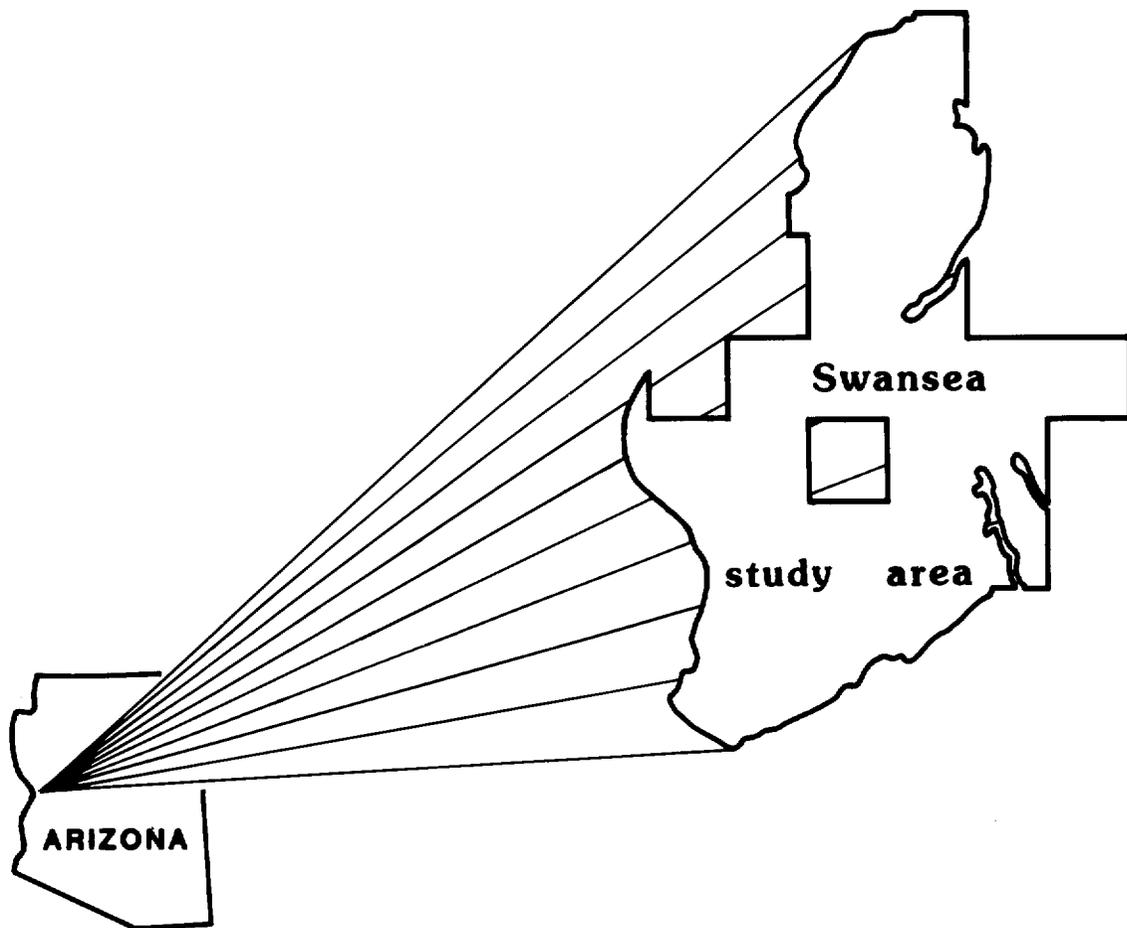


MLA 12-89

Mineral Land Assessment
Open File Report/1989

**Mineral Investigation of a Part of the Swansea
Wilderness Study Area (AZ-050-015A), La Paz
and Mohave Counties, Arizona**



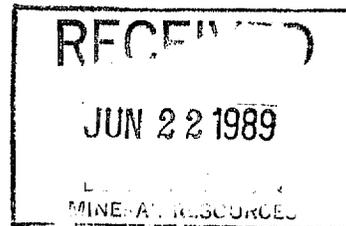
**BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR**

MINERAL INVESTIGATION OF A PART OF THE SWANSEA WILDERNESS STUDY
AREA (AZ-050-015A), LA PAZ AND MOHAVE COUNTIES, ARIZONA

by
George S. Ryan

MLA 12-89
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 Swansea Wilderness Study Area (AZ-050-015A), 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

°	degree	%	percent
ft	foot	oz	troy ounce
mi	mile	oz/st	troy ounce per short ton
ppm	part per million		

MINERAL INVESTIGATION OF A PART OF THE SWANSEA WILDERNESS
STUDY AREA (AZ-050-015A), LA PAZ AND MOHAVE COUNTIES, ARIZONA

by

George S. Ryan, Bureau of Mines

SUMMARY

In August 1987, the Bureau of Mines conducted a mineral investigation of 15,755 acres of the 41,690-acre Swansea Wilderness Study Area, La Paz and Mohave Counties, Arizona. This 15,755 acre area was preliminarily identified as suitable for wilderness and is administered by the Bureau of Land Management. 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).

