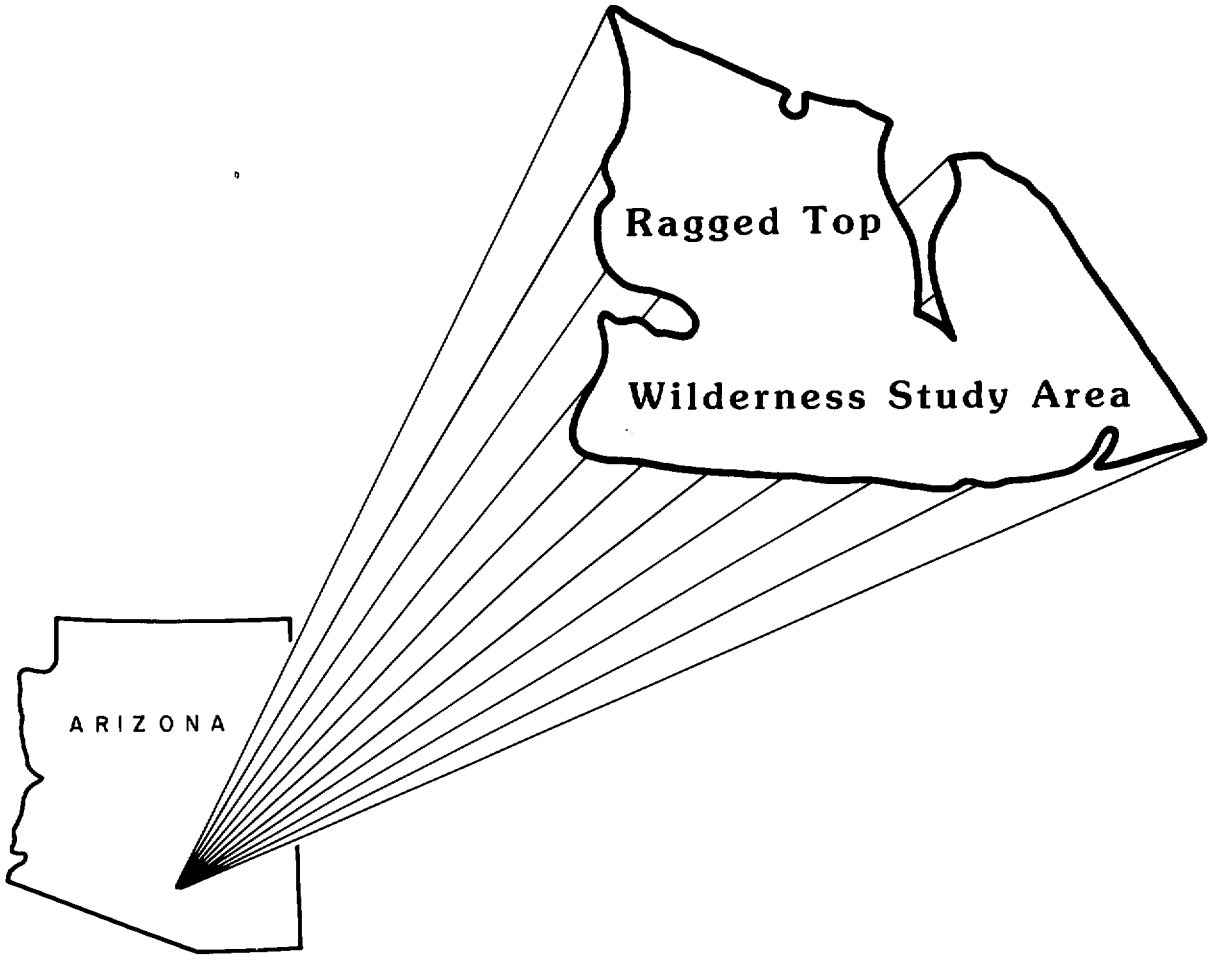
MLA 80-87

Mineral Land Assessment
Open File Report/1987

Mineral Investigation of the Ragged Top Wilderness Study Area (AZ-020-197), Pima County, Arizona



BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL INVESTIGATION OF THE RAGGED TOP WILDERNESS STUDY AREA (AZ-020-197), PIMA COUNTY, ARIZONA

by

Terry J. Kreidler

MLA 80-87
1987

Intermountain Field Operations Center
Denver, Colorado

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

BUREAU OF MINES
David S. Brown, Acting 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 the Ragged Top Wilderness Study Area (AZ-020-197), Pima 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 Branch of Mineral Land Assessment (MLA), Intermountain Field Operations Center, P.O Box 25086, Denver Federal Center, Denver, CO 80225.

