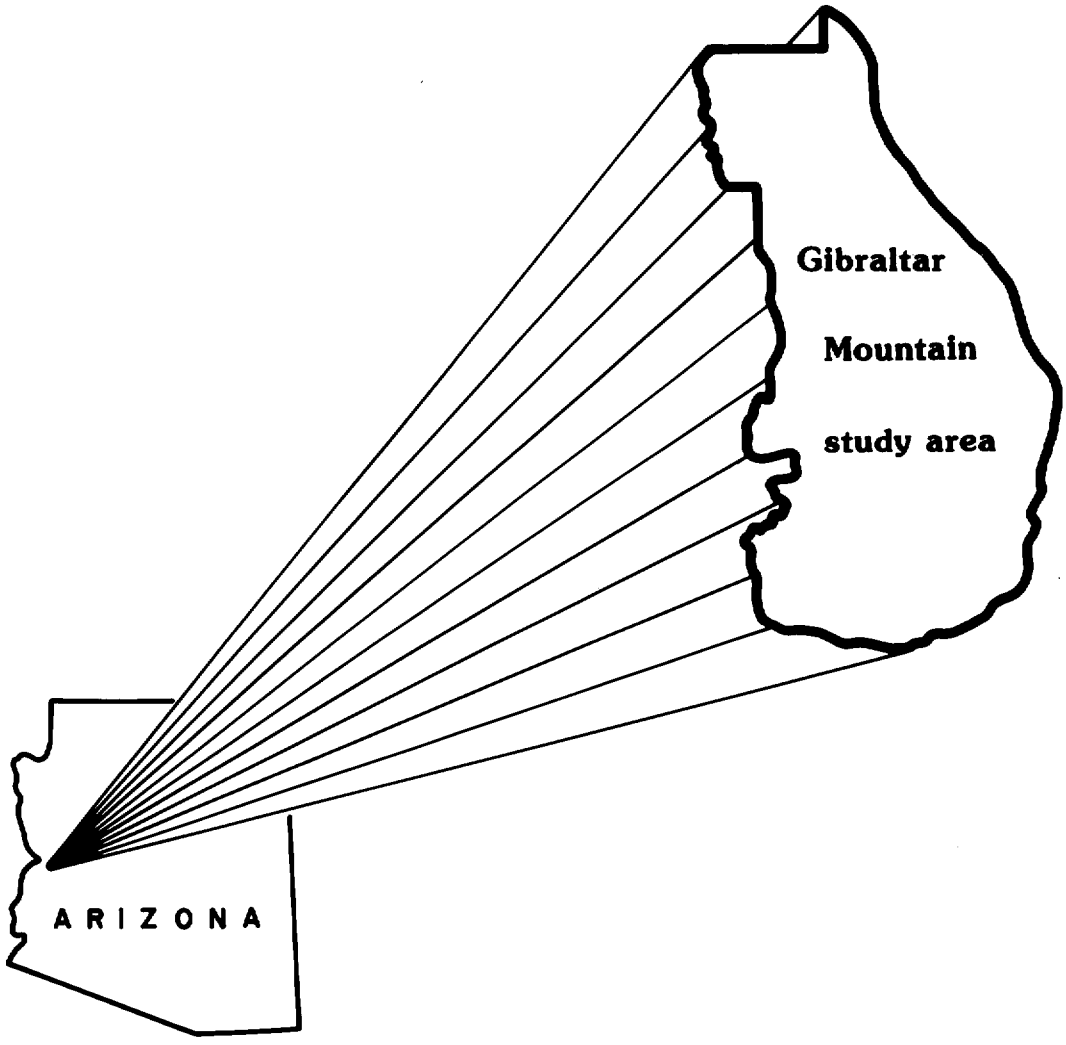
MLA 18-89

Mineral Land Assessment
Open File Report/1989

Mineral Investigation of a Part of the Gibraltar Mountain Wilderness Study Area (AZ-050-012), La Paz County, Arizona



BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL INVESTIGATION OF A PART OF THE GIBRALTAR MOUNTAIN WILDERNESS STUDY AREA (AZ-050-012), LA PAZ COUNTY, ARIZONA

by

David C. Scott

MLA 18-89
1989

Intermountain Field Operations Center,
Denver, Colorado

UNITED STATES DEPARTMENT OF THE INTERIOR
Manuel 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 Gibraltar Mountain Wilderness Study Area (AZ-050-012), La Paz County, 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, Building 20, Denver Federal Center, Denver, CO 80225.

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UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

°	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 INVESTIGATION OF A PART OF THE GIBRALTAR MOUNTAIN WILDERNESS STUDY AREA (AZ-050-012), LA PAZ COUNTY, ARIZONA

by

David C. Scott, Bureau of Mines

SUMMARY

In March 1988, the Bureau of Mines conducted a mineral investigation of 18,807 acres of the 25,260-acre Gibraltar Mountain Wilderness Study Area, La Paz County, Arizona. The 18,807-acre area was preliminarily identified as suitable for wilderness and is administered by the Bureau of Land Management. The mineral investigation was authorized by the Federal Land Policy and Management Act of 1976 (Public Law 94-579). Bureau personnel investigated mines, prospects, and mineralized areas to evaluate mineral reserves and identified resources. Eighteen rock-chip samples were taken in and near the study area.