Prospect pits, adits, and shafts in and near the area were examined and 37 rock-chip and grab samples were taken during this study; however, no mineral resources were identified. The study area is in a recently identified detachment fault region. Studies concerning detachment faults, attendant structures, and mineral suites have increased exploration interest in the region. Of primary interest is gold as evidenced by the discovery of the Copperstone Mine, 33 mi southwest of the study area. Past activity in the region included the production of copper, iron, lead, and manganese. Assay results from samples taken during this study confirm the presence of these elements in the study area. No oil and gas leases are presently active in the study area (August 1988). Sand and gravel along the Bill Williams River and tributaries in the study area contain no unique characteristics and similar deposits are plentiful and nearer to ultimate consumers.

INTRODUCTION

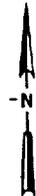
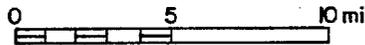
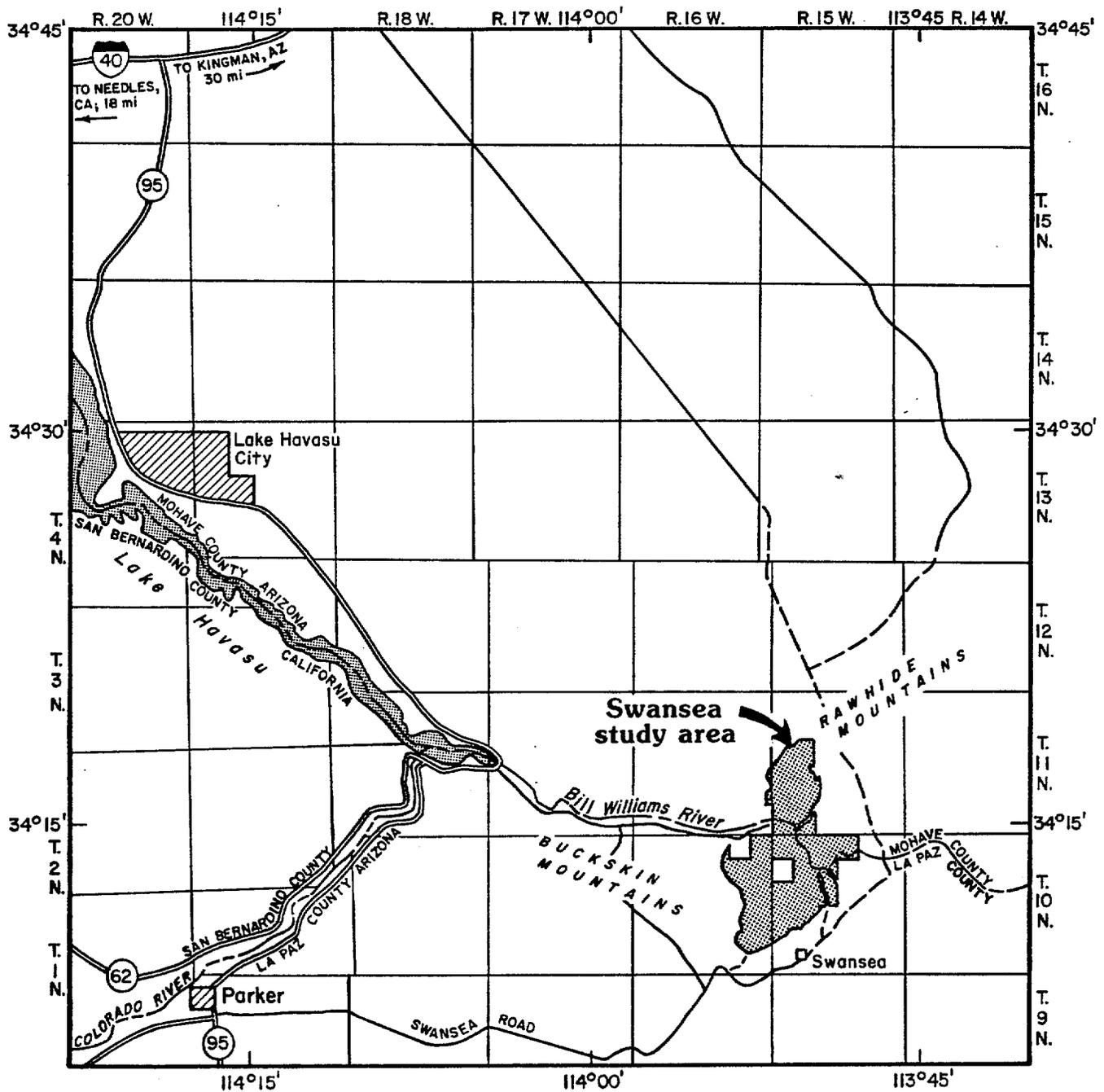
In April 1988, the Bureau of Mines, in cooperation with the U.S. Geological Survey (USGS), conducted a mineral investigation of a part of the Swansea Wilderness Study Area (WSA) in La Paz and Mohave Counties, Arizona, on lands administered by the Bureau of Land Management (BLM), Yuma District Office. The WSA comprises 41,690 acres; the Bureau studied the 15,755 acres deemed preliminarily suitable 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 mineral occurrences 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; 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 both surveys.

