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GEOLOGICAL SURVEY

Significance of gold and silver in drainage samples from the vicinity of the Baboquivari Peak Wilderness Study Area, Pima County, Arizona

By

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature. Any use of trade names is for descriptive purposes only and does not imply endorsement by the USGS.

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STUDIES RELATED TO WILDERNESS

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine their mineral values, if any. Results must be made available to the public and be submitted to the President and the Congress. This report discusses the results of a geochemical survey of the Baboquivari Peak Wilderness Study Area, Pima County, Arizona. The wilderness study area is administered by the U.S. Bureau of Land Management.

SUMMARY

Highly anomalous concentrations of gold and silver in samples of drainage sediment from the vicinity of the Baboquivari Peak Wilderness Study Area (AZ-020-203B), Pima County, Arizona, suggest that parts of the sampled area are mineralized. In some cases, anomalous concentrations of gold and silver are accompanied by anomalous concentrations of barium, bismuth, copper, lead, molybdenum, thorium, or tungsten.

Mineral deposits within a few miles of the wilderness study area are spatially associated with middle Tertiary rhyolites that were intruded as stocks less than 0.7 mi^2 in outcrop area and as an extensive dike system. The mineral deposits contain various combinations of gold, silver, beryllium, copper, lead, manganese, molybdenum, tungsten, vanadium, and zinc.

The gold and silver in samples of drainage sediment are probably derived from rhyolite dikes found in the sampled area. The gold and silver may be disseminated in the dikes or may occur in veins associated with the dikes. The association of rhyolite dikes and vein deposits fits the very general model for polymetallic vein deposits outlined by Cox (1986). However, because of a pronounced lack of correlation in drainage sediment samples between gold-silver concentrations and concentrations of other elements usually associated with polymetallic deposits, other deposit models should be considered in addition to polymetallic veins. Two other possible models are gold-silver deposits associated with an inferred porphyry molybdenum system (Seaman, 1983) and paleo-placer gold-silver deposits resulting from volcanic activity in Jurassic time.

INTRODUCTION

A reconnaissance geochemical survey of the Baboquivari Peak Wilderness Study Area was conducted in April, 1986, as part of a mineral resource evaluation of the wilderness study area. Samples of drainage sediment were collected at 10 sites in the vicinity of the Baboquivari Peak Wilderness Study Area. Because many of the samples contained anomalous concentrations of gold and silver, samples of drainage sediment were collected at an additional 14 stream sites in March, 1987; flecks of gold were noted in some samples when they were panned. This report will suggest possible mineral-deposit models that might account for the anomalous concentrations of gold and silver.

The Baboquivari Peak Wilderness Study Area comprises 2,065 acres in the southeastern part of Pima County, Arizona, and lies about 50 mi southwest of Tucson, Arizona (fig. 1). Access to the wilderness study area is provided on the east by state and private roads from Arizona Route 286, and on the west by Tohono O'Odham (formerly Papago) Indian Reservation roads from Arizona Route 86.