The study area is characterized by basalt that covers upper- and lower-plate rocks of the Buckskin-Rawhide detachment fault. A northeast-trending synform in the detachment fault extends from the Mammon Mine area, at the southwestern study area boundary, to the Planet metallic mining district, outside the northeastern area boundary. Upper-plate rocks of the detachment fault are exposed along the western study area boundary in the Cienega metallic mining district, and along the eastern study area boundary in the Planet metallic mining district. Lower-plate rocks of the detachment fault are exposed at the Mammon Mine, outside the southwestern study area boundary. The districts had copper, gold, and silver production.

No mineral resources were identified in the study area, but the detachment fault and related high-angle faults and fractures in the metallic

mining districts adjacent to the study area contain occurrences of copper, gold, and silver. Geologic conditions are similar in the study area. Copper, gold, and silver occurrences, similar to those found in the Planet, Cienega, and Mammon metallic mining districts, could be present beneath the basalt flow covering the study area.

Sand and gravel is found throughout the study area; however, similar material may be obtained outside the study area, nearer to a market place.

The U.S. Geological Survey assessed the study area as having few attributes of an oil and gas producing area and gave the area a low to zero potential for hydrocarbon accumulation.

INTRODUCTION

In March 1988, the Bureau of Mines, in a cooperative program with the U.S. Geological Survey (USGS), conducted a mineral investigation of a part of the Gibraltar Mountain Wilderness Study Area, La Paz County, Arizona, on lands administered by the Bureau of Land Management (BLM), Yuma District Office. The wilderness study area comprises 25,260 acres; the Bureau studied the 18,807 acres deemed preliminarily suitable for inclusion in the National Wilderness Preservation System. "Study area" (SA) 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 study, which was completed prior to the USGS investigations. The USGS will publish the results of their studies. A joint USGS-Bureau report, to be published by the USGS, will integrate and summarize the results of all surveys.

Geographic setting

The study area is in the Basin and Range physiographic province and encompasses the western part of the Buckskin Mountains, west-central Arizona. Parker, Arizona, the nearest municipality, is about 10 mi west (fig. 1). Access to the study area is from State Highway 95, north of Parker, and State Highway 72, south of Parker. Gravel roads and four-wheel-drive trails encircle the study area and provide access to the perimeter.

Topography in the study area is characterized by an extensive basalt plateau that is accentuated by broad, sandy washes. The eastern and southern boundaries follow Osborne Wash, which separates the study area from the extensive, sandy, Cactus Plain Wilderness Study Area.

Elevations in the study area range from 1,908 ft on an unnamed peak just east of Giers Mountain in the northern part of the area, to about 650 ft at the northwest corner of the area. Climate in the region is semiarid, with mild winters and hot summers.

Previous investigations

One of the earliest geologic investigations in the region described ore deposits in northern Yuma County (Bancroft, 1911). The report describes the geology and mineralization in the Cienega and Mammon metallic mineral districts, adjacent to the western study area boundary. Subsequent publications have dealt primarily with these districts, but contain sparse data about the study area. Within the last 10 years, many reports have been written about detachment faults and related mineralization in southwestern Arizona. A list of references related to detachment faults in southwestern Arizona can be found in a report by Lehman and others (1987).

