UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of stream-sediment, panned-concentrate, and rock samples from near the Baboquivari Peak Wilderness Study Area, Pima County, Arizona

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Open-File Report 89-574

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1989

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STUDIES RELATED TO WILDERNESS

Bureau of Land Management Wilderness Study Areas

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 presents additional results of a geochemical survey of the Baboquivari Peak Wilderness Study Area, Pima County, Arizona.

INTRODUCTION

In April 1986, the U.S. Geological Survey (USGS) conducted a reconnaissance geochemical survey of the Baboquivari Peak Wilderness Study Area, Pima County, Arizona (Adrian and others, 1987). Because many of the panned-concentrate samples were found to contain anomalous concentrations of gold and silver, additional samples were collected in March 1987, mostly upstream from where the samples were collected in 1986 (Adrian and others, 1988). In April 1988, the sampled area was expanded to include sites as far as 4 miles from the Baboquivari Peak Wilderness Study Area. The wilderness study area and surrounding sampled terrain will be collectively termed the "study area". This present report tabulates results of analyses of the 1988 samples. One rock sample (BQR127A) was collected in 1987. The possible significance of the anomalous concentrations of gold and silver is discussed in another report (Nowlan, 1988).

Figure 1 shows the location of the study area. The Baboquivari Peak Wilderness Study Area (AZ-020-203B) comprises about 3 mi^2 (8 km^2) in the southeastern part of Pima County, Arizona, and lies about 50 mi (80 km) southwest of Tucson, Arizona. Access to the study area is provided on the east by state and private roads from Arizona Route 286, and on the west by Tohono O'Odham Indian Reservation roads from Arizona Route 86.

The topographic relief in the study area is about 4,300 ft (1,311 m), with a maximum elevation of 7,734 ft (2,357 m) at the summit of Baboquivari Peak, a dramatic granite monolith that rises 500-1,000 ft above surrounding ridges and peaks. The study area lies along the east side of the crest of the Baboquivari Mountains in an area of rugged canyons, spectacular walls, and jagged outcrops of bedrock. Vegetation is characteristic of the lower and upper Sonoran life zones, ranging from shrubs and grasses at lower elevations, to chaparral at moderate elevations, to Arizona white oak and Mexican pinyon at higher elevations. Streams are ephemeral but may have running water for several months at a time during winter and early spring. More than 20 springs and wells are within the study area. Most of these springs, wells, and streams were sampled and analyzed as part of a study of water from sources on and near the Tohono O'Odham Indian Reservation (Ficklin and others, 1978, 1980; McHugh and others, 1989).

The study area is underlain mostly by granitic, volcanic, and sedimentary rocks of Jurassic age. The Jurassic rocks are cut by numerous Tertiary rhyolite dikes that generally trend northwest and in some cases were intruded along pre-existing faults. Tertiary rhyolitic and granodioritic intrusive bodies, ranging in size from a few hundred feet to over a mile long, are scattered throughout the study area. Geology of the study area is included in geologic quadrangle maps by Haxel and others (1980, 1982).

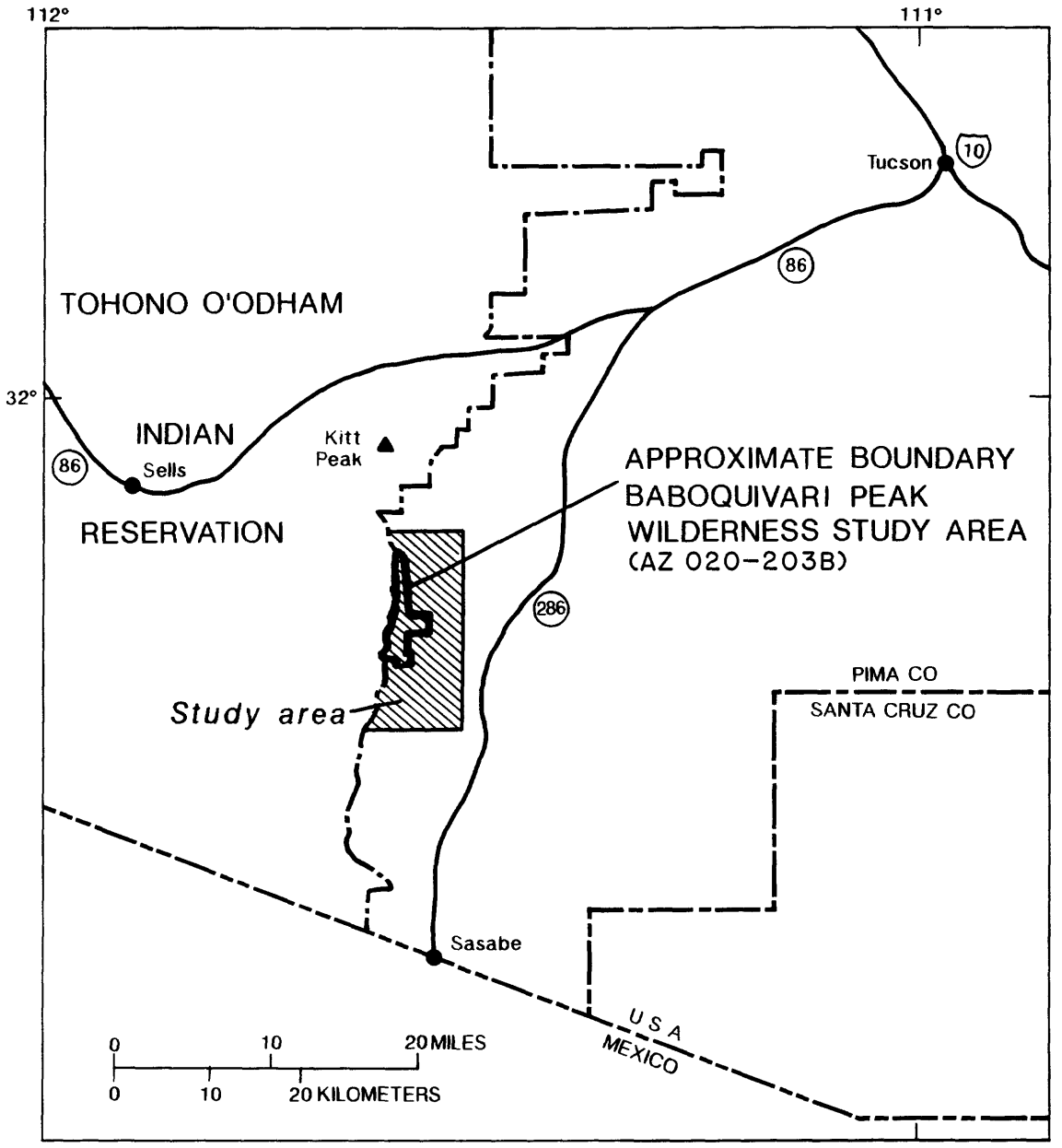

Figure 1. Index map, Baboquivari Peak Wilderness Study Area and vicinity, Pima County, Arizona.