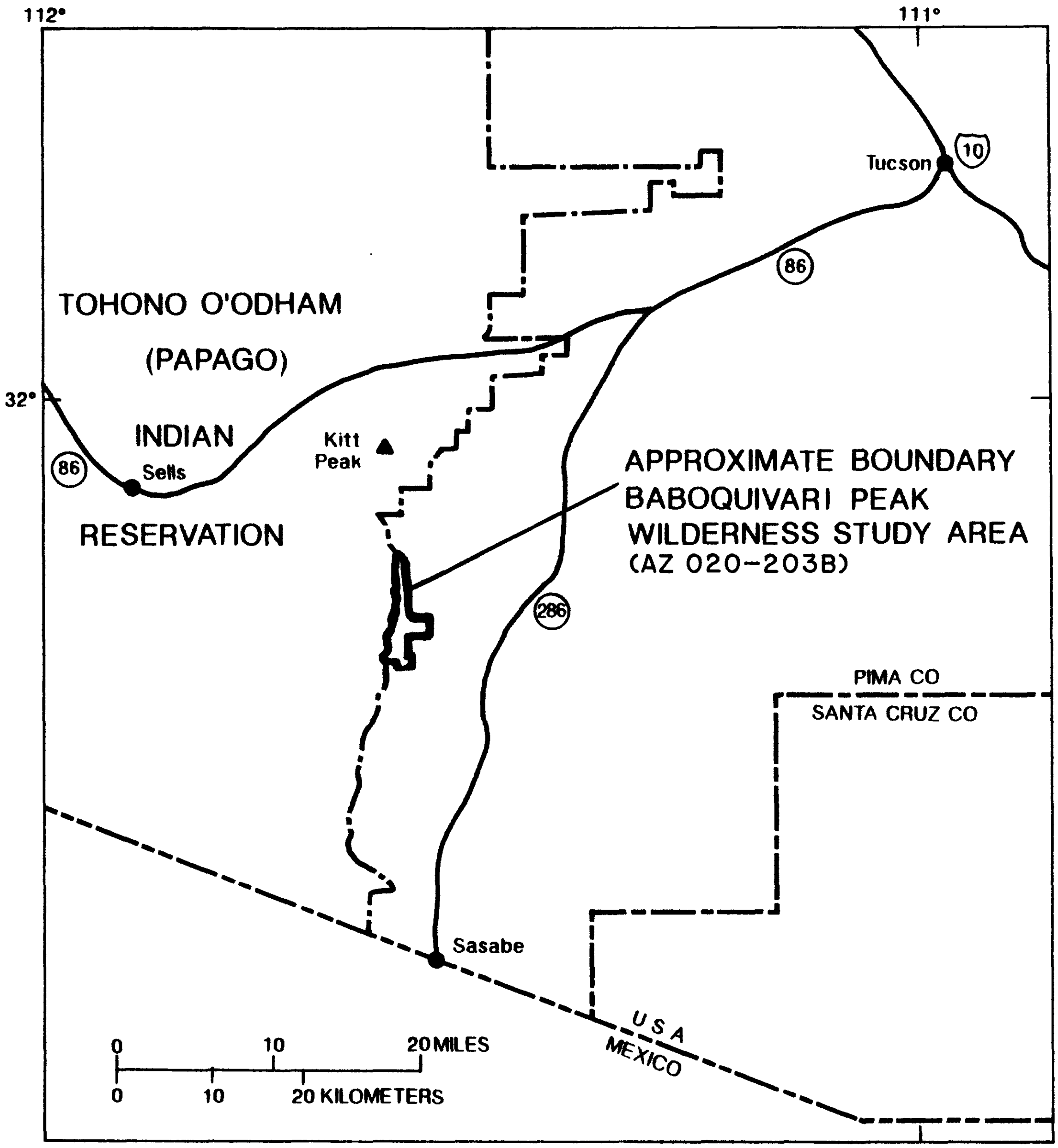

Figure 1. Location of the Baboquivari Peak Wilderness Study Area, Pima County, Arizona.

The topographic relief in the study area is about 3,400 ft with a maximum elevation of 7,734 ft at the summit of Baboquivari Peak. The wilderness study area occupies the east side of the crest of the Baboquivari Mountains in an area of rugged canyons, spectacular walls, and jagged outcrops of bedrock. The wilderness study area is within the Upper Sonoran life zone (Hunt, 1974, p. 149-155). Arizona white oak and Mexican pinyon are the dominant types of vegetation. Streams are ephemeral but water may flow for several months during winter and spring.

The Baboquivari Peak Wilderness Study Area is underlain by granitic, volcanic, and sedimentary rocks of Jurassic age (plate 1). The Jurassic rocks are intruded by numerous Tertiary rhyolite dikes that trend northwest and northeast. In some cases the dikes were intruded along pre-existing faults.

The Baboquivari Peak Wilderness Study Area is within the Baboquivari mining district (Keith, 1974, p. 14-17). The district includes the Baboquivari and Quinlan Mountains and extends from the Mexican border north to Arizona Route 86, a distance of about 33 mi (McDonnell, 1986). Mining in the district began in the late 1800's. Locations of mines, prospects, claims, and mineral occurrences in and near the wilderness study area are shown on plate 1 and their descriptions are given in table 1. Numerous small, shallow mines and prospects are scattered throughout the district but most of the production came from the Allison Mine (no. 4, table 1, plate 1) which produced over 47,000 tons of ore averaging 0.22 oz gold/ton and 2.7 oz silver/ton (Keith, 1974, p. 107). Within about 3.5 mi of the Baboquivari Peak Wilderness Study Area, deposits or minor occurrences of gold, silver, copper, lead, zinc, molybdenum, tungsten, manganese, vanadium, beryllium, and bismuth may be found.