Geographic setting

The study area is 25 mi southeast of Lake Havasu City, Arizona and 20 mi east of Parker (fig. 1). Geographically, the study area is in the Buckskin and Rawhide Mountains and is bisected by the Bill Williams River. Alamo Dam, 13 mi east of the WSA, controls the flow of the Bill Williams River and the water level is normally kept low, providing numerous fording points. The part of the study area north of the river is in the Rawhide Mountains in Mohave County and the part south of the river is in the Buckskin Mountains in La Paz County (pl. 1).

The main access to the study area is by Swansea Road east from State Highway 95 south of Parker to the ghost town of Swansea, which is 1 mi south



EXPLANATION

- INTERSTATE HIGHWAY
- STATE HIGHWAY
- IMPROVED ROAD
- UNIMPROVED ROAD

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

of the study area. Another access road exits east from Highway 95 along the south side of the Bill Williams River. The road is blocked at a ranch but bifurcates with a branch road turning south to intersect the Swansea Road. An unimproved pipeline road continues northeast from Swansea skirting the southeast boundary of the study area to a ford across the Bill Williams River and then continues north near the eastern side of the study area. Maps indicate that the area can also be accessed by unimproved roads from the north, northeast, and southeast. A private inholding, a Railroad Grant issued in 1922, consists of sec. 7, T. 10 N., R. 15 W., and has no road access.

Topographically, the study area south of the river consists of ridges and drainages with nonpreferential orientation except along the Bill Williams River where drainages empty to the north into the river. The elevation differential in the southern part of the study area is about 200 ft. North of the river, the study area is dominated by Black Mesa, a tilted block that is capped by volcanics and has a 900-ft-high cliff that extends 2 1/2 mi along the study area boundary.

Methods of investigation

The Bureau's prefield investigation included a review of literature, maps, and unpublished material related to mineral occurrences and mining activities in or near the Swansea study area. Master title plats and BLM recordation were checked to determine if any oil and gas leases and mineral claims were located in the study area.

Two Bureau geologists conducted a twelve-day field examination in the study area and vicinity; including a 1-hour helicopter over-flight. Thirty-seven samples were taken from adits, mines, prospect pits, and outcrops. All samples were analyzed for 32 elements (table 1) by inductively

coupled plasma-atomic emission spectrometry and for gold and silver by fire assay. Eighteen samples were assayed for barium and copper by the atomic absorption method and 5 samples were run for manganese using neutron activation. Values quoted in this report are taken directly from the assayer's report. All testing was done by the Chemex Labs, Inc., Sparks, NV. 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.

Previous areal studies

Although mining began near the study area in the middle and late 1800's, there were no geological studies made until the early 1900's. Early field studies included the detailed mapping of known mines and the correlation of rock types throughout the region by Lee (1908), Bancroft (1911), Blanchard (1913), Ross (1923), and Darton (1925).

Recently, the recognition of detachment faults and attendant gold mineralization initiated a new interest in the regional geological and structural history of the area. Parker (1966), Shackelford (1976; 1977), Rehrig and Reynolds (1977), Spencer and Welty (1985), Wilkins and Heidrick (1982), and Wilkins and others (1986) conducted studies adding to the understanding of the relationships of the metamorphic core complexes and the attendant mineralization of the ore deposits in southern California, southern Nevada, and western Arizona, including the study area. Geologic maps of the immediate vicinity of the Swansea study area include the Planet-Mineral Hill mining area (Spencer and others, 1986) the Lincoln Ranch basin (Spencer and Reynolds, 1986), and Swansea-Copper Penny area in and near the southwest corner of the study area (Spencer and Reynolds, 1987).

Coeval studies by the Bureau of Mines of other study areas in the detachment fault region of west-central Arizona include mineral investigations of: Cactus Plain WSA (Kreidler, 1986), East Cactus Plain WSA (Kreidler, 1987); Planet Peak WSA (Kreidler, 1989), Mohave Wash WSA (McDonnell, 1989), Rawhide Mountains WSA (Tuftin, 1989), and Gibraltar Mountain WSA (Scott, 1989).

MINING HISTORY

Earliest mining near the study area consisted of Indian diggings in the thick hematite layers found at the Mineral Hill and Planet Mine areas 8- and 6-mi west. Also, the "coyote holes" along copper carbonate beds at Mineral Hill are ascribed to the Indians or possibly the Spaniards (oral commun., Paul Konow, Mineral Hill prospector, 1988).

Copper mining recommenced at the Planet-Mineral Hill, and Swansea districts in the 1860's and steady production became the norm during the 1880's. Later, the declining price of copper resulted in the closing of the mines for several years at a time.

The study area is in the original Swansea mining district. Other early mining districts within 12 mi of the study area include Planet-Mineral Hill, and two smaller satellite districts, Clara and Owens, which were developed later south and north of the Swansea mining district. All are currently included in the Santa Maria mining district (Keith, 1978, p. 67). Production figures for the Santa Maria district are: Gold, 1,128 oz; silver, 35,000 oz; copper, 23,000 tons; and manganese, 400 tons of ore at an unspecified grade (Kreidler, 1986, p. 5). This total production includes manganese ore produced during World War II from the Mesa Manganese Prospect along the northeast study area boundary (pl. 1, sample no. 31-34). Although most mining had ceased by 1942 one unidentified mine produced copper until the 1970's (Keith, 1978, p. 71).