The study area is in the Baboquivari mining district (Keith, 1974, p. 14-17) which covers the Baboquivari and Quinlan Mountains, an area that reaches about 33 mi (53 km) from the Mexican border north to Arizona Route 86 (McDonnell, 1986). Known mineral deposits within the district consist of scattered small occurrences of gold, silver, copper, lead, zinc, molybdenum, tungsten, manganese, fluorine, and beryllium. The deposits are closely associated with fault zones and swarms of intrusive dikes and sills (Keith, 1974). Keith (1969) indicates a copper occurrence in the Baboquivari Peak Wilderness Study Area. A possible gold-silver occurrence near the center of the wilderness study area was reported by Cruver and others (1982) and by Stipp and others (1967). These are the only reported mineral occurrences within the wilderness study area. Mining took place for many years at the Allison mine (Keith, 1974), 3 miles west, and in the Jupiter Canyon region (Seaman, 1983), 1-2 miles south of the wilderness study area. Production figures for these nearby mining areas are listed by Keith and others (1983). McDonnell (1986) recently conducted an investigation of mineral occurrences in the study area. Nowlan and others (1989) assessed the mineral resources and mineral-resource potential of the Baboquivari Peak Wilderness Study Area.

METHODS OF STUDY

Sample Media

Analyses of stream-sediment samples represent the chemistry of the rock material eroded from the drainage basin upstream from each sample site. Such information is useful in identifying those basins which contain concentrations of elements that may be related to mineral deposits. Panned-concentrate samples derived from stream sediment provide information about the chemistry of certain minerals in rock material eroded from the drainage basin upstream from each sample site. The selective concentration of minerals, many of which may be ore related, permits determination of some elements that are not easily detected in stream-sediment samples.

Analyses of unaltered or unmineralized rock samples provide background geochemical data for individual rock units. Analyses of altered or mineralized rocks may provide useful geochemical information about the major- and trace-element assemblages associated with a mineralizing system.

Sample Collection

Stream-sediment and panned-concentrate samples were collected at 20 sites in the study area (plate 1). Rocks were collected at 18 sites. The areas of the drainage basins sampled ranged from 0.1 mi^2 to 1 mi^2.

Stream-sediment samples

The stream-sediment samples consisted of active alluvium collected primarily from first-order (unbranched) and second-order (below the junction of two first-order) streams as shown on USGS topographic maps (scale = 1:24,000).

Panned-concentrate samples

Two panned-concentrate samples were collected at each site from the same active alluvium as the stream-sediment samples. Stream sediment was screened

with a 2.0-mm (10-mesh) screen to remove the coarse material until a heaping 16-inch pan (approximately 20 lb or 9 kg) of less than 2.0-mm material was obtained.

Rock samples

Rock samples were generally collected from outcrops or mine dumps, but some are float samples. Most samples are mineralized or altered, but a few are apparently unaltered and were collected near altered or mineralized rock. Samples were usually collected within 20 ft of the site shown on plate 1, although a few were collected as far as 300 ft from the plotted site. Descriptions of the rock samples are in table 1.

Sample Preparation

The stream-sediment samples were air dried, then sieved using 30-mesh (0.595-mm) stainless-steel sieves. The portion of the sediment passing through the sieve was pulverized with ceramic plates to pass through a 100-mesh (0.15-mm) sieve and then saved for analysis.

The panned-concentrate samples were panned until most of the quartz, feldspar, organic material, and clay-sized material was removed. The samples were then dried at 90°C.

One concentrate sample from each site was sieved through a 35-mesh (0.500-mm) stainless-steel sieve and then bromoform (specific gravity 2.85) was used to remove the remaining quartz and feldspar. The resultant heavy-mineral sample was separated into three fractions using a large electromagnet (in this case a modified Frantz Isodynamic Separator). The most magnetic material (removed at a setting of 0.25 ampere), primarily magnetite, was not analyzed. The second fraction (removed at a setting of 1.75 ampere), largely ferromagnesian silicates and iron oxides, was saved for archival storage. The third fraction (the nonmagnetic material, which may include the nonmagnetic ore minerals, zircon, sphene, etc.), was split using a Jones splitter. One split was hand ground for spectrographic analysis; the other split was saved for mineralogical analysis. The nonmagnetic fraction is here termed the "nonmagnetic heavy-mineral-concentrate sample."

The entire amount of the other concentrate sample from each site, termed the "raw panned-concentrate sample", was analyzed for gold without further preparation.

Before the nonmagnetic heavy-mineral-concentrate samples were split or pulverized and before the raw panned-concentrate samples were analyzed, particles of gold were hand picked from certain samples. These samples are noted in the data tables.

Rock samples were crushed and then pulverized to minus-100 mesh (0.15 mm) with ceramic plates.

Sample Analysis

Spectrographic method

The stream-sediment and rock samples were analyzed for 35 elements and the nonmagnetic heavy-mineral-concentrate samples for 37 elements using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). The elements analyzed and their lower limits of determination are listed in table 2. Spectrographic results were obtained by visual comparison of spectra derived from the sample against spectra obtained

from standards made from pure oxides and carbonates. Element concentrations in the standards are geometrically spaced over any order of magnitude of concentration as follows: 100, 50, 20, 10, and so forth. Samples whose concentrations are estimated to fall between those values are assigned values of 70, 30, 15, and so forth. The precision of the analytical method is approximately plus or minus one reporting interval at the 83 percent confidence level and plus or minus two reporting intervals at the 96 percent confidence level (Motooka and Grimes, 1976). Values determined for the major elements (calcium, iron, magnesium, sodium, phosphorus, and titanium) are given in weight percent; all others are given in parts per million (ppm). Emission spectrographic analyses were performed by Betty M. Adrian, John H. Bullock, Jr., and Peter M. Theodorakos.