METHODS OF STUDY

Stream sediments and panned concentrates derived from stream sediments were chosen as the routine sample media for this reconnaissance study because they represent a composite of material eroded from all parts of the drainage basin of the sampled stream. Sample locations and outlines of drainage basins are shown on plate 1.

Three samples were collected at each site. One of the samples was air dried and then sieved through a 30-mesh (0.595-mm) stainless-steel sieve. The two additional samples collected at every site were sieved through a 2-mm sieve before they were panned in some cases and were not sieved before panning in other cases. Each sample to be panned consisted of a 16-in pan of stream sediment (about 20 lb) that was panned until about 1.5 oz or less remained. One of these panned concentrates was sieved through a 30-mesh sieve and then further concentrated by a series of steps involving heavy liquids and magnetic separations to produce a "nonmagnetic heavy-mineral-concentrate sample." The other panned concentrate received no further treatment before chemical analysis for gold and was termed a "raw panned-concentrate sample."

The minus-30-mesh stream-sediment samples and nonmagnetic heavy-mineral-concentrate samples were analyzed by emission spectrography for iron, magnesium, calcium, titanium, manganese, silver, arsenic, gold, boron, barium, beryllium, bismuth, cadmium, cobalt, chromium, copper, lanthanum, molybdenum, niobium, nickel, lead, antimony, scandium, tin, strontium, vanadium, tungsten, yttrium, zinc, zirconium, and thorium. In addition, the minus-30-mesh stream-sediment samples were analyzed for gold by atomic absorption; for arsenic, bismuth, cadmium, antimony, and zinc by inductively coupled plasma spectroscopy; for mercury by cold-vapor atomic absorption; and for uranium and thorium by delayed neutron activation analysis. The raw panned-concentrate samples were analyzed by atomic absorption for only gold.

Table 2 lists selected elements determined in each drainage-sediment sample type, the lower and upper limits of determination, the range of concentrations, the 50th percentile value, and the threshold (highest background) concentrations. Tabulations of the analytical results, descriptions of methods of sample preparation, and descriptions and references for the analytical methods are given by Adrian and others (1987, 1988); however, the results for minus-30-mesh stream-sediment samples collected in 1986 and analyzed for gold by atomic absorption are not included in the tabulations.

RESULTS

In order to establish threshold concentrations, emission-spectrographic results for minus-30-mesh stream-sediment samples were compared with results for 971 samples of minus-30-mesh stream sediment from the nearby Ajo 1° x 2° quadrangle (Theobald and Barton, 1983). These comparisons revealed no anomalous concentrations in minus-30-mesh stream-sediment samples from the vicinity of the Baboquivari Peak Wilderness Study Area, except for copper and silver, which are each anomalous in samples from three sites. Theobald and Barton (1983) reported no atomic absorption analyses for gold in minus-30-mesh stream-sediment samples. Concentrations of 0.002 parts per million (ppm) gold and greater are anomalous in stream-sediment samples from the vicinity of the Baboquivari Peak Wilderness Study Area. Thirteen of the 24 minus-30-mesh stream-sediment samples collected near the Baboquivari Peak Wilderness Study Area contain concentrations of 0.002 ppm gold or greater.

Analytical results for nonmagnetic heavy-mineral-concentrate samples were compared with results from 952 samples collected in the Ajo 1° x 2° quadrangle (Theobald and Barton, 1983). In contrast to results from the minus-30-mesh stream-sediment samples, results from nonmagnetic heavy-mineral-concentrate samples revealed striking gold-silver anomalies and also showed anomalous concentrations of barium, bismuth, lead, molybdenum, thorium, and tungsten. Twelve of the 24 samples from the vicinity of the Baboquivari Peak Wilderness Study Area contain detectable gold, ranging from 20 ppm to >1,000 ppm. The median value for the 12 samples containing detectable gold is 250 ppm. Gold analyses of raw panned-concentrate samples confirmed the gold anomaly. In contrast, no detectable gold was found in 952 samples of nonmagnetic heavy-mineral concentrate from the Ajo 1° x 2° quadrangle (Theobald and Barton, 1983, table 2).