CONTENTS

ILLUSTRATIONS

TABLES

LIST OF ABBREVIATIONS USED IN THIS REPORT

°	degree
ft	foot
in.	inch
lb	pound
mi	mile
oz	ounce
ppb	part per billion
ppm	part per million
%	percent

MINERAL INVESTIGATION OF THE RAGGED TOP WILDERNESS STUDY AREA (AZ-020-197), PIMA COUNTY, ARIZONA

by

Terry J. Kreidler, Bureau of Mines

SUMMARY

In accordance with the Federal Land Policy and Management Act of 1976, and at the request of the Bureau of Land Management, the Bureau of Mines conducted a mineral investigation in May 1987 to appraise the mineral resources of the 4,460-acre Ragged Top Wilderness Study Area.

No mineral resources were identified in the wilderness study area. Base- and precious-metal anomalies and enrichment in arsenic and barium in samples from in and near the study area are related to alteration halos surrounding the porphyry copper deposits at the Silver Bell Mine to the south and west. A barite occurrence in the southwestern part is not now or in the foreseeable future of commercial interest.

INTRODUCTION

In May 1987 the Bureau of Mines, in a cooperative program with the U.S. Geological Survey (USGS), conducted a mineral investigation of the 4,460-acre Ragged Top Wilderness Study Area (WSA), Pima County, Arizona, on lands administered by the Bureau of Land Management (BLM). 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. The USGS will open file the results of its report separately. A joint report, to be published by the USGS, will integrate and summarize the results of both surveys. This report presents the results of the Bureau's study, which was completed prior to the USGS investigation.

Geographic and geologic setting

The Ragged Top WSA is on the northeast side of the Silver Bell Mountains, about 3 mi northeast of the Silver Bell Mine, a porphyry copper deposit. The WSA is about 40 mi west of Tucson, AZ, and about 28 mi south of Casa Grande, AZ. Access is via the Silver Bell Road from Interstate Highway 10 (fig. 1).

Topography in the northern and eastern parts of the WSA is desert pediment, a rolling alluvial plain of low relief. The southeastern part is marked by the Ragged Top, a steep-sloped, jutting outcrop of high relief. Elevations range from 3,907 ft on Ragged Top to about 2,140 ft at the northwestern corner. The climate, typical of the Sonoran desert, is very hot and dry (about 8 in. of precipitation a year); vegetation is mostly cactus and desert brush.

The Silver Bell Mountains, a small, northwest-trending range in the Basin and Range physiographic province, comprise a complexly folded and faulted series of igneous, metamorphic, and sedimentary rocks ranging in age from Precambrian to Quaternary. Copper-lead-zinc-silver deposits occur in a relatively narrow band along the southwest flank of the range. Here, a thick sequence of Paleozoic- and Mesozoic-age clastic and carbonate sediments have been deformed and intruded by a series of mineralizing Laramide- and Tertiary-age stocks, dikes, and sills. (See Keith, 1974, p. 44-45.)

Ragged Top is an erosional remnant of Tertiary rhyolite, perhaps a volcanic plug or subvolcanic stock. Other rocks in the WSA include Precambrian granitics, mid-Tertiary sediments, and Laramide and Tertiary volcanics of intermediate composition. A northeast-trending fault cuts through the center of the WSA. (See Cruver and others, 1982, p. 98.)