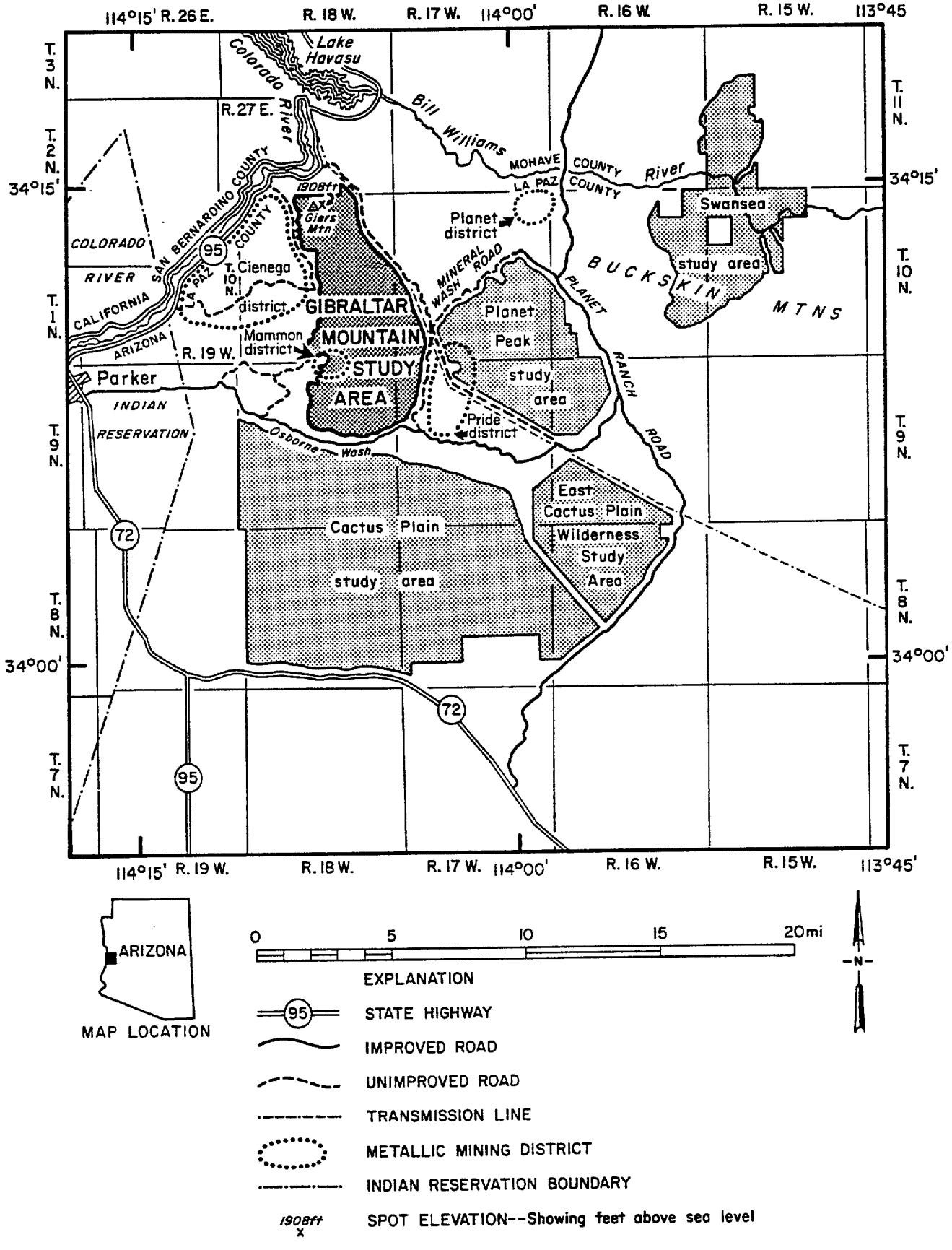


Figure 1.--Index and metallic mining district map of the Gibraltar Mountain study area, La Paz County, Arizona.

Recent Bureau of Mines wilderness reports in the region include: Cactus Plain (Kreidler, 1986); East Cactus Plain (Kreidler, 1987); Planet Peak (Kreidler, 1989); and Swansea (Ryan, 1989) (pl. 1).

Methods of investigation

A review of pertinent literature on geology, mineralization, and mining activity was completed prior to a field examination. Mining claims were researched and those recorded with the BLM as of March, 1989 are shown on plate 1. Oil and gas lease records were examined and leases on file with the BLM as of May 1988 are also shown on plate 1.

Two Bureau geologists spent six days conducting a field investigation of the study area. Accessible mine workings were surveyed by the compass-and-tape method and 18 rock-chip samples were taken. All samples were analyzed by inductively coupled plasma-atomic fluorescence spectroscopy (total digestion) for a suite of 24 elements and by fire assay/atomic absorption spectroscopy for gold. (See appendix for elements and detection limits.) All analyses were performed by Chemex Labs. Inc., Sparks, NV. Further inquiries about sample analysis can be directed to the Bureau of Mines, Resource Evaluation Branch, Intermountain Field Operations Center, Building 20, Denver Federal Center, Denver, CO.

GEOLOGIC SETTING

About 85% of the Gibraltar Mountain study area is covered by basalt, but a brief description of the geology and mineralization of adjacent mining districts is necessary to explain how similar occurrences could be present beneath the basalt. The basalt unit is middle to late Miocene-age, flat-lying to gently dipping, and consists of phenocrysts of fine-grained olivine, clinopyroxene, and plagioclase. The unit varies in thickness and has an

average thickness of about 100 ft. Small isolated outcrops of Proterozic-age granitic rock are exposed in the extreme northern part and comprise about 5% of the study area. The remaining 10% of the area is covered with alluvium. (See Spencer, 1987.)

The Tertiary-age Buckskin-Rawhide detachment fault, a large-displacement, low-angle, normal fault that separates upper- and lower-plate rocks in a metamorphic core complex, underlies the study area. (See Lehman and others, 1987, p. 3-4.) The fault is exposed at the Mammon Mine where lower-plate mylonitic gneiss is exposed. A northeast-trending synform in the detachment fault extends from the Mammon Mine northeasterly to the Planet metallic mining district.