Gold analyses of raw panned-concentrate samples have several advantages over gold analyses of nonmagnetic heavy-mineral-concentrate samples. The first advantage is that a large sample of raw panned concentrate (from 1-40 g in this study) is analyzed and thus problems of inhomogeneity are lessened. In contrast, only 5 mg of nonmagnetic heavy-mineral concentrate are analyzed. The second advantage is that preparation of raw panned-concentrate samples for analysis takes only a few simple steps so chances of losing gold particles are minimized. The third advantage is that analytical sensitivity is less than bedrock crustal abundance (0.002-0.005 ppm, Rose and others, 1979, p. 557) if the gold concentration of the raw panned-concentrate sample is converted to the concentration of the original stream sediment. The analytical method used in the analysis of raw panned-concentrate samples will detect 0.05 ppm gold in a 10-g sample. Gold concentrations of 0.3 ppm or greater are anomalous in the vicinity of the Baboquivari Peak Wilderness Study

Area; this is conservative and the threshold might be as low as 0.07 ppm. Twenty of the 24 raw panned-concentrate samples contain 0.3 ppm gold or greater.

The analyses of nonmagnetic heavy-mineral-concentrate samples show that gold and silver are present in equal amounts and that concentrations of the two metals vary sympathetically. The correlation coefficient for gold and silver in the 24 samples of nonmagnetic heavy-mineral concentrate from the vicinity of the wilderness study area is 0.92 (table 3). Microscopic examination of the samples revealed no silver or probable silver-bearing minerals other than gold, suggesting that the gold and silver are present as the alloy electrum. Samples from all four of the major canyon systems draining the Baboquivari Peak Wilderness Study Area (Contreras, Sabino, Brown, and Thomas) contain anomalous amounts of gold and silver (plate 1). Gold particles were commonly near 30 mesh in size and it is possible some coarser gold was removed when the samples were sieved through a 30-mesh sieve.

In addition to anomalous gold and silver, anomalous concentrations of barium, lead, molybdenum, thorium, or tungsten occur in one sixth to one half of the samples of nonmagnetic heavy-mineral concentrate from the vicinity of the wilderness study area (plate 1). Microscopic examination showed that barium concentrations are due to the presence of barite, and tungsten concentrations are due to scheelite; some of the scheelite is molybdenum rich.

The map patterns on plate 1 indicate that gold and silver concentrations are largely independent of the concentrations of the other anomalous elements; the correlation coefficients in table 3 support this independence. However, microscopic examination shows a correspondence between visible gold and pyrite. Thorium concentrations are independent of the other elements except that they tend to be negatively correlated with barium concentrations. Barium, bismuth, lead, molybdenum, and tungsten appear to be complexly interrelated.

DISCUSSION

Possible types of mineral deposits in the Baboquivari Peak Wilderness Study Area that might be the source of anomalous concentrations of gold and silver in drainage-sediment samples include polymetallic veins, gold-silver deposits associated with an inferred porphyry molybdenum deposit, and paleo-placer gold-silver deposits.

Polymetallic Vein Deposits

Mineral deposits within about 5 mi of the wilderness study area are spatially associated with faults and middle Tertiary felsic dikes. In a study of geology and ore potential in the vicinity of the Jupiter Mine (plate 1), Seaman (1983) suggested that the mineralization probably preceded the intrusion of the dikes. Evidence for the suggestion is the pervasive phyllic and propylitic alteration that presumably accompanied mineralization and is found in pre-Tertiary rocks but not in Tertiary rocks that appear to be older than the middle Tertiary felsic dikes. The spatial association of mineral deposits with middle Tertiary dikes suggests that Tertiary mineralization should not be ruled out.

Nearby mineral deposits, interpreted here to be polymetallic vein deposits, include the Allison Mine, the Black Dragon Mine, the Diablo prospect, the Gold Bullion Mine, deposits in the Jupiter Mine area, and the Lost Horse(?) Mine (see table 1 and plate 1).

Favorable criteria for polymetallic vein deposits listed by Cox (1986) are present within about 3 mi of the Baboquivari Peak Wilderness Study Area. Mineralized areas have not been identified within the wilderness study area but bedrock geology and favorable structures that are spatially associated with nearby mineral deposits extend into the wilderness study area. If the nearby mineralization took place in the Mesozoic, favorable criteria include (1) known vein deposits, (2) extensive faulting, (3) brecciation, (4) presence of at least one small granitic intrusion (Seaman, 1983, p. 28), (5) strong geochemical anomalies for gold, silver, barium, bismuth, lead, molybdenum, and tungsten in panned-concentrate samples derived from stream sediment and (6) the presence of gold, electrum (?), pyrite, and barite in samples of nonmagnetic heavy-mineral concentrate. If the nearby mineralization took place in the Cenozoic, favorable criteria, in addition to the above favorable criteria for Mesozoic mineralization, include (1) an association with Tertiary rhyolite dikes and (2) the intrusion of those dikes into sedimentary and metamorphic terrain.