Other methods

Table 3 lists other methods of analysis used on samples from the study area, and lists limits of determination, precision, and references for the methods. Stream-sediment and rock samples were analyzed by graphite furnace atomic absorption spectroscopy. Raw panned-concentrate samples were analyzed for gold by flame atomic absorption spectroscopy. Stream-sediment samples were analyzed for uranium and thorium by delayed neutron activation analysis and for antimony, arsenic, bismuth, cadmium, and zinc by inductively coupled plasma emission spectrometry. Analysts were David L. Fey, John B. McHugh, and Robert B. Vaughn.

DATA STORAGE SYSTEM

Upon completion of analytical work, the results were entered into a U.S. Geological Survey computer data base called PLUTO. This data base contains both descriptive geological information and analytical data. Any or all of this information may be retrieved and converted to a binary form (STATPAC) for computerized statistical analysis or publication (VanTrump and Miesch, 1977).

DESCRIPTION OF DATA TABLES

Tables 4-7 list the results of analyses for the samples of stream sediment, nonmagnetic heavy-mineral concentrate, raw panned concentrate, and rocks, respectively. The numeric portions of the sample identifications correspond to the numbers shown on the site location map (plate 1).

The removal of gold particles from panned-concentrate samples before analysis, of course, lowered the concentrations of gold and any other elements contained in the gold particles. Tables 5 and 6 include a column showing the recalculated concentrations of gold in the affected samples. The recalculated concentrations are based on the panned-concentrate sample weights and the number of gold particles removed from the samples. Each gold particle from samples listed in table 5 is assumed to weigh 20/μg, equivalent to a cube of gold that is about 0.1 mm long on each edge. Each gold particle, from samples listed in table 6, is assumed to weigh 200 μg, equivalent to a cube of gold that is about 0.2 mm long on each edge. The rationale for using the two different dimensions for gold particles is that the raw panned-concentrate samples were much larger (see weight columns in tables 5 and 6) than the nonmagnetic heavy-mineral-concentrate samples and thus only the larger gold particles were observed and removed from the raw panned-concentrate samples. The average size of gold particles was estimated from photomicrographs of gold

particles removed from the samples.

Columns in which the element headings show the letter "s" below the element symbol are emission spectrographic analyses; "aa" indicates atomic absorption analyses; "icp" indicates inductively coupled plasma-atomic emission spectroscopy; "faa" indicates flameless atomic absorption analyses; "cm" indicates colorimetric analyses; and "dn" indicates delayed neutron activation analyses. A letter "N" in the tables indicates that a given element was looked for but not detected at the lower limit of determination. If an element determined by emission spectrography was observed but was below the lowest reporting value, a "less than" symbol (<) was entered in the tables in front of the lower limit of determination. No distinction was made between "not detected" and "less than" for samples analyzed by methods other than emission spectrography. If an element was above the highest reporting value, a "greater than" symbol (>) was entered in the tables in front of the upper limit of determination. The weights of the panned-concentrate samples (tables 5 and 6) are given in grams and are in the columns headed by "weight."

Because of the formatting used in the computer program that produced tables 4-7, some of the elements listed in these tables (Ca, Fe, Mg, Na, Ti, Ag, Be, Au-aa, Th-dn, and U-dn) carry one or more nonsignificant zeros to the right of the significant digits. The spectrographic determinations for As, Au, Cd, Ge, Sb, and Sn in stream-sediment samples; for As, Cd, Cr, Ge, Ni, Sb, Sr, Pd, Pt, and Zn in nonmagnetic heavy-mineral-concentrate samples; and for As and Sb in rock samples showed that these elements were not detected at the lower limits of determination shown in table 2; consequently, the columns for these elements are omitted from tables 4, 5, and 7, respectively. Also, the concentration of Zr in all nonmagnetic heavy-mineral-concentrate samples is greater than the upper limit of determination and so Zr is omitted from table 5.

ACKNOWLEDGMENTS

The following landowners provided access and assistance: Ray Harm, W. Ross Humphreys, Donald E. Janson, John King (Anvil Ranch), and Santa Margarita Ranch, Inc.

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TABLE 1.--Descriptions of analyzed rock samples from near the Baboquivari Peak Wilderness Study Area, Pima County, Arizona.
[Source codes: F, float; M, mine dump or prospect; O, outcrop]

Sample	Source	Description
BQR127A	F	Fine grained granitic cobble with vein of specularite.
BQR131AA	O	Brecciated rhyolite with iron oxides after pyrite; from dike.
BQR131BA	O	Unaltered rhyolite from dike.
BQR131CA	O	Quartz from rhyolite dike.
BQR131DA	O	Rhyolite with 5-7-mm-thick quartz veins; from dike.
BQR131EA	O	Brecciated and potassically altered rhyolite from dike.
BQR131FA	O	Brecciated, vuggy rhyolite with 10-mm-thick quartz veins; from dike.
BQR133AA	F	Specularite cobble.
BQR133BA	F	Specularite cobble with silicate-rock material.
BQR134AA	O	Conglomerate.
BQR135AA	O	Chloritized granite.
BQR136AA	F	Rhyolite cobble with specularite.
BQR137AA	O	Quartz veins from andesitic rock.
BQR137AB	O	Andesitic rock with minor quartz veins.
BQR137BA	F	Specularite cobble.
BQR138AA	F	Specularite cobble.
BQR139AA	M	Quartz with limonite and rock material.
BQR139BA	M	Epidotized rock.
BQR139CA	M	Silicified, limonitic rock.
BQR143AA	F	Vuggy quartz from rhyolite boulder.
BQR143BA	F	Iron oxide material from cavities in rhyolite boulder.
BQR143CA	F	Rhyolite with iron oxides after pyrite; from rhyolite boulder.
BQR144AA	O	Rhyolite with iron oxides after pyrite; from dike.
BQR144BA	O	Rhyolite from dike at contact with intruded siliciclastic sedimentary rocks.
BQR144CA	O	Siliciclastic sedimentary rocks at contact with rhyolite dike.
BQR144DA	O	Siliciclastic sedimentary rocks several feet from contact with rhyolite dike.
BQR144EA	O	Sample of dioritic dike.
BQR145AA	F	Aphanitic cobble with clots of mafic minerals.
BQR147AA	M	Gossan.
BQR147BA	O	Coarse grained granitic rock with oxide copper.
BQR147CA	O	Fine grained granitic rock with oxide copper.
BQR148AA	M	Fresh rock with sulfides and fluorite.
BQR148BA	M	Massive quartz with gossan.
BQR148CA	M	Rock with iron oxides after pyrite.
BQR148DA	M	Massive quartz with fresh pyrite.
BQR148EA	O	Rhyolite from dike.
BQR153AA	M	Quartz with oxide copper and manganese oxides.
BQR153BA	M	Brecciated rock with oxide copper.
BQR154AA	M	Altered rock with possible sulfides.
BQR154BA	M	Altered rock with possible sulfides.