Copper, gold, and silver deposits are located along and adjacent to Tertiary detachment faults, similar to the Buckskin-Rawhide detachment fault, in western Arizona. Spencer and Welty (1986, p. 195) describe mineralization associated with detachment faults in the following paragraph.

> "Mineralization is characterized by early copper and iron sulfides, followed by massive specular hematite, in turn followed by fracture-filling chrysocolla and malachite. Mineralization occurred during faulting and was associated with unusually high geothermal gradients that were at least partially due to detachment-fault movement that brought hot, lower-plate rocks up from great depth and juxtaposed them with cool, near-surface, upper-plate rocks. Mixing of ascending, reduced, metal-bearing aqueous solutions with higher level, oxidized fluids is proposed as an important process leading to oxide mineralization. Movement of the redox interface down normal-fault ramps at the same rate as displacement of hanging-wall rocks resulted in continous mineralization at some upper-plate sites over significant periods of geologic time; this produced the largest orebodies. Aqueous solutions that precipitated iron oxides near the detachment fault carried manganese oxides to higher levels where vein and stratabound sedimentary manganese oxides were deposited."

The significance of the mineralization associated with detachment faults is important to the evaluation of minerals in the study area. The Buckskin-

Rawhide detachment fault, which underlies the study area, may have acted as a conduit for similar mineralization beneath the basalt covering the study area.

Ryder (1983) evaluated the petroleum potential of wilderness lands in Arizona based on the known or interpreted distribution of reservoir rocks and hydrocarbon source beds, geologic history, and stratigraphic and structural features favorable for oil and gas accumulations in each wilderness. Based on these data, Ryder gave the study area a low to zero potential for hydrocarbon accumulation. Many oil and gas leases have been applied for and received within the study area, however, no exploratory holes have been drilled.

MINING DISTRICTS AND HISTORY

The study area is entirely within the Cienega mining district, where copper, gold, and silver deposits were discovered as early as 1860 (Keith, 1978, p. 129). The mining district includes the Cienega, Mammon, Planet, and Pride metallic mineral districts as defined by Keith and others (1983, map) (fig. 1).

The Cienega metallic mining district is adjacent to the northwestern boundary of the study area (fig. 1). From 1870 to 1969, production from the district totalled 19,000 tons of ore that contained 1,714,000 lb of copper, 1,600 oz of silver, and 12,000 oz of gold. Mineral deposits occur as replacement of silicates, carbonates, and oxides, with quartz-hematite in northwest-trending shear zones in the upper plate of the Buckskin-Rahwide detachment fault (Spencer and Welty, 1986, p. 196).

The Mammon metallic mining district is along and inside the southwestern boundary of the study area (fig. 1). Production from 1909 to 1955 totalled 800 tons of ore that contained 87,000 lb of copper, 100 oz of silver, and less than 100 oz of gold. Mineral deposits consist of chrysocolla, malachite,

hematite, and calcite in northwest-trending, steeply dipping shear zones in lower-plate mylonitic gneiss of the Buckskin-Rawhide detachment fault (Spencer and Welty, 1986, p. 196).

The Planet metallic mining disrict is about 7 mi northeast of the study area (fig. 1). Production from the district totalled 1,010,000 tons of ore that contained 19,520,000 lb of copper, 600 oz of silver, and 400 oz of gold. Copper carbonates, silicates, and sulfides with quartz and calcite occur in disseminations, veinlets, and replacement bodies of hematite in the upper plate of the Buckskin-Rawhide detachment fault and in northwest-trending shear zones related to the detachment fault (Spencer and Welty, 1986, p. 196).

The Pride metallic mining district is about 8 mi east of the northeastern part of the study area (fig. 1). Production from the district totalled 40 tons of ore that contained 20 lb of copper, less than 100 oz of silver, and less than 100 oz of gold. Malachite, chrysocolla, hematite, and quartz occur in both lower and upper plates of the detachment fault, in northwest-trending, high-angle shear zones (Spencer and Welty, 1986, p. 196).

As of March 1989, 18 claims were on file with the BLM, but no evidence of any current mining activity was found in the study area (pl. 1). Cyprus Mining Co. is presently evaluating the Mammon Mine area, just outside the southwestern study area boundary, as a possible copper leaching site (Jim Jones, owner, Mammon Mine, Parker, AZ, oral commun., Jan. 1989).

APPRAISAL OF SITES EXAMINED

No mineral resources were identified in the study area. Copper, gold, and silver occurrences are associated with upper- and lower-plate rocks of the Buckskin-Rawhide detachment fault, which underlies the study area. Rock-chip samples were taken from the lower-plate rocks exposed at the Mammon Mine

adjacent to the southwestern part of the study area. Rock-chip samples were also taken from upper-plate rocks exposed along the northwestern part of the study area. Sampled localities are discussed by geographic location.