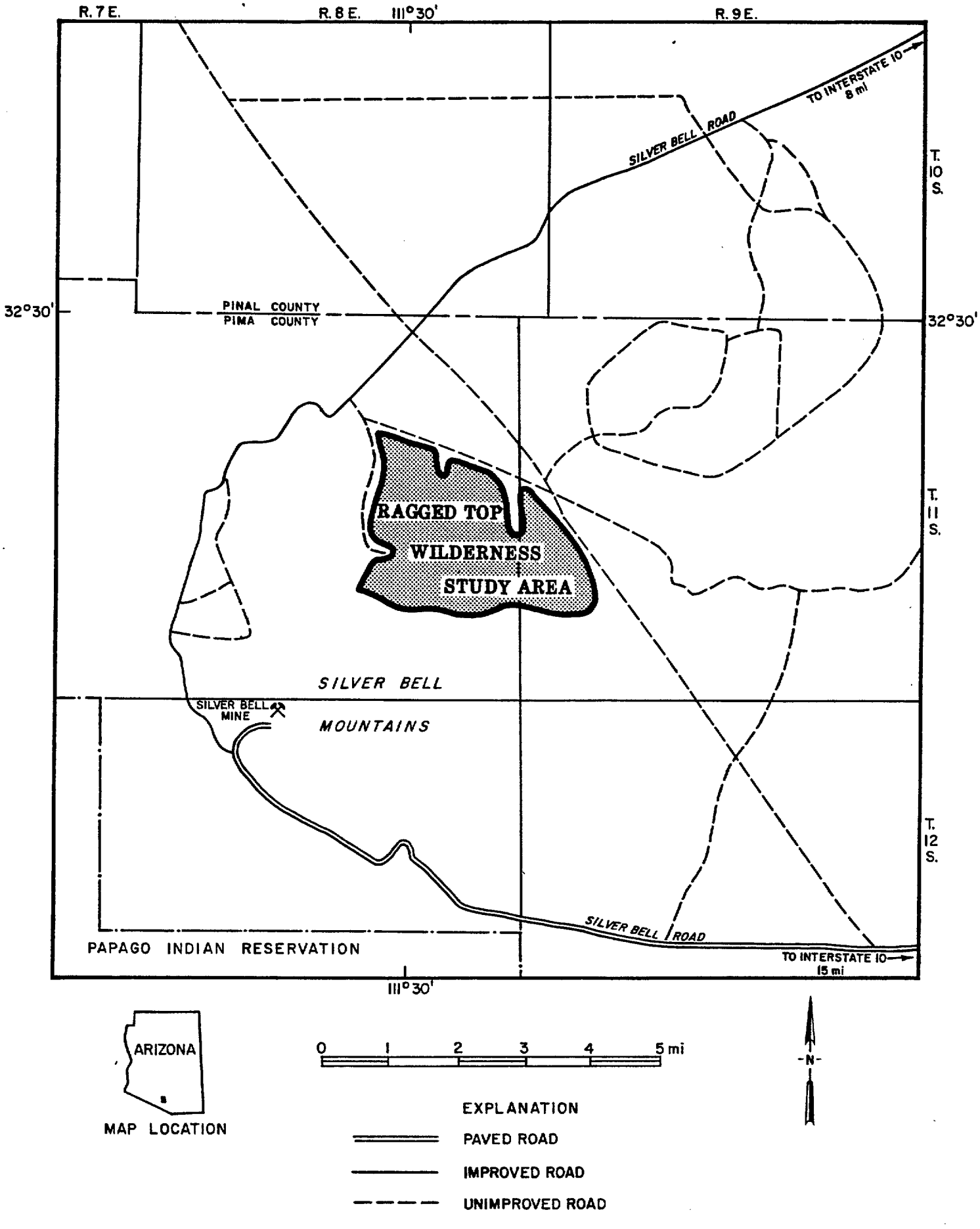


Figure 1.--Index map of the Ragged Top Wilderness Study Area, Pima County, Arizona.

Previous work

Previous geologic investigations in the Silver Bell Mountains centered on the copper deposits on the southwest flank. Stewart (1912) did the first comprehensive studies of the Silver Bell mining district. Richard and Courtright (1966) studied the structure and mineralization of both the Oxide and El Tiro porphyry deposits that make up the Silver Bell Mine; Graybeal (1982) discussed the geology of the El Tiro deposit. The only known previous study of the WSA is the geology, energy, and minerals (GEM) report on the area by Cruver and others (1982) done under contract for the BLM.

Methods of investigation

Bureau personnel reviewed sources of minerals information including published and unpublished literature, Bureau files, and mining claim and oil and gas lease records at the BLM State Office in Phoenix. Discussions on the mineral occurrences in the study area were held with BLM personnel at the Phoenix District Office.

Field work, completed in eight employee-days, consisted of mapping and sampling mines and prospects. Twenty-four samples were taken, 16 from the Ragged Top Mine and 8 from prospects, 4 inside and 4 outside the WSA. All samples were analyzed for gold, silver, and 32 other elements by neutron activation; 4 for copper, lead, zinc, manganese, molybdenum, and silver by direct coupled plasma emission spectroscopy; and 20 for copper, lead, and zinc by wet chemistry and atomic absorption. Analyses were done by Bondar-Clegg, Lakewood, CO. Complete analytical data are available for inspection at the U.S. Bureau of Mines, Intermountain Field Operations Center, Building 20, Denver Federal Center, Denver, CO.