TABLE 1.--Descriptions of analyzed rock samples from near the Baboquivari Peak Wilderness Study Area, Pima County, Arizona.--continued.
[Source codes: F, float; M, mine dump or prospect; O, outcrop]

Sample	Source	Description
BQR154CA	M	Altered rock with limonite.
BQR155AA	F	Rhyolite with 10-mm-thick quartz veins.
BQR155BA	O	Sample of porphyritic rhyolitic dike with 10-mm-thick quartz veins.
BQR157AA	O	Sample of 20-mm-thick quartz vein in granite.
BQR157BA	O	Granite stained with iron oxides.
BQR162AA	F	Rhyolite cobble with 3-mm-thick veins of quartz and specularite.

TABLE 2.--Limits of determination for the spectrographic analysis of stream sediments, based on a 10-mg sample

[The spectrographic limits of determination for heavy-mineral-concentrate samples are based on a 5-mg sample and are therefore two reporting intervals higher than the limits listed, except as noted]

Elements	Lower determination limit	Upper determination limit
	Weight Percent	
Calcium (Ca)	0.05	20
Iron (Fe)	0.05	20
Magnesium (Mg)	0.02	10
Sodium (Na)	0.2	5
Phosphorus (P)	0.2	10
Titanium (Ti)	0.002	1
	Parts per million	
Silver (Ag)	0.5	5,000
Arsenic (As)	200	10,000
Gold (Au)	10	500
Boron (B)	10	2,000
Barium (Ba)	20	5,000
Beryllium (Be)	1	1,000
Bismuth (Bi)	10	1,000
Cadmium (Cd)	20	500
Cobalt (Co)	10	2,000
Chromium (Cr)	10	5,000
Copper (Cu)	5	20,000
Gallium (Ga)	5	500
Germanium (Ge)	10	100
Lanthanum (La)	50	1,000
Manganese (Mn)	10	5,000
Molybdenum (Mo)	5	2,000
Niobium (Nb)	20	2,000
Nickel (Ni)	5	5,000
Lead (Pb)	10	20,000
Antimony (Sb)	100	10,000
Scandium (Sc)	5	100
Tin (Sn)	10	1,000
Strontium (Sr)	100	5,000
Thorium (Th)	100	2,000
Vanadium (V)	10	10,000
Tungsten (W)	20	10,000
Yttrium (Y)	10	2,000
Zinc (Zn)	200	10,000
Zirconium (Zr)	10	1,000
Palladium (Pd)*	5	1,000
Platinum (Pt)*	20	1,000

*Determined in heavy-mineral-concentrate samples only. Limits are for heavy-mineral-concentrate samples.

TABLE 3.--Analytical methods used other than emission spectrography

[AA, flame atomic absorption; FAA, flameless atomic absorption; ICP, inductively coupled plasma spectrometry; DN, delayed neutron activation analysis]

Element determined	Sample type	Method	Lower limit of determination, ppm	Precision, percent relative standard deviation	References
Gold (Au)	raw panned concentrates	AA	0.05*	9.3-42.5	Thompson and others, 1968; O'Leary and Meier, 1986.
Gold (Au)	rocks, stream sediments	FAA	0.001	3.7-21.1	Meier, 1980; O'Leary, and Meier, 1986.
Thorium (Th)	stream sediments	DN	1*	1.2-74.8	Millard, 1976.
Uranium (U)	stream sediments	DN	0.1*	1.0-17.7	Millard, 1976.
Antimony (Sb)	rocks, stream sediments	ICP	2	6.4-11	Crock and others, 1987.
Arsenic (As)	rocks, stream sediments	ICP	5	3.5-20	Crock and others, 1987.
Bismuth (Bi)	rocks, stream sediments	ICP	2	2.2-11.9	Crock and others, 1987.
Cadmium (Cd)	rocks, stream sediments	ICP	0.1	2.8-8.8	Crock and others, 1987.
Zinc (Zn)	rocks, stream sediments	ICP	2	1.4-11.9	Crock and others, 1987.

* Based on 10-g sample

Table 4. Results of analyses of stream-sediment samples from the Baboquivari Peak Wilderness Study Area, Pima County, Arizona.

Sample	Latitude	Longitude	Ca-pct s	Fe-pct s	Mg-pct s	Na-pct s	P-pct s	Ti-pct s	Ag-ppm s	B-ppm s	Ba-ppm s	Be-ppm s	Bi-ppm s
BQA132	31 47 26	111 31 56	.70	7	.5	2.0	<.2	.3	<.5	<10	500	1.5	N
BQA137	31 45 7	111 35 8	.10	15	1.0	2.0	<.2	1.0	N	20	700	1.0	N
BQA138	31 45 8	111 35 7	.20	10	1.0	2.0	<.2	.7	<.5	20	500	1.0	N
BQA140	31 42 7	111 35 23	.15	15	.7	2.0	<.2	.7	N	10	1,000	1.0	N
BQA141	31 42 4	111 35 43	.15	10	.7	1.0	<.2	.5	<.5	50	700	1.0	N
BQA142	31 42 6	111 35 40	.15	15	.5	1.5	<.2	.5	N	10	1,500	1.5	N
BQA146	31 46 29	111 33 41	1.00	10	1.0	1.5	<.2	.7	<.5	20	700	<1.0	N
BQA147	31 46 49	111 31 55	1.00	10	2.0	1.5	<.2	.5	<.5	15	700	2.0	<10
BQA149	31 44 12	111 35 16	.15	10	1.0	2.0	<.2	.7	5.0	15	700	<1.0	N
BQA150	31 43 53	111 35 26	.20	10	.7	1.5	<.2	.7	<.5	20	500	1.0	N
BQA151	31 43 22	111 35 59	.07	20	.7	1.5	N	1.0	N	N	500	<1.0	N
BQA152	31 43 18	111 35 46	.20	10	1.0	1.0	<.2	.5	<.5	20	700	1.0	N
BQA156	31 50 28	111 33 21	.07	7	.5	2.0	N	.3	<.5	10	300	1.0	10
BQA157	31 50 28	111 33 11	.10	10	.5	3.0	<.2	.3	.5	<10	700	1.0	15
BQA158	31 50 28	111 33 0	.20	7	1.0	3.0	<.2	.5	<.5	<10	500	1.0	<10
BQA159	31 50 53	111 32 40	.15	2	.3	2.0	<.2	.2	<.5	10	300	1.0	10
BQA160	31 51 58	111 33 37	.15	7	.5	2.0	<.2	.5	N	15	500	1.0	N
BQA161	31 51 56	111 33 34	.70	20	2.0	3.0	<.2	.7	N	<10	500	1.5	N
BQA162	31 52 8	111 33 24	.15	15	.3	2.0	<.2	.5	N	10	300	1.5	N
BQA163	31 44 12	111 34 10	.10	7	.5	3.0	N	.5	N	15	1,000	1.0	N