Mammon Mine area

The Mammon Mine is on three patented mining claims just outside the southwestern boundary of the study area (pl. 1). Several small adits and prospects were found at the mine; however, the main working is an adit about 500 ft in length. The adit was driven on a N. 40° W.-striking, 40° S.W.-dipping shear zone in an isolated outcrop of lower-plate mylonitic gneiss of the Buckskin-Rawhide detachment fault. The zone contains intensely sheared rocks that are heavily stained with iron oxide and secondary copper minerals; calcite and hematite are also present. The shear zone cannot be traced into the study area, and no mineralized rock was found in the basalt overlying the mylonitic gneiss. The mylonitic gneiss does not crop out anywhere in the study area.

Two samples were collected in the study area east of the Mammon Mine (pl. 1, sample nos. 15-16). Sample 15, a select sample from the dump of a 48-ft-deep shaft in basalt, contained 1- to 4-in.-thick veinlets of hematite. Gold was detected (5 ppb), and elevated concentrations of copper and zinc were present: 8,280 ppm (0.83%) copper and 1,805 ppm (0.18%) zinc (table 1). The copper and zinc are probably associated with the hematite veinlets; no structure was visible in the shaft. Sample 16, collected from a pit dug in reddish basalt, contained no significant concentrations of any elements.

Gray Eagle Mine area

A 41-ft-long adit, a shaft, and a prospect pit were found outside of the study area, but within 1/4 mi of the western boundary, near the Gray Eagle

Mine (pl. 1, sample nos. 11-14). The workings are in the upper plate of the Buckskin-Rawhide detachment fault, in Paleozoic and Mesozoic limestones and shales. East to northeast-trending high-angle faults and fractures in the limestone and shale contain azurite, calcite, chrysocolla, malachite, and hematite. These structures trend toward the study area, but could not be traced past the fault exposed in the workings.

Four samples were collected from the workings (table 1, sample nos. 11-14). Gold concentrations range from less than 5 ppb to 1,560 ppb (0.045 oz/st). The high concentration was in a select sample from the dump of a pit. Copper concentrations range from 1,790 ppm (0.18%) to over 10,000 ppm (greater than 1%). All samples contain elevated lead, silver, and zinc concentrations: lead, from 150 to 876 ppm (0.08%); silver, 2 to 140 ppm (4.0 oz/st); zinc, 70 to 1,020 ppm (0.10%). These mineralized faults trend toward the study area, and may be present beneath the basalt.

Giers Mountain area

A cluster of workings was found in the extreme northwestern part of the study area on the northwest flank of Giers Mountain (pl. 1, sample nos. 1-10). Four prospect pits and one shallow shaft are just inside the boundary; one adit, one shaft, and one prospect pit are just outside.

The workings are on northwest- to northeast-striking faults in granite in the upper plate of the Buckskin-Rawhide detachment fault. The faults pinch and swell from 2 to 4 ft in thickness, but exposures are less than 100 ft long. Azurite, malachite, and limonite are common in the gouge of the faults.

Samples 1 to 10 collected from the faults contained gold concentrations ranging from less than 5 ppb to 6,400 ppb (0.18 oz/st). Copper concentrations range from 42 ppm to greater than 10,000 ppm (greater than 1%). Lead, silver,

and zinc contents are generally insignificant (table 1; fig. 2, nos. 1-10). Similar mineralized faults containing these elements may be present beneath the basalt elsewhere in the study area. No resources were calculated because of the short strike lengths of the faults and sporadic element concentrations.

Miscellaneous prospects

Two other pits are within the southern part of the study area. One pit, in sec. 11, T. 9 N., R. 18 W., is in basalt; no structure was noted and no significant metallic concentrations were found in a sample from the pit (pl. 1; table 1, sample no. 17).

The other pit, in sec. 6, T. 9 N., R. 17 W., is in basalt; no structure was found. No unusual concentrations of any element were noted in the sample from the pit (pl. 1; table 1, sample no. 18).

Sand and gravel

Sand and gravel deposits of Quaternary age are present in drainages in the study area; however, there is presently no demand for material near the study area. Greater volumes of similar sand and gravel are present outside the study area and are more readily accessible for development. Therefore, any increase in local demand for sand and gravel would not neccessarily place a demand on the deposits in the study area.

CONCLUSIONS

No mineral resources were identified in the study area. About 85% of the study area is covered by basalt and is void of near-surface mineralized rock. Along the western study area boundary, high-angle faults and fractures in the upper and lower plates of the Buckskin-Rawhide detachment fault contain copper, gold, and silver occurrences. Based on the proximity of these deposits to the study area and the existence of the Buckskin-Rawhide

detachment fault under the basalt in the study area, similar copper, gold, and silver occurrences could also be present in the subsurface of the study area.

The USGS assessed the study area as having zero to low potential for oil and gas accumulation. Sand and gravel is present in drainages in the study area; however, similar materials are outside the study area, nearer to market places.

RECOMMENDATIONS FOR FURTHER STUDY

Detailed geological, geophysical, or geochemical studies, followed by subsurface testing of delineated target areas should be done inside the western boundary of the study area to see if copper, gold, and silver mineralization, similar to that outside the area, is present at depth.