Other Possible Deposit Types

Although polymetallic veins associated with the Tertiary rhyolite dikes are a reasonable source for anomalous concentrations of gold and silver, the lack of correlation between gold-silver concentrations and concentrations of barium, bismuth, molybdenum, lead, and tungsten in concentrate samples from streams draining the Baboquivari Peak Wilderness Study Area suggests that the source of the gold and silver may be different than that of the other five metals. The consistent gold-silver ratios argue that a single mineralizing event accounts for the precious metals. Additional mineral-deposit models that may apply to gold-silver deposits include deposits associated with a porphyry molybdenum system and paleo-placers. These models are somewhat speculative, but should be considered, nevertheless.

Gold-silver deposits associated with an inferred porphyry molybdenum system

Favorable criteria for Climax-type porphyry molybdenum deposits (Ludington, 1986) and for low-fluoride porphyry molybdenum deposits (Theodore, 1986) are present within the wilderness study area and within 2 mi of the south edge of the wilderness study area. Although gold is not characteristically associated with Climax-type porphyry molybdenum deposits (Ludington, 1986), the model is included because of other favorable criteria in the vicinity. Favorable criteria for either type of porphyry molybdenum deposit include (1) pervasive propylitic and phyllic alteration in the Jupiter Mine area (plate 1), (2) presence of felsic intrusive rocks, (3) Mesozoic or Tertiary age of mineralization, (4) strong geochemical anomalies for gold, silver, barium, bismuth, lead, molybdenum, or tungsten in panned-concentrate samples from streams draining the wilderness study area, and (5) pyrite in samples of nonmagnetic heavy-mineral concentrate. Additional or specific criteria for the existence of a Climax-type porphyry molybdenum deposit include (1) anomalous molybdenum, tungsten, and fluorine concentrations in samples from adits, dumps, and pits in the Jupiter Canyon area, (2) a system of silicic dikes, and (3) tungsten in the form of wolframite in the Jupiter Mine area (Keith, 1974, p. 109). Additional or specific favorable criteria for the existence of a low-fluoride porphyry molybdenum deposit include (1) numerous faults, (2) presence of calc-alkaline intrusive rocks, (3) tungsten in the form of scheelite in panned-concentrate samples from streams draining the wilderness study area, and (4) presence of polymetallic vein deposits of gold, silver, copper, lead, zinc, and manganese in the Jupiter Canyon area (Cox, 1986).

The presence of a porphyry molybdenum deposit in the vicinity of Jupiter Canyon, within 2 mi of the southern edge of the Baboquivari Peak Wilderness Study Area, was suggested by Seaman (1983). The suggestion was based on the existence of some of the criteria listed above (Seaman, 1983, p. 5). In addition, samples of water from springs and shallow wells 3 to 5 mi southwest of Jupiter Canyon contain concentrations of molybdenum as high as 450 µg/L (Ficklin and others, 1978, 1980). An exploration hole drilled in Jupiter Canyon to a depth of about 500 ft in Early Jurassic rhyodacite porphyry of Tinaja Spring (plate 1) penetrated only propylitic and phyllic alteration (Seaman, 1983, p. 39-43, 84). If a porphyry molybdenum deposit exists, it is probably 1,500-3,000 ft below the surface (Seaman, 1983, p. 84-86).