Sample	Co-ppm s	Cr-ppm s	Cu-ppm s	Ga-ppm s	La-ppm s	Mn-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s	Pb-ppm s	Sc-ppm s	Sr-ppm s	Th-ppm s
BQA132	10	20	70	30	50	1,000	7	N	30	150	7	300	N
BQA137	10	20	50	50	50	1,500	<5	20	30	100	20	100	N
BQA138	10	20	50	30	50	1,500	5	<20	30	70	20	100	N
BQA140	10	20	15	30	50	2,000	N	<20	20	30	10	150	N
BQA141	10	30	50	20	<50	1,000	<5	N	30	20	10	150	N
BQA142	10	20	50	30	50	>5,000	N	<20	20	50	10	100	N
BQA146	10	30	50	20	<50	1,000	<5	<20	30	30	10	200	N
BQA147	20	50	100	30	100	2,000	7	<20	100	100	10	300	N
BQA149	10	50	30	30	<50	1,500	<5	<20	30	50	10	100	N
BQA150	10	20	30	20	<50	1,500	N	20	20	50	10	100	N
BQA151	30	30	50	30	<50	1,000	N	<20	30	50	10	100	N
BQA152	15	30	50	15	50	2,000	10	<20	50	30	10	100	N
BQA156	10	15	30	15	50	500	7	20	20	30	5	100	N
BQA157	10	10	70	30	<50	1,000	5	<20	10	30	5	100	N
BQA158	15	20	70	30	70	1,000	10	20	50	30	7	100	<100
BQA159	<10	<10	7	20	N	700	5	<20	<5	20	5	100	N
BQA160	10	10	70	15	50	1,000	10	20	10	30	7	100	N
BQA161	70	50	150	30	70	1,500	15	<20	150	20	15	200	N
BQA162	10	15	50	20	70	700	7	20	15	20	5	100	N
BQA163	15	<10	70	30	50	1,000	15	<20	10	50	7	100	N

Table 4. Results of analyses of stream-sediment samples from the Baboquivari Peak Wilderness Study Area, Pima County, Arizona.--Continued

Sample	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	As-ppm icp	Bi-ppm icp	Cd-ppm icp	Sb-ppm icp	Zn-ppm icp	Au-ppm aa	Th-ppm dn	U-ppm dn
BQA132	100	N	20	<200	300	<5	<2	.4	<2	80	<.001	90.1	11.50
BQA137	70	N	50	<200	700	<5	<2	.5	<2	61	<.001	13.7	4.38
BQA138	70	N	70	<200	700	10	<2	.4	<2	65	<.001	14.6	4.01
BQA140	300	N	20	<200	300	10	<2	.9	<2	52	.070	14.1	7.35
BQA141	100	N	20	<200	200	<5	<2	.4	<2	46	.220	14.1	4.08
BQA142	200	N	20	<200	500	61	<2	.9	18	38	1.100	19.7	7.44
BQA146	150	N	20	N	500	<5	<2	.6	<2	56	<.001	13.9	4.18
BQA147	70	N	20	500	300	<5	<2	2.4	<2	320	<.001	29.4	10.30
BQA149	70	N	20	<200	300	<5	<2	.7	<2	57	2.300	11.0	4.14
BQA150	100	N	50	<200	300	8	<2	.6	<2	53	<.001	13.3	4.78
BQA151	700	N	30	<200	700	<5	<2	2.0	<2	44	.320	14.9	10.40
BQA152	150	<20	20	N	500	17	<2	.5	3	35	.160	14.5	4.64
BQA156	70	N	20	N	200	<5	3	.2	<2	36	<.001	42.5	8.00
BQA157	50	N	20	<200	200	<5	5	.7	<2	50	<.001	133.0	14.00
BQA158	70	<20	50	N	300	<5	<2	.3	<2	44	<.001	57.7	8.31
BQA159	20	N	15	N	70	<5	<2	.2	<2	30	.001	28.1	5.58
BQA160	70	N	150	N	1,000	<5	<2	.2	<2	44	.007	27.2	7.20
BQA161	500	N	50	N	1,000	<5	3	1.6	<2	80	.001	53.1	7.02
BQA162	150	N	50	N	500	<5	<2	.7	<2	38	.001	73.7	12.60
BQA163	30	N	20	N	500	<5	<2	.3	<2	65	.001	18.1	5.45

Table 5. Results of analyses of nonmagnetic heavy-mineral-concentrate samples from the Baboquivari Peak Wilderness Study Area, Pima County, Arizona.

[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown.]

Sample	Latitude	Longitude	Ca-pct s	Fe-pct s	Mg-pct s	Na-pct s	P-pct s	Ti-pct s	Ag-ppm s	Au-ppm s
BQH132	31 47 26	111 31 56	1.0	1.5	<.05	N	.5	>2.0	N	N
BQH137	31 45 7	111 35 8	<.1	2.0	.07	N	<.5	2.0	N	N
BQH138	31 45 8	111 35 7	.1	5.0	.20	N	<.5	>2.0	N	N
BQH140	31 42 7	111 35 23	.5	2.0	.07	<.5	.5	1.0	100	>1,000
BQH141	31 42 4	111 35 43	.5	.7	.07	N	.5	>2.0	10	70
BQH142	31 42 6	111 35 40	<.1	1.0	.05	.5	N	1.0	100	700
BQH146	31 46 29	111 33 41	1.5	1.5	.07	N	1.0	1.5	N	N
BQH147	31 46 49	111 31 55	1.5	2.0	.15	.5	.7	>2.0	20	N
BQH149	31 44 12	111 35 16	1.0	5.0	.10	.7	.5	2.0	<1	N
BQH150	31 43 53	111 35 26	.3	2.0	.10	<.5	<.5	>2.0	N	N
BQH151	31 43 22	111 35 59	<.1	2.0	.20	1.5	N	.5	50	300
BQH152	31 43 18	111 35 46	.7	1.5	.15	<.5	.5	1.5	150	>1,000
BQH156	31 50 28	111 33 21	.1	2.0	.05	N	N	>2.0	7	N
BQH157	31 50 28	111 33 11	1.0	3.0	.07	<.5	.5	>2.0	2	N
BQH158	31 50 28	111 33 0	.7	1.5	<.05	N	.5	>2.0	N	N
BQH159	31 50 53	111 32 40	3.0	2.0	<.05	N	1.0	>2.0	N	N
BQH160	31 51 58	111 33 37	2.0	1.5	.05	<.5	1.0	2.0	5	N
BQH161	31 51 56	111 33 34	5.0	2.0	.15	.5	1.0	2.0	N	N
BQH162	31 52 8	111 33 24	3.0	2.0	.05	.5	<.5	>2.0	N	N
BQH163	31 44 12	111 34 10	1.0	3.0	.10	1.5	N	2.0	N	N

