3.79	---	---	.07	10

APPENDIX A--Results and lower detection limits of multi-element analyses for selected samples from the Rawhide Mountains study area, La Paz and Mohave Counties, Arizona--Continued

Element

Sample No.	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	Tl	U	V	W	Zn
	%	ppm		%	ppm						%	ppm				
3	0.05	40	69	0.02	---	90	44	---	---	55	---	---	---	12	---	74
9	.12	74	11	.01	2	80	1,836	---	---	34	---	---	---	153	---	2,042
25	.33	2,470	4	.01	9	160	554	10	---	67	0.01	---	---	44	---	1,305
29	.57	376	16	.04	36	360	70	---	---	27	.01	---	---	36	5	7,090
53	.08	156	---	---	---	90	20	---	30	82	---	---	---	78	---	9
64	.06	190	197	.02	13	190	18	---	---	178	.01	---	10	53	---	37
74	.25	757	---	.02	7	---	---	---	30	37	---	---	10	101	---	4
88	.30	910	---	.05	5	360	896	---	10	278	.03	---	---	150	---	675
101	.20	525	49	.02	4	440	1,000	---	---	184	.01	10	---	131	---	>10,000
111	.05	56	1	---	8	270	36	---	---	202	---	---	---	72	---	55
115	.18	415	---	.03	---	---	8	---	10	38	.01	---	---	33	---	64
117	.26	281	82	.37	3	530	1,518	5	---	168	.08	---	---	63	---	2,801
118	.23	1,501	44	---	18	220	40	---	---	69	.01	---	---	81	---	122
127	.93	468	111	.59	3	430	9,096	5	30	230	.10	---	---	35	---	>9,999
148	.23	56	25	.31	5	350	>9,999	5	10	124	.01	---	---	10	---	1,453
154	.18	795	244	.03	3	540	>9,999	---	30	118	.01	---	---	328	25	>9,999
160	.54	1,469	24	.04	6	430	4,888	---	20	64	.06	---	---	566	5	>9,999
171	.73	4,421	116	.07	1	440	>9,999	---	40	176	.02	---	---	352	45	>9,999
184	.81	1,094	15	.03	3	370	514	---	30	29	.02	---	---	44	40	>9,999
193	.20	210	1	.03	3	550	6	5	---	417	.06	---	---	70	---	13
200	.62	240	14	.06	10	470	6	---	---	215	.07	---	---	51	---	25
205	.48	225	---	.06	13	690	32	---	10	234	.03	---	---	123	---	20

APPENDIX A--Results and lower detection limits of multi-element analyses for selected samples from the Rawhide Mountains study area, La Paz and Mohave Counties, Arizona--Continued

Element	Symbol	Unit	Lower detection limit
Aluminum	Al	%	0.01
Silver	Ag	ppm	.2
Arsenic	As	ppm	5
Barium	Ba	ppm	10
Beryllium	Be	ppm	.5
Bismuth	Bi	ppm	2
Calcium	Ca	%	.01
Cadmium	Cd	ppm	.5
Cobalt	Co	ppm	1
Chromium	Cr	ppm	1
Copper	Cu	ppm	1
Iron	Fe	%	.01
Gallium	Ga	ppm	10
Mercury	Hg	ppm	1
Potassium	K	%	.01
Lanthanum	La	ppm	10
Magnesium	Mg	%	.01
Manganese	Mn	ppm	1
Molybdenum	Mo	ppm	1
Sodium	Na	%	.01
Nickel	Ni	ppm	1
Phosphorus	P	ppm	10
Lead	Pb	ppm	2
Antimony	Sb	ppm	5
Selenium	Se	ppm	10
Strontium	Sr	ppm	1
Titanium	Ti	%	.01
Thallium	Tl	ppm	10
Uranium	U	ppm	10
Vanadium	V	ppm	1
Tungsten	W	ppm	5
Zinc	Zn	ppm	1

APPENDIX B--Salient statistics for gold, silver, copper, and manganese.

[Abbreviations used: oz, troy ounce; lb, pound; LTU, long ton unit; mt, metric tons.
Data from U.S. Bureau of Mines publication: Mineral Commodity Summaries, 1988.]

Commodity	Average 1987 domestic price ($U.S.)	U.S. mine production (primary metal)	Apparent U.S. consumption 1987 (primary metal)	Net import reliance (approximate)	Major import sources	Government stockpiles (?)	Major uses
Gold	444.00 per oz	3.00 million oz	2.80 million oz	unavailable	Canada, 49% Switzerland, 13% Uruguay, 9% Other, 29%	265.3 million oz	Jewelry and arts, industrial, dental, investments.
Silver	7.20 per oz	45.0 million oz	144.0 million oz	57%	Canada, 28% Mexico, 27% U. Kingdom, 16% Peru, 12% Other, 17%	227.0 million oz	Photography, electrical and electronics, sterlingware and electroplate, brazing alloys and solders.
Copper	.78 per lb	1,130,000 mt	2,190,000 mt	25%	Chile, 35% Canada, 34% Peru, 8% Other, 13%	120,000 mt	Electrical, construction, industrial mahinery, transportation.
Manganese	1.27 per LTU	none	690,000 short tons	100%	Gabon, 43% Brazil, 24% Other, 33%	214,700 short tons	Steel production, pig iron, dry cell batteries, transportation, construction, machinery.