Mining and leasing activity

The nearest mining district to the study area is the Silver Bell, about 1 mi south and west (pl. 1). The first production from the district came in 1865 when oxidized copper ores containing minor lead-silver concentrations were mined at the Boot Mine from replacement deposits in garnetized limestone. By 1909 the economic possibilities of low-grade disseminated copper in igneous rocks were recognized, and over the next three years, extensive churn drilling partially delineated the Oxide and El Tiro ore bodies of the Silver Bell Mine, which at that time were subeconomic. However, production from vein and replacement ore bodies similar to those at the Boot Mine continued intermittently until 1930. Asarco began further exploration drilling on the Silver Bell porphyry copper deposits in 1948 and production in 1954. (See Richard and Courtright, 1966, p. 157.) The mine has been on standby since 1984; the only production since then has been from precipitate recovery (Asarco annual report, 1986). Total production from the district, 1885-1981, amounts to 1.3 billion lbs of copper; about 50 million lbs of lead, zinc, and molybdenum combined; about 6 million oz of silver; and about 2,000 oz of gold (Keith and others, 1983, p. 48). Recently, Asarco drilled out another porphyry copper body, the North Silver Bell deposit, in sec. 33, T. 11 S., R. 8 E., less than 1 mi southwest of the WSA. The company has plans for future development of the deposit pending further increases in the price of copper (S. A. Anzalone, Asarco, Inc., Tucson, AZ, written commun., 1987).

Within the WSA, little mining activity has taken place. Of a block of mining claims covering the Ragged Top Mine area, 21 lie wholly or partly in the WSA (pl. 1). The history of the mine is not known beyond the fact that it was previously known as the Franco Riqueza Claims and reportedly produced some

copper-lead-zinc ore (Cruver and others, 1982, p. 98). South of the Ragged Top Mine are two barite prospects, one pit, and one shallow shaft; it is unlikely there was any production.

There are no oil and gas leases in the vicinity of the wilderness study area. Ryder (1983) rated the petroleum potential of the study area as zero because it is in a region intruded by Mesozoic- and Tertiary-age igneous rocks.

APPRAISAL OF SITES EXAMINED

Sites examined include the Ragged Top Mine, two barite prospects, and five other prospect pits. Geochemical anomalies in the samples from these sites indicate that the southwestern part of the WSA is in the outer part of the propylitic alteration zone surrounding the three ore bodies of the Silver Bell Mine.

Ragged Top Mine

The Ragged Top Mine is in the "cherry stem" on the western boundary of the WSA, in secs. 23 and 26, T. 11 S., R. 8 E., and can be reached by way of a four-wheel-drive road from the Silver Bell Road (pl. 1). Workings consist of two adits, and a shallow prospect shaft. The upper adit, 95 ft long, was driven along a mineralized zone and ends in a partially collapsed and filled winze, now only 30 ft deep. The lower adit, about 500 ft long and 67.5 ft below the upper adit, is a crosscut that intersects the mineralized zone approximately 300 ft from the portal (fig. 2). Sixteen samples were taken in the mine, all but two (fig. 2, no. 17 and 18) from the mineralized zone.

An alteration zone surrounds the deposit, extending over an area about 200 ft in diameter. Observed from a distance, this zone appears yellowish-orange, a color due in large part to altered and weathered sulfides, particularly pyrite.