REFERENCES

Bancroft, H., 1911, Reconnaissance of the ore deposits in northern Yuma County, Arizona: U.S. Geological Survey Bulletin 451, 130 p.

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, Woode Toll, Netta, and Everson, B. A., 1983, Metallic mineral districts and production in Arizona: Arizona Bureau of Geology and Mineral Technology, Bulletin 194 54 p.

Kreidler, T. J., 1986, Mineral investigation of a part of the Cactus Plain Wilderness Study Area (AZ-050-014A/B), La Paz County, Arizona: U.S. Bureau of Mines Open-File Report MLA 64-86, 11 p.

_____1987, Mineral investigation of the East Cactus Plain Wilderness Study Area (AZ-050-017), La Paz County, Arizona: U.S. Bureau of Mines Open-File Report MLA 81-87, 10 p.

_____1989, Mineral investigation of the Planet Peak Wilderness Study Area, (AZ-050-013) La Paz County, Arizona: U.S. Bureau of Mines Open-File Report MLA 9-89, 34 p.

Lehman, N. E., Spencer, J. E., and Welty, J. W., 1987, Middle Tertiary mineralization related to metamorphic core complexes and detachment faults in Arizona and California: Society of Mining Engineers Preprint 87-21, 9 p.

Ryan, G. S., 1989, Mineral investigation of a part of the Swansea Wilderness Study Area (AZ-050-015A), La Paz and Mohave Counties, Arizona: U.S. Bureau of Mines Open-File Report MLA 12-89, 19 p.

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 902 A-P, p. 1C-22C.

Spencer, J. E., 1987, Compilation geologic map of the Buckskin and Rawhide Mountains, west central Arizona, Arizona Bureau of Geology and Mineral Technology, scale 1:100,000.

Spencer, J. E., and Welty, J. W., 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, p. 195-198.