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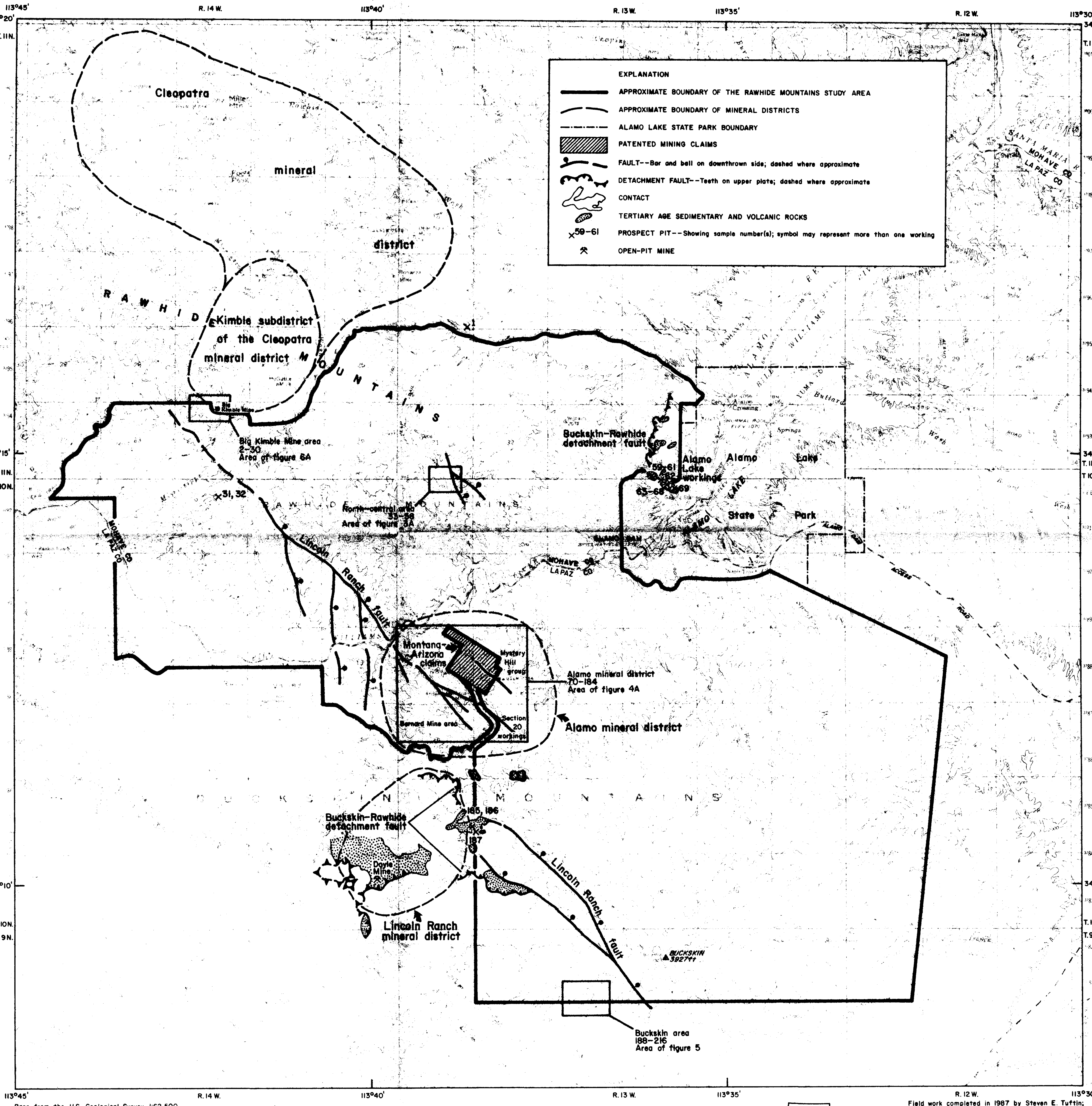
MLA 13-89
PLATE 1



Base from the U.S. Geological Survey, 1:62,500
Alamo Dam, 1966; and Artillery Peak, 1966.

SCALE 1:50,000

0 ½ 1 2 3 4mi

CONTOUR INTERVAL 80ft

ARIZONA

MAP LOCATION

Field work completed in 1987 by Steven E. Tuftin; assisted by Rodney E. Jeske and John T. Neubert.

Geology adapted from Tosdal and others, in press.

MINE AND PROSPECT MAP OF THE RAWHIDE MOUNTAINS STUDY AREA, LA PAZ AND MOHAVE COUNTIES, ARIZONA

BY

STEVEN E. TUFTIN, U.S. BUREAU OF MINES

1989