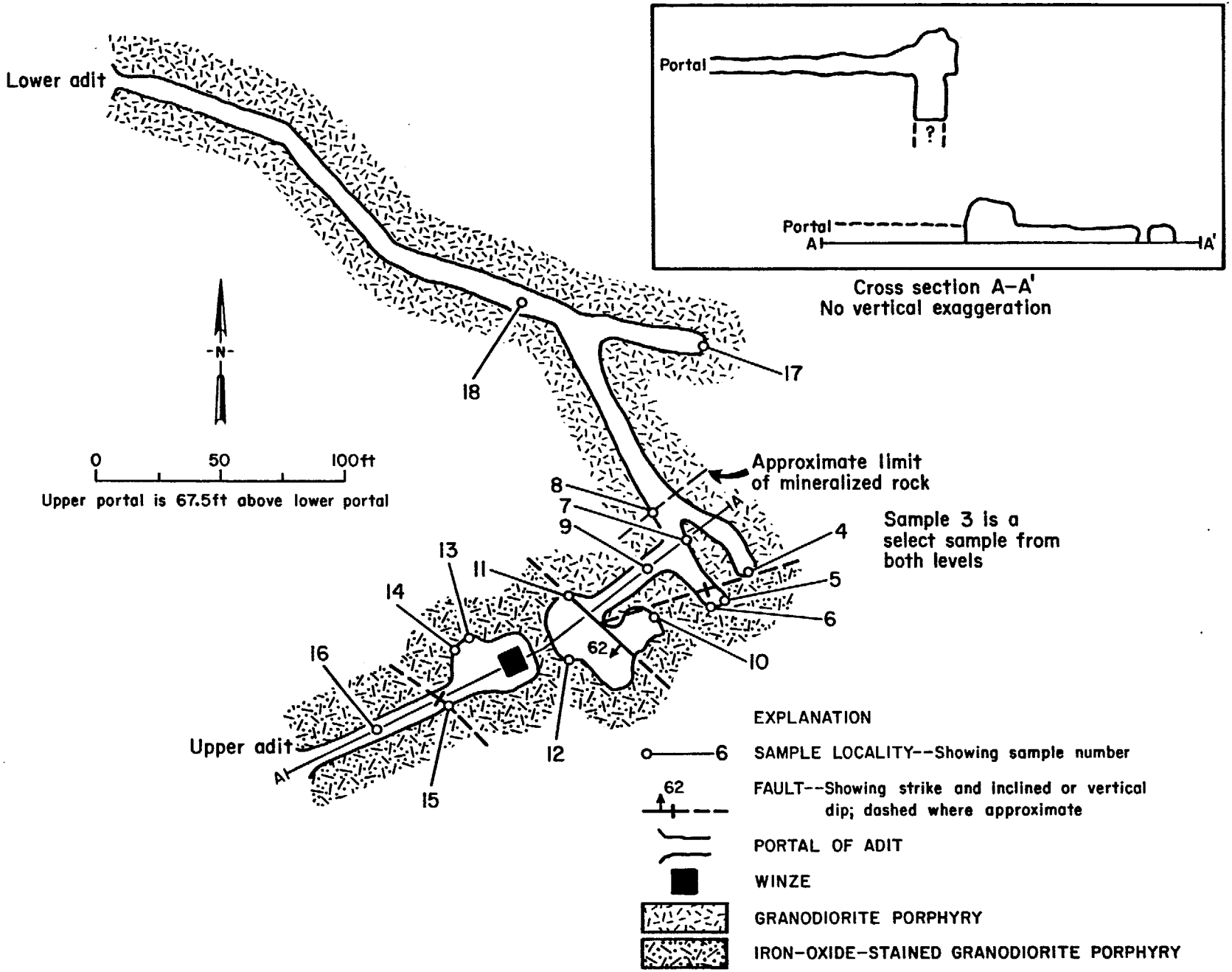


Figure 2.--The Ragged Top Mine.

Sphalerite, galena, and minor amounts of chalcopyrite occur in the mineralized zone as small irregular-shaped pods and veinlets filling fractures in a weathered and altered granodiorite porphyry. A select sample of sulfides was taken from several veinlets and pods in both levels to ascertain the base-metal content of the ore minerals; it contained 29% zinc, 15.3% lead, and 1.56% copper (table 1, no. 3). However, the average metal content (0.95% lead, 0.82% zinc, and 0.24% copper) of the remaining 13 samples from the

Table 1.--Data for samples from the Ragged Top Mine, Ragged Top Wilderness Study Area, Pima County, Arizona.

[Gold (Au), silver (Ag), barium (Ba) and arsenic (As) determined by neutron activation, detection limits 5 ppb, 5 ppm, 100 ppm, and 1 ppm respectively; copper (Cu), lead (Pb), and zinc (Zn) determined by wet chemistry and atomic absorption, detection limits 0.01%; symbols used: ---, not detected.]

Sample No.	Length (in.)	Au ppb	Ag ppm	Cu percent	Pb percent	Zn percent	Ba ppm	As ppm
3	select	58	8	1.56	15.3	29.0	760	20
				Mineralized zone				
4	45	66	7	.08	.21	.49	820	34
5	62	24	---	.01	.05	.08	1100	24
6	55	35	7	.01	.01	.14	890	33
7	44	75	25	.13	1.12	1.39	250	28
8	42	4050	190	1.37	4.42	.98	390	35
9	45	70	---	---	---	---	850	39
10	38	84	10	.20	.56	.54	700	34
11	48	3660	140	.69	2.32	2.70	---	33
12	30	597	36	.21	.41	1.06	380	41
13	33	240	5	.19	3.15	1.65	600	39
14	54	4270	240	.04	.26	.22	---	29
15	52	140	10	.06	.85	.83	300	33
16	42	170	12	.16	.61	.58	850	38
				Nonmineralized zone				
17	37	64	---	---	---	.01	1100	38
18	39	11	---	.01	---	.01	880	8

mineralized zone (table 1, no. 4-16) shows the sparse concentration of the metals in the rock, even though lead and zinc contents are locally high enough to be of possible economic interest (table 1).