In 1987, the Cyprus Minerals Company's Copperstone gold deposit began production 33 mi southwest of the Swansea area. The deposit, located in the upper plate of the Moon Mountain detachment fault, is expected to yield 85,000 troy ounces of gold annually for 6 years (Spencer and others, 1988a, p. 1).

Placer gold has been produced from the Clara mining district, 4 mi southeast of the study area, and placer claims have been located periodically northeast, east, and northwest of the study area; at the time of the Bureau's investigation there was no mining activity in any of the areas.

Although there has been some exploration drilling near the Planet Mine, 6 mi west of the study area in the last 5 years, no mineral development or production has resulted. A small company is currently preparing to operate at Mineral Hill, 8 mi west of the study area, to produce iron and rare-earth minerals (oral commun., Paul Konow, Mineral Hill prospector, 1988). As of July 1988, there were no mining claims staked in the Swansea study area and no exploration activities were observed.

GEOLOGIC SETTING

The Swansea study area is in a region characterized by detachment faults. Detachment faults are low-angle normal faults with a mylonized metamorphic rock in the lower plate, a breccia zone of lower plate material of variable thickness along the contact, and younger sedimentary-series rocks constituting the upper plate (Reynolds, 1980, p. 9). Occasionally a wedge of metamorphic rock is included in the bottom of the upper plate. The detachment faults and attendant mineralization have been determined to be of mid-Tertiary age. Although not completely understood, it has been suggested that mineralizing solutions migrated through conduits in lower plate rocks into the permeable contact breccias and up the normal (listric) faults and shear zones associated

with the detachment faulting (Spencer and others, 1988b, p. 3). Most deposits found have been replacement types in carbonate rocks along detachment surfaces or in the upper plates. Minerals generally are massive assemblages of chrysocolla, malachite, azurite, and brochantite. Abundant hematite and massive specularite are found in association with detachment fault orebodies.

Precambrian metamorphic rocks of both lower and upper plates of the metamorphic core complexes are widespread in the Buckskin and Rawhide Mountains, in which the study area is located (Wodzicki and others, 1982, p. 23). Most of the study area is underlain by lower plate metamorphic rocks. Upper plate sedimentary rocks are found in the study area on Black Mesa and at the nearby Swansea and Planet Mines.

Keith (1978, p. 71) states, "The Santa Maria district has not been examined in detail for mineral deposits although containing several major productive deposits and very interesting geologic features favorable for economic mineralization," also, "The district lies in the northern arm of an apparent wide, northwest-trending, strongly mineralized, structurally complex zone that could contain important, large, economic mineral deposits."

OIL AND GAS

Petroleum resources are considered to be nonexistent in the study area because of its metamorphic history. In addition, normal basin-and-range faults, with some exceptions, allow volatile petroleum products to escape along fault surfaces. Cretaceous and Tertiary detachment faulting has generated additional heat and escape routes for hydrocarbons. Ryder (1983, p. C-19) rates the oil and gas potential of the region, in which the study area lies, low because the organic richness, reservoir quality, and thermal history of the rocks are not conducive to the generation of significant volumes of

hydrocarbons. There are currently (August, 1988) no active oil or gas leases extant in the study area.

APPRAISAL OF SITES EXAMINED

Although no major production is known to have taken place in the study area a number of location and prospect pits, bulldozer cuts, near-surface stopes, adits, and shafts were found and sampled. A 265-ft-long exploration adit was mapped and sampled.

Prospect pits and bulldozer cuts to expose geology and minerals found in the west-central study area (pl. 1, sample nos. 1-7), and prospects in the southwest of the study area (pl. 1, sample nos. 10-15), have occurrences of copper oxides and carbonates in association with the iron oxides. In addition to the expected elevated concentration of observed copper and iron, anomalous concentrations of other elements occur at the following sample points (pl. 1): silver, no. 4, 0.48 opt; manganese, no. 11, 1,400 ppm; and strontium, no. 1, 1,368 ppm; more complete assay results are shown in table 1. These mineralized exposures are limited and are not associated with major structures or carbonate rocks.

The Mesa Manganese Prospect consists of two small adjoining stopes near the surface on the east side of Black Mesa (pl. 1, sample nos. 31-34). Representative of upper plate mineralization in the study area, the manganese is in lenses in a brecciated zone in Paleozoic limestone. It is estimated that about 150 tons of ore was removed during World War II at a grade lower than was normally mined but, because of the need, was supported by government incentive awards. Sample no. 31 of residual material at the entry to one of the stopes assayed 10.9% manganese oxide (MnO). Sample no. 37, from a trench northwest of the stopes, assayed 20.3% MnO and is probably more representative

of the material that was mined. All the samples from the prospect area, except no. 36, contained minor silver and elevated barium concentrations (table 1).

The 265-ft-long exploration adit (fig. 2, sample nos. 17-21) is in a side drainage to the wash that terminates at the Swansea Pumping Station (site) at the Bill Williams River. The adit is at the base of a rugged cliff on which no structure or minerals were observed. Five chip samples were taken in the adit on crosscutting structures (fig. 2). One sample (no. 18) from a 2-ft-wide, hematite-stained fault zone on the west wall, contained 0.015 oz/st gold, 4,500 ppm barium, 2,050 ppm lead, and 2,400 ppm zinc. Sample no. 19 from the east wall, on the same structure, assayed 0.015 oz/st gold, 1,500 ppm barium, 1,755 ppm lead, and 3,930 ppm zinc.