Paleo-placer gold-silver deposits

Samples containing anomalous concentrations of gold and silver were collected throughout the sampled area. Therefore, if mineralization is limited to a particular rock unit, that unit must be widespread. In addition to the system of dikes formed by the middle Tertiary rhyolite of Allison Camp, the geologic unit common to most of the sampled area is the Early Jurassic Pitoikam Formation, which is made up of conglomerate, sandstone, siltstone, and some mudstone or shale (Haxel and others, 1980). The uppermost part of the formation includes volcanic conglomerate and dacitic flows. Overlying the Pitoikam Formation within the sampled area is the Early Jurassic Mulberry Wash Volcanic Formation (Haxel and others, 1980). Units of the Mulberry Wash Volcanic Formation within the wilderness study area are composed of volcanic debris and dacitic (or andesitic) flows, flow breccia, and dikes. Nearby units of the Mulberry Wash Volcanic Formation, not exposed in the sampled area, are composed of rhyodacite, latite, and andesite flows and rhyodacite volcanic conglomerate. The geologic setting is one of volcanic activity that could have been accompanied by epithermal precious-metal mineralization and subsequent formation of precious-metal placer deposits in ancient stream channels. Perhaps these postulated paleo-placer deposits are now being eroded and the gold and silver are being carried into present-day streams. The separation of gold and silver from the other anomalous elements in the study area could result from this recycling of the gold and silver.

CONCLUDING REMARKS

Evidence of past prospecting activities within the Baboquivari Peak Wilderness Study Area is scarce to nonexistent, suggesting that visible evidence of mineralization is not obvious. Further studies are necessary to test the validity of the proposed mineral deposit models or to suggest other models.

The rhyolite dikes need to be studied more carefully for evidence of mineralization or alteration. Sufficient quantities of gold should be recovered from the streams so that trace-element concentrations can be compared with the trace-element concentrations in gold from nearby mines. A careful study of the volcanic conglomerates might reveal fossil stream channels where paleo-placer gold could be concentrated. Minerals such as pyrite or specularite should be sought and their gold content examined. Additional samples of stream sediment should be collected on and beyond the peripheries of the presently sampled area so that the areal extent of the geochemical anomaly may be determined.

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TABLE 1.--Mines, claims, prospects, and mineral occurrences in and near the Baboquivari Peak Wilderness Study Area, Pima County, Arizona

Map no. (plate 1)	Name	Minerals	Geology	Workings and production	References
1	Black Dragon Mine	manganese	Discontinuous lenses, coatings, and fracture fillings of manganese oxides in sheared and brecciated rhyolitic rocks	Open cuts and pits; produced about 165 long tons of ore averaging 27.6 percent manganese and 19 tons of concentrate averaging 36.0 percent manganese	Cruver and others, 1982, p. 56. Farnham and others, 1961, p. 117. Keith, 1974, p. 108. McDonnell, 1986, p. 6.
2	Lost Horse(?) Mine	molybdenum gold silver copper(?)	Fracture fillings in fault zone that cuts metasedimentary rocks	About 200 ft of underground workings; no known production	Johnson, 1972, p. 40. McDonnell, 1986, p. 6. Mining Journal, 1938.
3	Contreras Canyon area (includes Hop Sage, Shamrock, Windy, and Donna III claims)	beryllium bismuth	Beryl-bearing quartz veins and pegmatites as much as 3 ft thick in granitic rocks	Shallow trenches and exploratory drilling; no known production	Balla, 1962, p. 21-31. Clark, 1956, p. 10-21. McDonnell, 1986, p. 6. Meeves and others, 1966, p. 21.
4	Allison Mine	silver gold copper lead manganese	Mineralized quartz veins in shear zones in metasedimentary rocks and rhyolitic to andesitic flows and intrusions	Several thousand ft of underground workings; mill ruins; produced an estimated 47,000 tons of ore averaging 0.22 oz gold/ton, 2.7 oz silver/ton, and minor lead and copper	Cruver and others, 1982, p. 56. Fair, 1965, p. 83. Keith, 1974, p. 107. McDonnell, 1986, p. 6. Wilson and others, 1934, p. 179-180. Worcester, 1931.
5	Upper Brown Canyon	gold(?) silver(?)	Sedimentary and silicic to intermediate volcanic rocks cut by network of rhyolite dikes	Minor prospecting by past landowner along dike system; may be same as locality 98 listed by Cruver and others (1982, p. 64); field check by U.S. Bureau of Mines personnel in 1985 found no evidence of prospecting or production	Cruver and others, 1982, p. 64. McDonnell, 1986, p. 6-7.