Of the 13 samples from the mineralized zone (table 1, no. 4-16); 3 contain concentrations of gold and silver far above the average for the other samples (nos. 8, 11, and 14). The average gold content of the 10 low-gold samples is 141.7 ppb; the 3 anomalous samples averaged nearly 4,000 ppb. The average silver content in the 10 low-silver samples is 11.8 ppm; the 3 anomalous samples average 190 ppm. Several samples have greater than 1% copper, lead, and zinc. There is no apparent correlation between precious-metal content and base-metal content.

Arsenic and barium are both highly mobile in a mineralizing environment, forming halos around deposits, and are often used as a geochemical-prospecting tool to locate deposits of base and precious metals. All 16 samples from the Ragged Top Mine have higher than average arsenic content, and ten samples, including the two from the nonmineralized zone, have higher than average barium content. The average content for an igneous rock of intermediate composition is 2 ppm arsenic and 500 ppm barium (Levinson, 1980, p. 865).

The erratic nature and small exposed size of this occurrence precludes the identification of a base- or precious-metal resource at the Ragged Top Mine. However, the nature of the occurrence is consistent with being in the propylitic alteration zone of a large porphyry copper ore body.

Barite prospects

Two barite prospects are in the WSA (sec. 27, T. 11 S., R. 8 E.) approximately 2,500 ft west southwest of the Ragged Top Mine, (pl. 1, nos. 19-21).

The northernmost working (pl. 1, no. 19, 20), a partially collapsed shaft about 30 ft deep, was sunk on a 4.5-ft-wide, vuggy quartz vein. The vein strikes N. 15-20° E., dips vertically, and contains pods of barite. The barite pods vary in size from a few inches to about 1.5 ft. Other minerals observed in the vein are pyrite, hematite, and limonite. The vein can be traced on the surface for about 20 ft before it disappears beneath the alluvium. A select sample of barite pods contained 48.6% barium, equivalent to 82.6% barite, (table 2, no. 20); a grab sample of dump material, primarily vein quartz, contained 5,100 ppm barium (0.86% barite), less than 36 ppb gold, and less than 5 ppm silver (table 2, no. 19).

The second working is a prospect pit (pl. 1, no. 21) about 700 ft southwest of the shaft on a quartz-barite vein 2-6 ft wide. Although untraceable on the surface, it appears to be an extension of the vein exposed at the shaft. The strike of the vein is N. 21° E. and it dips vertically. Unlike the vein at the shaft, the quartz and barite here are more homogeneous. A sample of the vein contained 4.8% barium (8.2% barite) (table 2, no. 21).

No barite resource was identified. The lowest commercial grade in use today is 92% $BaSO_4$ (equivalent to a specific gravity of 4.2) for use in drilling fluids, other uses require grades between 96% and 98% (Brobst, 1983, p. 486, 496). Barite exposed in the prospect pit is of too low a grade to be commercially of interest. Selective mining of the vein and hand sorting of the barite pods at the shaft would yield a concentrate containing about 80% $BaSO_4$, requiring further beneficiation to bring it up to minimum commercial grade. Even so, the exposure at this site is limited and the extent of the pod-bearing part of the vein is not known. A drilling program would be

required to evaluate the extent and grade of barite mineralization, but the most crucial factor in any future development of this vein would be in establishing a local market for the final product. This seems unlikely as barite has not been mined in Arizona for several years, and as of September 1987, all domestic barite production comes from bedded and residual deposits; none is mined from veins (S. G. Ampian, U.S. Bureau of Mines, 1987, personal commun.).

Table 2.--Data for samples 1, 2, and 19-24 from the Ragged Top Wilderness Study Area, Pima County, Arizona.

[Gold (Au), silver (Ag), and barium (Ba) determined by neutron activation, detection limits 5 ppb, 5 ppm, and 100 ppm respectively; copper (Cu), lead (Pb), zinc (Zn), and manganese (Mn) determined by wet chemistry and atomic absorption, detection limits 0.01%; symbols used: na, not analyzed; ---, not detected; >, greater than. Ba in ppm unless otherwise noted.]