Sample points 25-26 and 29 were caved adits and from the amount of subsidence and the dump size it is estimated that they were originally less than 30-ft long.

A shaft north of the river in sec. 4, T. 10 N., R. 15 W. (pl. 1, sample no. 27) appears to have sustained production of copper although no record of production was located. The shaft is caved and inaccessible but a select sample was taken from the site of a loading bin. The sample contained 3.6% copper and >15% iron.

Other samples collected in the area of the shaft included samples from pits, caved adits, and outcrops (pl. 1, nos. 23-26, 28-29). All of the sample localities except no. 24 contained copper carbonates and oxides with ubiquitous specularite. Sample nos. 25 and 26, in addition to high copper and iron content, also contained 1,420 and 1,425 ppm manganese, respectively. Sample no. 24 was taken from a location pit in a chloritized metavolcanic rock

and was unusual only in that it assayed 415 ppm strontium. Sample no. 25 from a caved adit contained 0.01 oz/st silver.

The elevated concentrations of elements such as arsenic, barium, magnesium, lead, strontium, and zinc found in various samples (table 1) are consistent with the suite of minerals noted at the older producing properties (Harrer, 1964, p. 134). Hematite or specularite is found at most of the examined workings. Pervasive chloritic alteration, noted as being typical of detachment-related lower-plate mineralization (Reynolds 1980, p. 7), also was found at all of the workings examined in the study area, except the Mesa Manganese Prospect. The presence of oxide, carbonate, silicate, and sulfate minerals suggest that conditions during deposition were oxidizing and probably formed at a shallow depth; it is possible that more reducing, sulfide-rich assemblages may be present at depth (Wodzicki and others, 1982, p. 94).

Inferred sand and gravel resources are readily available along the Bill Williams River and in its major drainages. However, the material in the study area contains no unique characteristics. The desert environment of southern Arizona provides numerous sources of such material closer to population centers.

CONCLUSIONS

The Swansea study area contains no identified metallic mineral resources. Mineral assemblages contained in the various samples taken in the study area are similar in content to assemblages noted at the nearby Swansea and Planet Mines. The presence of these mineral occurrences suggest the possibility of subsurface occurrences being present.

Sand and gravel is present but has no exclusivity in use or form to deposits more readily available to markets.

Metamorphic rocks, faults and fault zones, and the lack of significant accumulation basins or thrusting over such basins precluded the development or accumulation of oil and gas resources.

RECOMMENDATIONS

The study area needs an intense explorative evaluation using new concepts and technology applicable to detachment fault mineralization.

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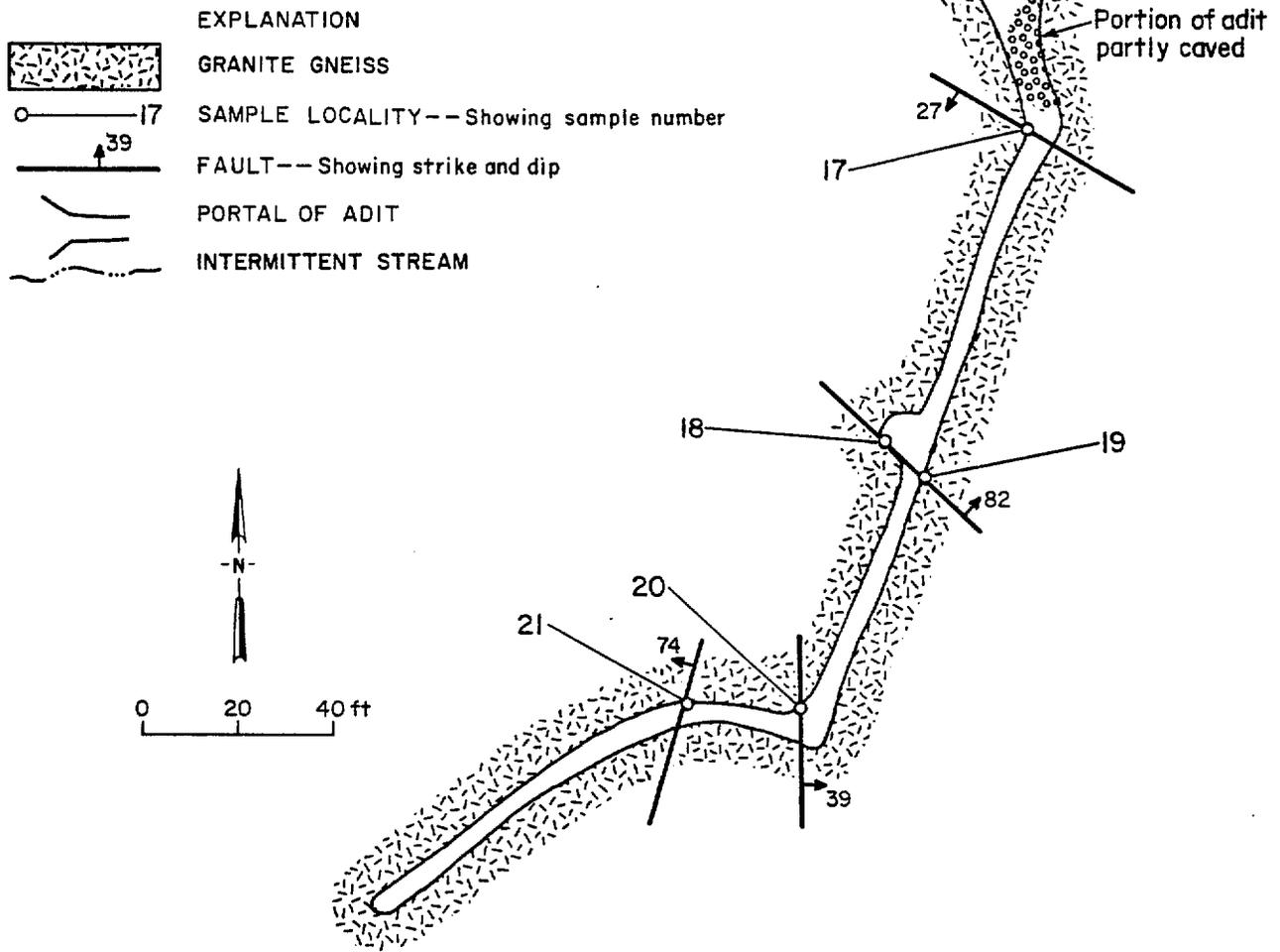