Sample	B-ppm s	Ba-ppm s	Be-ppm s	Bi-ppm s	Co-ppm s	Cu-ppm s	Ga-ppm s	La-ppm s	Mn-ppm s	Mo-ppm s
BQH132	N	300	15	N	<20	10	N	500	100	5,000
BQH137	<20	150	3	N	N	N	<10	N	150	30
BQH138	20	300	5	N	N	N	<10	100	150	30
BQH140	<20	200	N	N	N	N	<10	N	100	N
BQH141	20	500	<2	N	N	15	N	N	50	300
BQH142	N	700	20	N	N	N	<10	N	700	10
BQH146	N	2,000	<2	N	N	N	N	<100	150	2,000
BQH147	N	3,000	5	N	N	<10	<10	150	200	200
BQH149	N	500	15	N	N	N	<10	100	150	30
BQH150	N	2,000	<2	<20	N	N	<10	<100	150	20
BQH151	N	700	N	N	N	N	10	N	100	N
BQH152	<20	>10,000	30	<20	N	10	N	N	100	700
BQH156	N	2,000	150	>2,000	<20	<10	N	100	70	70
BQH157	N	700	15	>2,000	<20	10	N	200	150	100
BQH158	N	150	10	500	<20	10	N	200	150	70
BQH159	N	300	50	500	N	<10	N	500	200	20
BQH160	N	150	15	2,000	N	<10	N	150	100	70
BQH161	N	150	2	2,000	N	<10	N	150	150	150
BQH162	N	150	5	2,000	N	10	N	200	200	70
BQH163	N	1,500	150	70	N	<10	10	N	150	300

Table 5. Results of analyses of nonmagnetic heavy-mineral-concentrate samples from the Baboquivari Peak Wilderness Study Area, Pima County, Arizona.--Continued

Sample	Nb-ppm s	Pb-ppm s	Sc-ppm s	Sn-ppm s	Th-ppm s	V-ppm s	W-ppm s	Y-ppm s	Weight	Part	Recal Au
BQH132	<50	30,000	20	N	>5,000	100	1,000	1,000	--	--	--
BQH137	N	50	10	N	500	20	N	1,000	--	--	--
BQH138	<50	70	30	N	N	70	N	1,500	--	--	--
BQH140	N	<20	N	N	N	50	<50	150	.052	32	>13,000
BQH141	<50	20,000	15	N	<200	50	2,000	200	.126	50	8,000
BQH142	N	100	N	N	N	20	<50	70	.570	591	21,000
BQH146	<50	50,000	N	N	N	50	2,000	200	.134	6	900
BQH147	70	2,000	10	N	1,000	100	300	200	.046	1	430
BQH149	<50	5,000	<10	N	200	20	N	300	.209	21	2,000
BQH150	<50	10,000	10	N	N	30	N	500	.143	5	700
BQH151	N	70	N	N	N	30	100	100	4.513	9	340
BQH152	70	20,000	N	N	N	100	5,000	100	.196	54	>6,500
BQH156	150	200	15	N	3,000	50	1,500	700	--	--	--
BQH157	100	300	30	N	>5,000	50	2,000	1,000	--	--	--
BQH158	70	50	20	N	>5,000	70	1,000	1,000	--	--	--
BQH159	100	50	10	N	2,000	100	150	700	--	--	--
BQH160	70	200	<10	N	2,000	50	700	1,000	--	--	--
BQH161	<50	300	N	N	3,000	150	1,000	200	--	--	--
BQH162	150	50	<10	N	>5,000	100	1,000	700	--	--	--
BQH163	50	2,000	N	500	N	50	1,500	70	--	--	--

Table 6. Results of analyses of raw panned-concentrate samples from the Baboquivari Peak Wilderness Study Area, Pima County, Arizona.

[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown.]

Sample	Latitude	Longitude	Au-ppm aa	Weight	Part	Recal Au
BQG132	31 47 26	111 31 56	<.05	11.07	--	--
BQG137	31 45 7	111 35 8	.31	10.60	--	--
BQG138	31 45 8	111 35 7	.14	8.59	--	--
BQG140	31 42 7	111 35 23	30.60	19.25	5	83
BQG141	31 42 4	111 35 43	49.00	11.23	--	--
BQG142	31 42 6	111 35 40	253.00	12.66	15	490
BQG146	31 46 29	111 33 41	.88	9.52	--	--
BQG147	31 46 49	111 31 55	.09	5.88	--	--
BQG149	31 44 12	111 35 16	33.00	14.83	2	60
BQG150	31 43 53	111 35 26	84.50	12.43	--	--
BQG151	31 43 22	111 35 59	16.70	14.97	--	--
BQG152	31 43 18	111 35 46	86.60	14.44	--	--
BQG156	31 50 28	111 33 21	3.32	5.09	--	--
BQG157	31 50 28	111 33 11	<.05	11.13	--	--
BQG158	31 50 28	111 33 0	.14	8.44	--	--
BQG159	31 50 53	111 32 40	.32	7.43	--	--
BQG160	31 51 58	111 33 37	2.61	2.68	--	--
BQG161	31 51 56	111 33 34	1.50	8.36	--	--
BQG162	31 52 8	111 33 24	10.00	17.97	--	--
BQG163	31 44 12	111 34 10	.08	9.72	--	--

Table 7. Results of analyses of rock samples from the Baboquivari Peak Wilderness Study Area, Pima County, Arizona.
[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown.]