Table 1.--Continued

Map no. (plate 1)	Name	Minerals	Geology	Workings and production	References
6	Diablo prospect	copper molybdenum gold silver	Fracture zone in syenite; spatial association with andesite and rhyolite dikes	Thirty-ft-deep shaft; no known production	Donald, 1959, p. 34-40. McDonnell, 1986, p. 6.
7	Jupiter Mine area (includes Iowana Mine)	gold silver lead copper zinc tungsten	Discontinuous mineralized quartz-calcite in fissure veins cutting metasedimentary and granitic rocks and dioritic dikes	Several thousand ft of underground workings; mill ruins; exploratory drilling for large tonnage, low-grade open-pit operation in 1974 yielded negative results; produced several hundred tons of ore averaging 1 oz gold/ton, 16 oz silver/ton, and minor lead and copper	Cruver and others, 1982, p. 45. Keith, 1974, p. 109. McDonnell, 1986, p. 6. Seaman, 1983, p. 51-52. Wilson and others, 1934, p. 181.
8	Gold Bullion Mine	gold silver molybdenum copper lead tungsten vanadium zinc	Discontinuous mineralized quartz fissure veins and pegmatites as much as 12 ft thick cutting metasedimentary and granitic rocks and rhyolite dikes	Several hundred ft of underground workings; mill ruins; produced at least 3,100 tons of ore averaging about 1.0 oz gold/ton and 12 oz silver/ton; also produced several hundred tons of high-grade molybdenum ore and minor amounts of copper, lead, tungsten, and vanadium	Cruver and others, 1982, p. 57. Donald, 1959, p. 42-44. Joseph, 1915-1916, p. 7. Keith, 1974, p. 109. Kirkemo and others, 1965, p. E10-E11. McDonnell, 1986, p. 6. Seaman, 1983, p. 49-50. Wilson and others, 1934, p. 181.
9	Edna J placer area	gold	Finely divided gold in a 6- to 11-ft-thick gravel bar	Small intermittent placer operation; produced a few tens of ounces of gold	Cruver and others, 1982, p. 45-46. Johnson, 1972, p. 39-40. Keith, 1974, p. 108. McDonnell, 1986, p. 6. Wilson, 1961, p. 81.

TABLE 2.--Statistics for elements present in anomalous concentrations in 24 drainage samples collected near the Baboquivari Peak Wilderness Study Area, Pima County, Arizona

[Concentrations determined by emission spectrographic methods except that gold-a was determined by atomic absorption. N, not detected; L, detected but below limit of determination; <, less than value shown; G, greater than upper limit of determination]

Element	Lower limit of determination	Upper limit of determination	Minimum concentration	Maximum concentration	50th percentile	Threshold concentration	Number of anomalous samples
			Minus-30-mesh stream sediment				
Gold-a, ppm	0.002	--[a]	<0.002	0.90	0.002	<0.002	13
Silver, ppm	0.5	5,000	N	1	N	N	3
Copper, ppm	5	20,000	7	50	15	30	3
			Nonmagnetic heavy-mineral concentrates				
Gold, ppm	20	1,000	N	G	L	N	12
Silver, ppm	1	10,000	N	1,000	10	N	17
Barium, ppm	50	10,000	L	10,000	1,000	2,000	5
Bismuth, ppm	20	2,000	N	2,000	N	700	2
Molybdenum, ppm	10	5,000	N	300	N	15	5
Lead, ppm	20	50,000	N	3,000	200	300	6
Thorium, ppm	200	5,000	N	2,000	200	200	11
Tungsten, ppm	100	20,000	N	700	L	300	4
			Raw panned concentrates				
Gold-a, ppm	0.05[b]	--[a]	<0.02	52	1.0	0.29	20

[a]Upper limit is open ended.
[b]Based on 10-g sample.

TABLE 3.--Correlation coefficients for elements found to be present in anomalous concentrations based on analyses of 24 nonmagnetic heavy-mineral-concentrate samples derived from stream sediments collected near the Baboquivari Peak Wilderness Study Area, Pima County, Arizona

	Au	Ag	Ba	Bi	Mo	Pb	W	Th
Au	--	0.92	-0.01	0.01	-0.08	0.02	0.02	-0.16
Ag	0.92	--	0.15	0.12	-0.02	0.16	0.15	-0.25
Ba	-0.01	0.15	--	0.25	0.15	0.51	0.51	-0.42
Bi	0.01	0.12	0.25	--	0.24	0.20	0.52	0.13
Mo	-0.08	-0.02	0.15	0.24	--	0.62	0.66	0.26
Pb	0.02	0.16	0.51	0.20	0.62	--	0.72	0.04
W	0.02	0.15	0.51	0.52	0.66	0.72	--	0.13
Th	-0.16	-0.25	-0.42	0.13	0.26	0.04	0.13	--