Figure 2.--Map of adit near wash to Swansea Pumping Station (site), Swansea study area, La Paz and Mohave Counties, Arizona.

Table 1.--Selected analytical data and descriptions of samples from the Swansea study area, La Paz and Mohave Counties, Arizona.

[Ag, silver; As, arsenic; Au, gold; Ba, barium; Ca, calcium; Cu, copper; Fe, Iron; Mg, magnesium; Mn, manganese; Pb, lead; Sr, strontium; Zn, zinc; ---, assayed for but not detected; >, more than; xxx, not applicable; (), minimum detection limits.]

No.	Sample		Assay data												Description	
	Type	Width (ft)	Au	Ag	Ca	Fe	Mg	As	Ba	Cu	Mn	Pb	Sr	Zn		
			opt		%			ppm (unless otherwise noted)								
			(0.002)	(0.01)	(1)	(0.01)	(0.01)	(1)	(1)	(1)	(1)	(2)	(1)	(1)		
1	Chip	0.5	---	---	2.82	1.96	0.46	20	190	5	950	18	368	8	Limonite-stained fault 2 to 6 in. thick in brecciated, chloritized, felsite; strike N. 45° W., dip 57° E.	
2	do.	2.0	---	---	1.93	1.19	.04	5	10	355	88	4	201	3	Fault zone in metavolcanics with minor hematite stains.	
3	do.	2.5	---	0.09	1.13	12.90	.61	30	270	9,340	1,055	4	102	10	Malachite and hematite along bedding in limestone, zone capped by chloritized felsite; strike N. 60° W., dip 25° S.	
4	do.	2.0	---	.48	.80	>15.00	.27	105	240	5.67%	859	---	86	---	Same zone as sample no. 3, with azurite, malachite, and hematite.	
5	Select	xxx	---	.12	.55	>15.00	.37	110	120	5.02%	653	41	---	---	Selected sample of rocks with azurite, malachite, hematite, and specularite, from dump of small pit in chloritized felsite.	
6	Chip	1.5	---	.01	1.12	10.85	.40	90	40	1,570	644	22	161	13	Hematite-stained fault gouge between fractured felsite in footwall and chloritized metavolcanics in hanging wall; strike N. 70° E., dip 55° N.	
7	Grab	xxx	---	.01	.71	>15.00	.40	120	60	4.28%	697	4	114	---	Location pit in chloritized metavolcanics with hematite, azurite, and malachite.	
8	Chip	2.0	---	---	3.61	1.40	.23	5	50	58	79	2	45	5	Pit, 10 ft long, 3 ft wide, 4 ft deep in highly fractured quartzite with hematite staining.	
9	do.	.5	---	---	.40	>15.00	.95	35	310	283	845	6	16	16	Black limestone capping on metavolcanics.	
10	do.	2.0	---	.01	.83	13.50	1.44	25	20	.71%	462	---	124	17	Bulldozer cut, 5-ft deep in metavolcanics, with azurite, malachite, and hematite.	
11	do.	2.5	---	.01	1.83	6.49	3.82	30	280	496	1,400	94	50	28	Pit, 3 ft long, 4 ft wide, 5 ft deep, in greenish-gray metavolcanics, with hematite staining.	
12	do.	3.0	---	.02	1.25	>15.00	5.53	50	440	9,730	921	20	134	88	Bulldozer cut, 3-ft deep exposing shear zone in metavolcanics with azurite, malachite, and pyrite pseudomorphs; strike N. 75° W., dip 90°.	