Sample	Latitude	Longitude	Ca-pct s	Fe-pct s	Mg-pct s	Na-pct s	P-pct s	Ti-pct s	Ag-ppm s	Au-ppm s	B-ppm s	Ba-ppm s
BQR127A	31 45 29	111 35 5	1.00	15.00	.15	3.0	N	.300	N	N	<10	200
BQR131AA	31 47 28	111 31 59	.05	1.50	.10	2.0	<.2	.200	<.5	N	15	500
BQR131BA	31 47 28	111 31 59	.07	1.00	.10	2.0	<.2	.150	<.5	N	15	300
BQR131CA	31 47 28	111 31 59	<.05	<.05	.02	<.2	<.2	.002	N	N	10	100
BQR131DA	31 47 28	111 31 59	.15	.20	.10	3.0	<.2	.200	<.5	N	10	300
BQR131EA	31 47 28	111 31 59	<.05	1.00	.10	1.0	<.2	.100	N	N	10	500
BQR131FA	31 47 28	111 31 59	<.05	.50	.15	1.0	<.2	.070	<.5	N	10	300
BQR133AA	31 45 10	111 35 7	.05	>20.00	.50	N	N	.050	N	N	N	50
BQR133BA	31 45 10	111 35 7	<.05	>20.00	.50	N	N	.030	N	N	N	<20
BQR134AA	31 45 21	111 35 22	.10	5.00	.50	2.0	<.2	.300	<.5	N	100	1,000
BQR135AA	31 45 22	111 35 30	2.00	10.00	2.00	3.0	.2	1.000	N	N	10	700
BQR136AA	31 45 8	111 35 13	<.05	7.00	.20	2.0	<.2	.200	N	N	10	100
BQR137AA	31 45 7	111 35 8	.05	.50	.15	.3	<.2	.070	<.5	N	10	500
BQR137AB	31 45 7	111 35 8	.50	7.00	2.00	2.0	<.2	.700	N	N	20	1,000
BQR137BA	31 45 7	111 35 8	<.05	>20.00	.70	N	N	.070	N	N	N	20
BQR138AA	31 45 8	111 35 7	<.05	>20.00	<.02	N	N	.010	N	N	N	<20
BQR139AA	31 42 6	111 35 19	1.50	3.00	.20	N	<.2	.020	15.0	N	15	70
BQR139BA	31 42 6	111 35 19	.50	3.00	.20	N	<.2	.200	3.0	N	300	150
BQR139CA	31 42 6	111 35 19	2.00	5.00	.50	N	<.2	.150	7.0	N	200	150
BQR143AA	31 46 27	111 33 33	N	.20	.03	N	<.2	.020	N	N	10	100
BQR143BA	31 46 27	111 33 33	<.05	5.00	.70	N	<.2	.200	<.5	N	30	200
BQR143CA	31 46 27	111 33 33	N	.70	.20	.3	<.2	.070	N	N	10	500
BQR144AA	31 46 30	111 34 33	<.05	.50	.05	2.0	<.2	.070	<.5	N	<10	150
BQR144BA	31 46 30	111 34 33	.20	.50	.07	3.0	<.2	.050	.7	N	<10	500
BQR144CA	31 46 30	111 34 33	.05	3.00	.50	1.0	<.2	.500	.7	N	15	500
BQR144DA	31 46 30	111 34 33	.50	5.00	1.00	1.0	<.2	.700	N	N	15	700
BQR144EA	31 46 30	111 34 33	.50	3.00	.70	2.0	<.2	.500	N	N	10	1,000
BQR145AA	31 46 26	111 34 20	7.00	5.00	3.00	1.5	N	.500	N	N	N	2,000
BQR147AA	31 46 49	111 31 55	.10	>20.00	.20	2.0	N	.100	30.0	N	N	300
BQR147BA	31 46 49	111 31 55	.07	5.00	.50	2.0	N	.100	10.0	N	N	200
BQR147CA	31 46 49	111 31 55	2.00	10.00	7.00	2.0	N	.500	<.5	N	<10	150
BQR148AA	31 44 1	111 35 8	15.00	10.00	2.00	.2	N	.300	2,000.0	50	20	3,000
BQR148BA	31 44 1	111 35 8	<.05	3.00	.70	1.0	N	.200	100.0	N	30	700
BQR148CA	31 44 1	111 35 8	N	5.00	1.50	.7	N	.500	20.0	N	50	1,000
BQR148DA	31 44 1	111 35 8	.05	5.00	.50	.5	N	.150	100.0	<10	20	700
BQR148EA	31 44 1	111 35 8	<.05	1.00	.20	.7	N	.070	.5	N	20	1,000
BQR153AA	31 43 25	111 35 50	N	.07	.02	N	N	N	30.0	N	N	100
BQR153BA	31 43 25	111 35 50	.05	7.00	1.00	1.5	N	.300	2.0	N	30	1,500
BQR154AA	31 43 24	111 35 40	N	2.00	.50	1.5	N	.200	<.5	N	15	1,500
BQR154BA	31 43 24	111 35 40	.07	10.00	.50	1.5	N	.500	<.5	N	20	3,000
BQR154CA	31 43 24	111 35 40	N	2.00	.50	1.0	N	.300	2.0	N	20	2,000
BQR155AA	31 50 34	111 33 5	.05	1.50	.70	<.2	N	.200	N	N	30	2,000
BQR155BA	31 50 34	111 33 5	N	1.00	.50	1.0	N	.150	N	N	<10	5,000
BQR157AA	31 50 27	111 33 11	<.05	1.00	.10	.2	N	.015	<.5	N	N	200
BQR157BA	31 50 27	111 33 11	.07	1.50	.30	2.0	N	.070	N	N	N	200
BQR162AA	31 52 8	111 33 24	.07	1.50	.15	3.0	N	.070	N	N	N	70

Table 7. Results of analyses of rock samples from the Baboquivari Peak Wilderness Study Area, Pima County, Arizona.--Continued