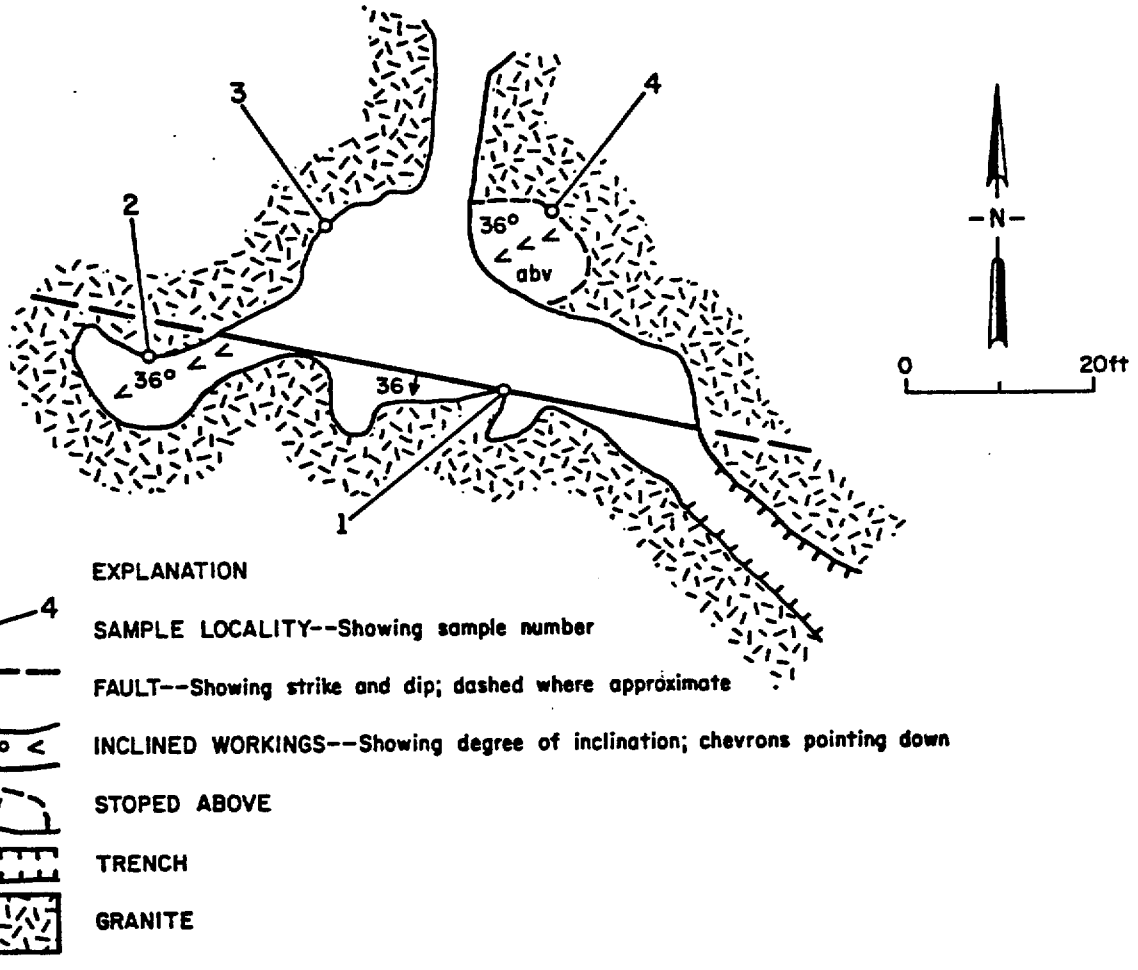


FIGURE 2

Sample No.	Type	Length (ft)	Assay data Au (ppb)	Ag (ppm)	Ba (ppm)	Cu (ppm)	Pb (ppm)	Mo (ppm)	Zn (ppm)	Description
1	Chip	2.0	860	1.5	310	>10,000	2	<1.0	45	Azurite, malachite, and hematite in N. 75° W.-striking, 36° SW-dipping fault; granite (sample length is also fault thickness).
2	do.	3.4	170	1.5	1,730	207	14	<1.0	65	Do.
3	do.	4.0	6,400	2.0	3,720	>10,000	2	<1.0	79	Do.
4	do.	2.3	191	1.0	1,100	8,860	2	9.0	47	Do.

[Au was determined by the fire assay/atomic absorption method; all other elements were determined by inductively coupled plasma-atomic fluorescence spectroscopy. <, less than, >, greater than; Au, gold; Ag, silver; Ba, barium; Cu, copper; Pb, lead; Mo, molybdenum; Zn, zinc.]

Figure 2.--Adit along northwest boundary of the study area, showing sample localities and analytical results and descriptions.

Table 1.--Analytical data and description of samples not shown on figure 2, from in and near the Gibraltar Mountain study area, La Paz County, Arizona.

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

Sample			Assay Data							
No.	Type	Length (ft)	Au (ppb)	Ag	Ba	Cu	Pb	Mo	Zn	Description
						(ppm)				
5	Chip	5.0	<5	0.5	1,050	42	4	<1	32	15-ft-deep shaft in granite; iron oxide and malachite stain; no structure visible.
6	do.	.8	750	3.0	5,020	>10,000	2	51	69	20-ft-long pit exposing N. 40° E.-striking, 66° SE.-dipping fault in granite; azurite and malachite stain and minor hematite.
7	do.	3.1	2,100	2.0	4,310	6,060	2	5	56	Pit exposes N. 40° W.-striking, 60° SW.-dipping fault in granite; azurite, iron oxide, malachite staining.
8	do.	2.0	2,400	2.5	1,080	4,850	12	9	62	Pit exposes N. 59° E.-striking, 56° SE.-dipping fault in granite; azurite, and malachite staining.
9	do.	1.4	960	2.0	>10,000	>10,000	2	38	95	Do.
10	do.	3.0	5	1.0	8,700	95	12	3	91	15-ft-long pit exposes N. 5° E.-striking, vertical-dipping fault in granite; iron oxide stain.
11	do.	3.6	30	58.0	>10,000	2,080	150	<1.0	70	Pit exposes N. 20° W.-striking, 72° E.-dipping fault in limestone; iron oxide and malachite stain, minor hematite.
12	Select	---	1,560	140.0	2,330	>10,000	876	6	918	High grade from dump of a pit dug in limestone; azurite, malachite, and iron oxide stain.
13	Chip	3.4	<5	10.0	5,190	>10,000	520	3	1,020	41-ft-long adit on E.-W.-striking, 55° N.-dipping fault in limestone; calcite, iron oxide, and malachite stain.

Table 1.--Analytical data and description of samples not shown on figure 2, from in and near the Gibraltar Mountain study area, La Paz County, Arizona--Continued