Table 1.--Selected analytical data and descriptions of samples from the Swansea study area, La Paz and Mohave Counties, Arizona--Continued

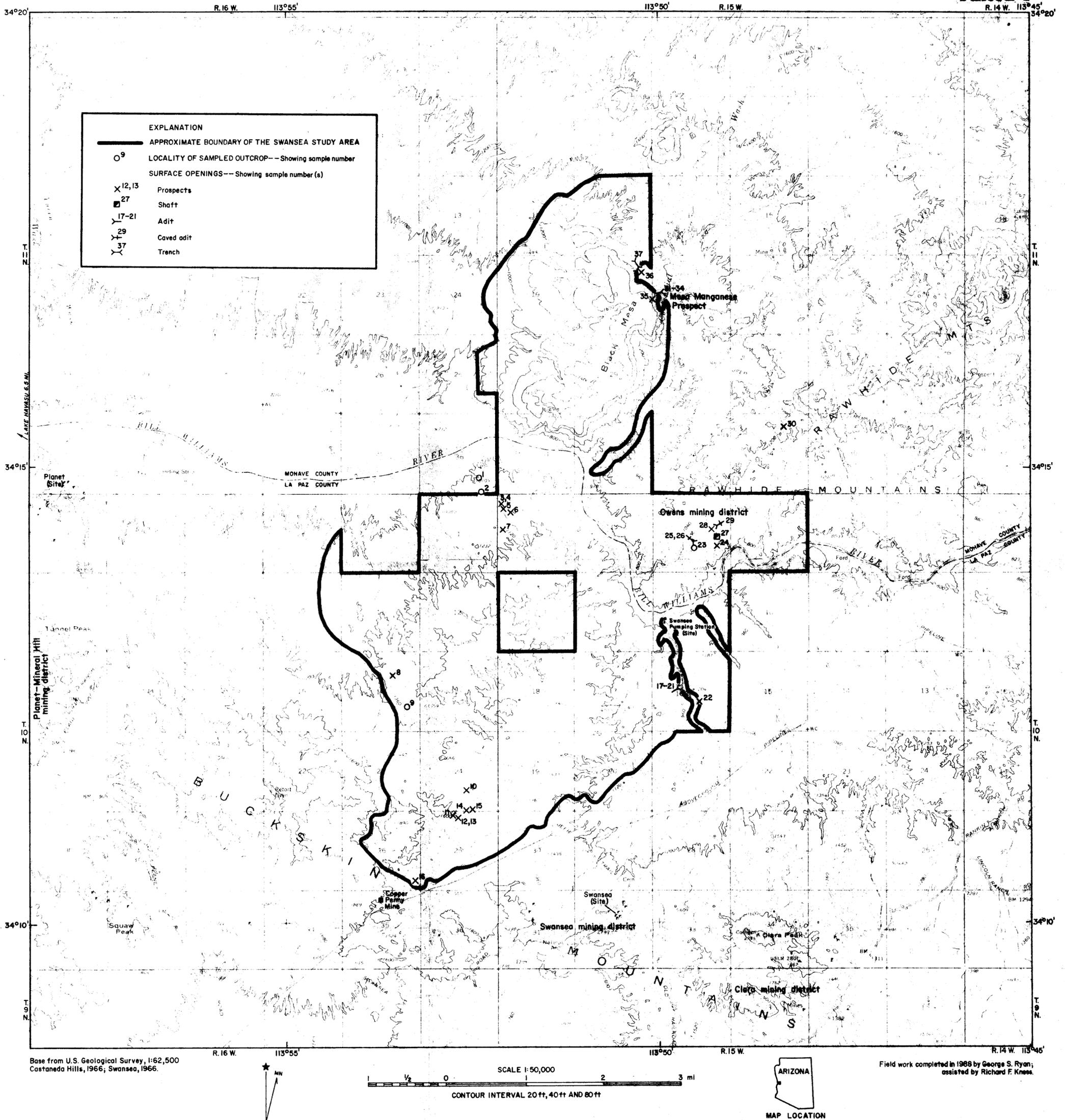
No.	Sample		Assay data												Description
	Type	Width (ft)	Au	Ag	Ca	Fe	Mg	As	Ba	Cu	Mn	Pb	Sr	Zn	
			opt (0.002)	(0.01)	(1)	% (0.01)	(0.01)	(1)	(1)	(1)	(1)	(2)	(1)	(1)	
13	Grab	xxx	---	0.01	0.37	>15.00	1.36	50	370	6.43%	1,195	12	53	---	Metavolcanic rocks with azurite, malachite, and specularite from stockpile at site of sample no. 12.
14	Chip	1.5	---	---	2.41	10.50	1.67	20	70	2,050	382	---	24	19	Location pit in chloritized metavolcanics, with minor malachite and specularite.
15	Grab	xxx	---	---	.91	>15.00	2.66	65	90	1.49%	534	---	57	39	Location pit in metavolcanics with malachite and specularite.
16	Chip	2.0	0.007	.03	5.43	5.01	.41	160	40	4.66%	1,865	26	64	13	Location pit, 15 ft wide, and 8 ft deep, in brown metavolcanics, with malachite along fractures.
17	do.	.5	---	---	.82	4.22	1.79	20	150	18	720	16	100	134	Fault zone with hematite-stained gouge, in highly fractured fine-grained metaintrusive; strike N. 60° W., dip 26° S.
18	do.	2.0	.015	.01	.26	2.68	.39	20	4,500	377	149	2,050	125	2,400	Fault zone with hematite-streaked gouge in meta-intrusive; strike N. 47° W., dip 82° N.
19	do.	2.5	.015	.01	.43	2.94	.70	15	1,510	284	519	1,755	102	3,930	Fault zone with hematite-stained gouge in meta-intrusive; strike N. 47° W., dip 82°.
20	do.	3.0	---	---	.58	2.84	1.08	---	80	81	481	40	33	573	Fracture zone with minor hematite in metaintrusive; strike N-S, dip 39° E.
21	do.	.67	---	---	.84	4.27	1.45	5	60	95	629	44	48	115	Fault zone with minor hematite in gouge in meta-intrusive; strike N. 14° E., dip 74° W.
22	do.	1.5	---	---	6.57	.92	.20	5	100	29	646	8	63	6	Location pit with small shear zone in thin-bedded, shaly limestone; strike N. 70° W., dip 35° S.
23	Grab	xxx	---	---	2.65	>15.00	.40	55	20	426	208	6	16	6	Specularite in chloritized metavolcanics.
24	Chip	2.0	---	---	4.88	4.44	1.28	---	10	1,785	500	2	415	21	Strongly chloritized metavolcanics, with minor azurite.
25	do.	1.5	---	.01	.79	13.20	5.90	90	30	4.71%	1,420	---	46	---	Caved adit, strongly fractured metavolcanics with azurite and malachite; oriented N. 50° W.
26	Grab	xxx	---	.01	.60	>15.00	5.48	95	40	5.59%	1,425	---	32	20	Stockpile at site of sample no. 25.
27	Select	xxx	---	---	.34	>15.00	2.43	95	20	3.60%	777	---	21	---	Select sample of ore from loading site near shaft.