Sample No.	Length (in.)	Au ppb	Ag ppm	Cu percent	Pb percent	Zn percent	Mn percent	Ba ppm	As ppm
1	grab	---	---	na	na	na	27.5	>3%	489
2	26	---	---	0.14	0.02	0.01	.3	1,100	71
19	grab	---	9	---	.1	.02	na	5,100	27
20	select	---	---	na	na	na	na	48.6%	45
21	35	---	---	na	na	na	na	4.8%	16
22	27	170	63	1.3	4.2	3.1	na	1,400	10
23	55	220	---	.02	.23	.26	na	3,200	---
24	42	34	280	1.8	3.3	4.5	na	1,800	---

This localized enrichment in barium may be related to the mineralizing system responsible for the mineral occurrences at the Ragged Top Mine.

Other prospects

Two prospect pits were found outside the northwestern tip of the WSA (pl. 1, nos. 1, 2). At locality 1, a manganese mineral covered the dump of a small pit dug in an intermediate volcanic rock. None was seen in place; however, indicating the manganese probably occurred in an isolated pod. A sample from the dump contained 27.5% manganese and greater than 3% barium (table 2, no. 1). No resource is indicated.

The second pit was dug in an altered volcanic rock of intermediate composition laced with thin veinlets of quartz or calcite, but no sulfides. A chip sample from the pit did not contain any appreciable metal concentrations (table 2, no. 2).

Three prospect pits are near the southwestern corner of the area. The northernmost pit (pl. 1, no. 22) is in highly altered granodiorite porphyry. Malachite and azurite coat fractures and the rock is heavily iron stained. No structure is apparent, and no sulfide minerals were seen. A chip sample from the pit contained relatively high concentrations of copper (1.3%), lead (4.2%), and zinc (3.1%) (table 2, no. 22).

The remaining two prospects are along the southern boundary, one inside and one outside the WSA (pl. 1, no. 23, 24). Both are pits in an altered, highly fractured volcanic rock of intermediate composition. At locality 23, inside the WSA, fracture surfaces are stained by iron oxide; at locality 24, malachite and azurite as well as a black, amorphous mineral, possibly an oxidized copper mineral, were also observed. Sample 23 did not contain any metal concentrations of interest. Sample 24, however, contained concentrations of copper (1.8%), lead (3.3%), and zinc (4.5%) similar to sample 22 (table 2). No resources were identified.

Samples 22-24 contained an average of 141 ppb gold, and samples 22 and 24 contained 63 and 280 ppm silver, respectively.

All samples from the prospects discussed in this section contained anomalous amounts of barium and all but two (no. 23, 24) contained anomalous arsenic.

CONCLUSIONS

No mineral resources were identified in the Ragged Top Wilderness Study Area.

The geochemical anomalies in the samples from this study area are consistent with those found in the propylitic alteration zone surrounding a large porphyry copper system. Since the mineralized area is within a mile of the North Silver Bell porphyry copper deposit, the alteration is most likely related to that mineralizing system.

The barite-bearing quartz vein is not at this time or in the foreseeable future of commercial value.

REFERENCES

Brobst, D. A., 1983, Barium minerals; in Lefond, S. J., ed., Industrial minerals and rocks: New York, American Institute of Mining, Metallurgical, and Petroleum Engineers, p. 485-501.

Cruver, S. K., Wodzicki, Antoni, and Krason, Jan, 1982, Geology, energy, and mineral resources assessment of the Wymola area, Arizona: prepared for the Bureau of Land Management by Geoexplorers International, Denver, CO, 109 p.

Graybeal, F. T., 1982, Geology of the El Tiro area, Silver Bell mining district, Pima County, Arizona; in Titley, S. R., ed., Advances in geology of the porphyry copper deposits southwestern North America, Tucson, Arizona, University of Arizona Press, p. 487-505.

Keith, S. B., 1974, Index of mining properties in Pima County, Arizona: Arizona Bureau of Mines Bulletin 189, 156 p.