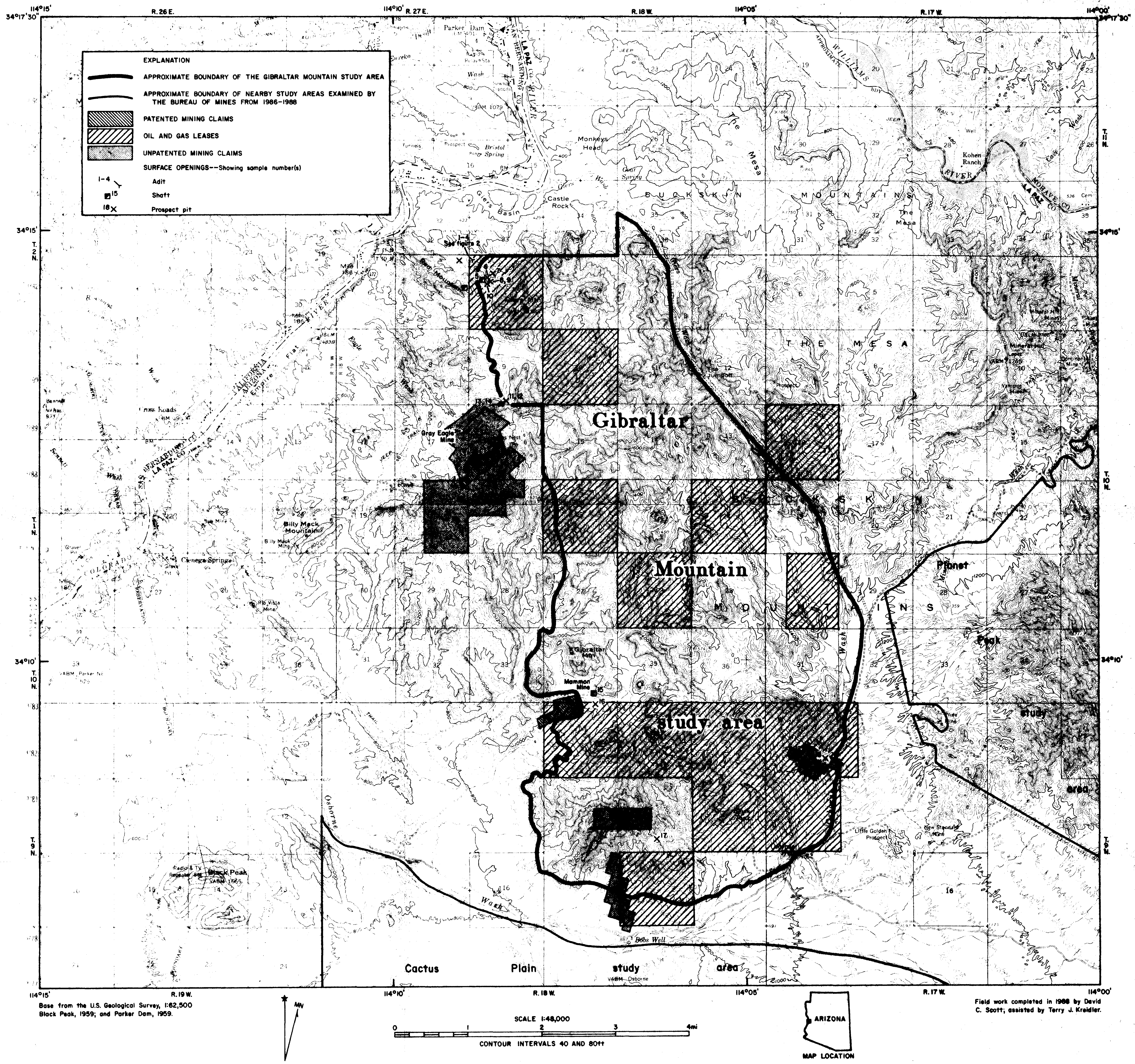
Sample			Assay Data							
No.	Type	Length (ft)	Au (ppb)	Ag	Ba	Cu	Pb	Mo	Zn	Description
						(ppm)				
14	Select	---	<5	2.0	520	1,790	150	<1	138	Sample from dump of adit, same as sample no. 13; contains selected chips of hematite.
15	do.	---	5	3.5	230	8,280	4	5	1,805	Sample from dump of 48-ft deep shaft in black basalt; 1 to 4 in. veinlets of hematite.
16	Chip	3.4	<5	.5	510	26	2	2	127	Pit in red basalt; minor calcite; no structure.
17	Select	---	<5	.5	310	54	2	4	111	Pit in black basalt; no structure or visible minerals.
18	do.	---	<5	.5	1,670	17	16	6	152	Pit in basalt; minor manganese oxide; no structure.

APPENDIX--Analytical limits, Chemex Laboratories, Sparks, Nevada, (gold and silver were determined by fire assay/atomic absorption spectroscopy, all other by inductively coupled plasma-atomic fluorescence spectroscopy).All concentrations reported in ppm, unless otherwise noted.

Element	Detection limit	Upper limit
Au	5.0 ppb	10,000
Ag	0.5	500
Al	0.1%	25%
Ba	10.0	10,000
Be	0.5	10,000
Bi	2.0	10,000
Ca	0.1%	25%
Cd	0.5	10,000
Co	1.0	10,000
Cr	1.0	10,000
Cu	1.0	10,000
Fe	0.1%	25%
K	0.1%	20%
Mg	0.1%	25%
Mn	1.0	10,000
Mo	1.0	10,000
Na	0.1%	10%
Ni	1.0	10,000
P	10.0	10,000
Pb	2.0	10,000
Sr	1.0	10,000
Ti	0.1%	10%
V	1.0	10,000
W	10.0	10,000
Zn	2.0	10,000

DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

OPEN FILE REPORT
MLA 18-89
PLATE 1



MINE AND PROSPECT MAP OF THE GIBRALTAR MOUNTAIN STUDY AREA, LA PAZ COUNTY, ARIZONA

BY

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

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