Table 1.--Selected analytical data and descriptions of samples from the Swansea study area, La Paz and Mohave Counties, Arizona--Continued

No.	Sample		Assay data												Description	
	Type	Width (ft)	Au	Ag	Ca	Fe	Mg	As	Ba	Cu	Mn	Pb	Sr	Zn		
			opt			%	(0.01)	(0.01)	(1)	(1)	(2)	(1)	(2)	(1)		(1)
28	Select	xxx	---	---	0.45	>15.00	1.94	55	90	3.99%	330		42	26	---	Location pit in grey metavolcanics with black specularite and malachite coatings.
29	Grab	xxx	---	---	.63	>15.00	2.56	75	30	3.99%	676		---	32	10	Caved adit; pods of black specularite with azurite coatings and hematite clods, adit oriented N. 60° E.
30	do.	xxx	---	---	3.49	1.08	1.71	---	20	31	306		---	79	26	Location pit in quartzite-mica schist, no minerals.
31	Chip	2	---	0.06	>15.00	2.10	.18	135	630	225	10.90 ^{1/}		258	159	207	Joint in quartz-conglomerate at entry to stope. Pyrolusite and wad as cement; strike N. 75° W., dip 50° N.
32	do.	2	---	.04	>15.00	1.52	2.02	45	400	74	4.25 ^{1/}		248	247	318	Right stope, manganese and limonite along fractures in conglomerate.
33	do.	1.5	---	.01	12.85	3.20	.09	200	1.03%	276	9.96 ^{1/}	1,995	251	302	302	Passage between stopes, manganese and limonite on joint in quartzite conglomerate.
34	do.	1.5	---	.04	>15.00	1.16	.07	110	1.51%	116	7.71 ^{1/}	1,300	454	386	386	Left stope, manganese and limonite on joint in strongly fractured quartzite conglomerate, strike N. 75° W, dip 55° N.
35	Grab	xxx	---	.09	>15.00	.96	.27	110	1.97%	257	8.34 ^{1/}		236	423	641	Pit, 6 ft long, 5 ft wide, and 7 ft deep in quartzite conglomerate with wad and pyrolusite.
36	Chip	4	---	---	>15.00	1.18	.25	530	1.11%	383	11.60 ^{1/}	5,230	1,520	990	990	Manganese prospect, face 35 ft wide and 18 ft high. White quartz-conglomerate with wad and pyrolusite coatings on fractures.
37	Grab	xxx	---	.01	>15.00	1.27	.09	2,210	3.32%	673	20.30 ^{1/}		248	247	318	Sample from stockpile near 75-ft-long trench, 3 to 5 ft wide, and 4 ft deep in strongly fractured quartzite conglomerate with manganese and hematite staining.

^{1/} percent MnO.

(Additional elements included in analysis: aluminum, antimony, beryllium, bismuth, cadmium, columbium, chromium, gallium, lanthanum, molybdenum, nickel, phosphate, potassium, selenium, sodium, stibnite, titanium, tungsten, uranium, vanadium. Results available for inspection at the U.S. Bureau of Mines, Intermountain Field Operations Center, Building 20, Denver Federal Center, Denver, Colorado.)



**MINE AND PROSPECT MAP OF THE SWANSEA STUDY AREA,
LA PAZ AND MOHAVE COUNTIES, ARIZONA**

BY
GEORGE S. RYAN, U.S. BUREAU OF MINES
1989