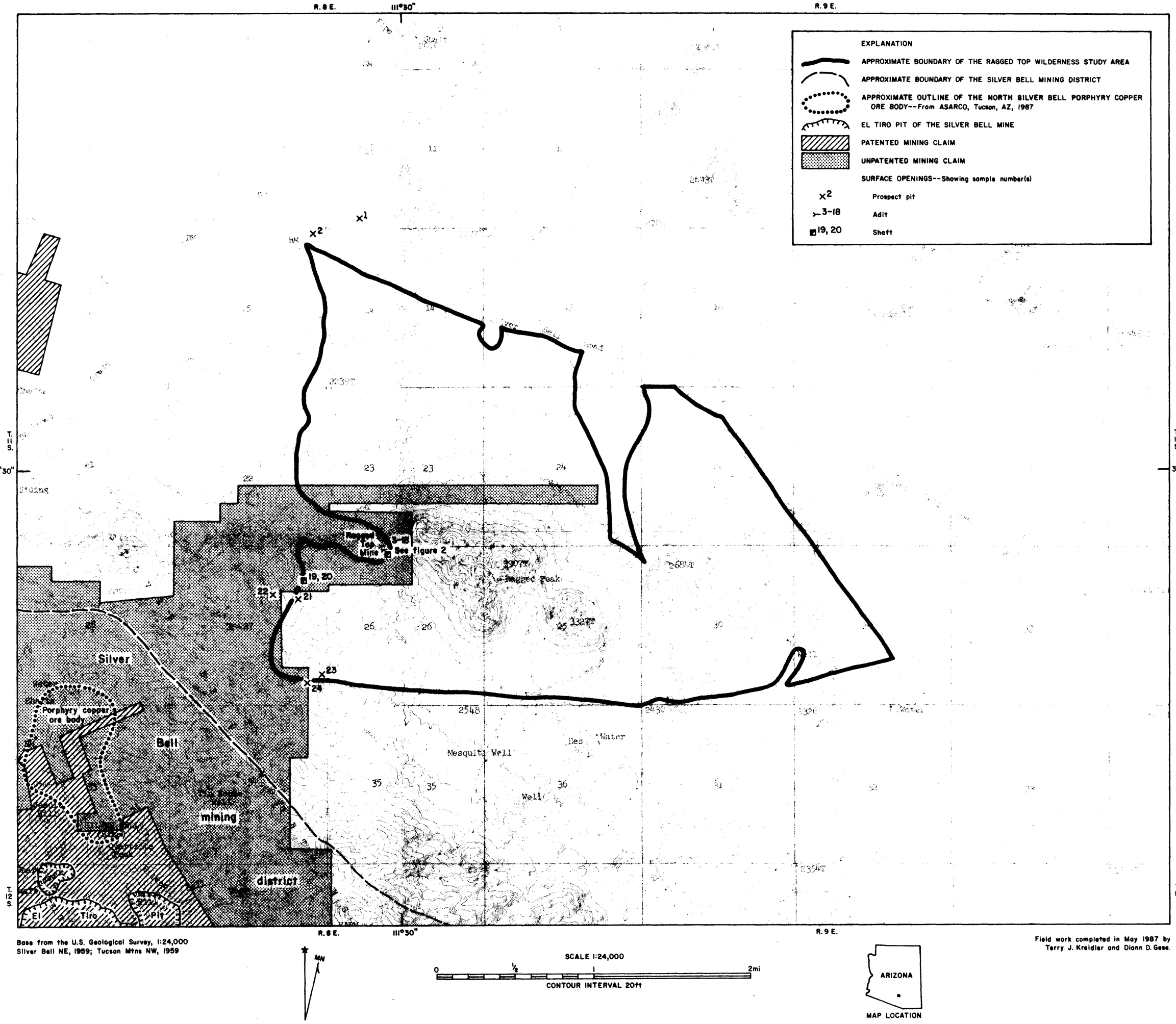
Keith, S. B., Gest, D. E., DeWitt, Ed, Toll, N. W., and Everson, B. A., 1983, Metallic mineral districts and production in Arizona: Arizona Bureau of Geology and Mineral Technology Bulletin 194, 58 p.

Levinson, A. A., 1980, Introduction to exploration geochemistry: Wilmette, Illinois, Applied Publishing Ltd., 924 p.

Richard, Kenyon, and Courtright, J. H., 1966, Structure and mineralization at Silver Bell, Arizona; in Titley, S. R., and Hicks, C. L., eds., Geology of the porphyry copper deposits southwestern North America: Tucson, Arizona, University of Arizona Press, p. 157-163.

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. C1-C22.

Stewart, C. A., 1912, The geology and ore deposits of the Silver Bell mining district, Arizona: American Institute of Mining, Metallurgical, and Petroleum Engineers Bulletin, vol. 65, p. 122-123.



Base from the U.S. Geological Survey, 1:24,000
Silver Bell NE, 1959; Tucson Mtns NW, 1959

MN

SCALE 1:24,000
0 ½ 1 2mi
CONTOUR INTERVAL 20ft

MAP LOCATION

Field work completed in May 1987 by
Terry J. Kreidler and Diann D. Gese.

MINE AND PROSPECT MAP OF THE RAGGED TOP WILDERNESS STUDY AREA, PIMA COUNTY, ARIZONA

BY

TERRY J. KREIDLER, U.S. BUREAU OF MINES

1987