Sample	Be-ppm s	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	Ga-ppm s	Ge-ppm s	La-ppm s	Mn-ppm s	Mo-ppm s	Nb-ppm s
BQR127A	2.0	N	N	50	N	<5	100	N	100	200	20	50
BQR131AA	1.0	N	N	N	N	20	20	N	50	150	<5	20
BQR131BA	1.0	N	N	N	N	20	50	N	N	100	<5	<20
BQR131CA	N	N	N	N	N	<5	N	N	N	20	N	N
BQR131DA	1.5	<10	N	N	N	10	30	N	70	100	<5	20
BQR131EA	1.5	<10	N	N	N	5	15	N	N	70	<5	<20
BQR131FA	1.5	<10	N	N	N	5	15	N	N	150	<5	<20
BQR133AA	2.0	N	N	N	N	N	0	N	70	200	N	N
BQR133BA	2.0	N	N	<10	N	N	0	N	N	200	10	N
BQR134AA	1.0	N	N	<10	<10	10	50	N	50	500	N	<20
BQR135AA	1.0	N	N	15	15	50	50	N	100	2,000	N	20
BQR136AA	7.0	N	N	N	<10	<5	70	N	50	200	<5	70
BQR137AA	N	N	N	N	N	5	N	N	N	100	N	N
BQR137AB	<1.0	N	N	20	<10	20	30	N	50	500	N	20
BQR137BA	1.0	N	N	N	N	70	0	N	N	500	5	N
BQR138AA	10.0	N	N	10	N	15	0	N	N	200	15	N
BQR139AA	<1.0	N	<20	N	<10	50	N	<10	N	300	N	N
BQR139BA	1.0	N	N	N	<10	5	N	10	N	100	100	N
BQR139CA	1.5	N	50	<10	N	30	N	10	N	700	100	N
BQR143AA	1.0	<10	N	N	N	5	N	N	N	500	N	<20
BQR143BA	3.0	N	N	<10	30	150	70	N	70	1,000	7	N
BQR143CA	<1.0	N	N	N	N	5	30	N	<50	100	<5	20
BQR144AA	<1.0	N	N	N	N	5	30	N	<50	300	<5	20
BQR144BA	<1.0	<10	N	N	N	20	30	N	<50	150	<5	<20
BQR144CA	1.5	N	N	<10	20	70	100	N	<50	700	10	<20
BQR144DA	1.5	N	N	10	30	70	50	N	50	1,500	<5	<20
BQR144EA	1.0	N	N	10	<10	10	70	N	70	700	N	20
BQR145AA	1.0	N	N	10	30	10	100	N	50	2,000	5	N
BQR147AA	1.5	150	N	N	N	7,000	500	N	N	50	2,000	N
BQR147BA	7.0	50	N	20	N	2,000	100	N	200	1,000	200	20
BQR147CA	3.0	N	N	30	150	1,000	100	N	70	5,000	5	N
BQR148AA	10.0	500	20	20	<10	7,000	150	N	<50	>5,000	7	N
BQR148BA	5.0	20	N	N	N	15	70	N	N	50	100	<20
BQR148CA	10.0	N	N	N	<10	10	150	N	N	70	100	N
BQR148DA	20.0	10	N	<10	N	5	30	N	N	30	200	<20
BQR148EA	<1.0	<10	N	N	N	20	200	N	N	100	<5	<20
BQR153AA	N	<10	N	N	N	2,000	N	N	N	3,000	50	N
BQR153BA	7.0	N	N	20	10	1,000	150	N	<50	1,500	10	N
BQR154AA	N	N	N	<10	N	20	100	N	<50	150	N	N
BQR154BA	1.0	N	N	15	200	15	200	N	<50	200	N	20
BQR154CA	1.0	N	N	N	N	15	100	N	N	500	<5	<20
BQR155AA	2.0	N	N	N	N	10	100	N	70	20	5	<20
BQR155BA	<1.0	N	N	N	N	7	150	N	<50	50	5	N
BQR157AA	N	N	N	N	N	7	N	N	N	20	<5	N
BQR157BA	1.5	N	N	N	N	5	50	N	N	30	<5	<20
BQR162AA	<1.0	N	N	N	N	5	100	N	N	20	15	<20

Table 7. Results of analyses of rock samples from the Baboquivari Peak Wilderness Study Area, Pima County, Arizona.--Continued

Sample	Ni-ppm s	Pb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s	Th-ppm s	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Au-ppm faa
BQR127A	N	10	7	N	300	N	70	70	100	N	200	.001
BQR131AA	5	150	<5	<10	100	N	20	N	15	N	70	<.001
BQR131BA	5	100	<5	<10	100	N	15	N	10	N	100	<.001
BQR131CA	<5	N	N	N	N	N	<10	N	<10	N	N	<.001
BQR131DA	5	20	<5	N	<100	N	15	N	20	N	100	<.001
BQR131EA	5	50	<5	N	100	N	30	N	10	N	70	<.001
BQR131FA	<5	50	<5	N	<100	N	30	N	10	N	100	<.001
BQR133AA	10	N	10	30	N	N	300	150	<10	N	N	<.001
BQR133BA	20	N	10	20	N	N	500	70	<10	N	N	<.001
BQR134AA	5	150	7	<10	100	N	70	N	20	N	200	<.001
BQR135AA	20	20	20	<10	100	N	100	N	70	N	1,000	<.001
BQR136AA	<5	10	5	15	N	N	10	N	100	N	>1,000	<.001
BQR137AA	<5	N	N	N	<100	N	20	N	N	N	20	<.001
BQR137AB	15	15	10	N	300	N	150	N	20	N	300	<.001
BQR137BA	15	N	10	20	N	N	200	50	N	<200	<10	<.001
BQR138AA	<5	N	<5	50	N	N	30	70	N	N	<10	<.001
BQR139AA	<5	3,000	N	N	<100	N	20	N	<10	500	<10	.510
BQR139BA	5	700	5	N	<100	N	70	100	<10	<200	50	.130
BQR139CA	5	2,000	<5	N	100	N	50	30	10	1,000	30	.200
BQR143AA	<5	70	N	N	N	N	15	N	<10	N	20	.014
BQR143BA	20	1,000	10	N	N	N	100	N	20	500	100	.220
BQR143CA	<5	30	<5	N	<100	N	15	N	10	N	70	.001
BQR144AA	<5	50	N	N	100	N	10	N	15	N	70	<.001
BQR144BA	<5	100	<5	10	100	N	15	N	15	N	70	<.001
BQR144CA	10	300	20	N	<100	N	100	N	15	N	500	<.001
BQR144DA	20	50	20	N	100	N	100	N	50	<200	300	<.001
BQR144EA	5	30	7	N	200	N	50	N	20	N	200	<.001
BQR145AA	10	15	15	N	300	N	100	N	50	N	200	.037
BQR147AA	5	500	5	N	N	N	100	N	10	N	70	.008
BQR147BA	<5	300	N	N	N	<100	50	<20	100	<200	500	.005
BQR147CA	100	20	20	N	300	N	200	N	50	200	200	.003
BQR148AA	10	>20,000	7	N	500	N	150	20	10	2,000	70	45.000
BQR148BA	<5	2,000	<5	N	N	N	100	50	N	N	70	3.500
BQR148CA	<5	1,500	7	N	N	N	200	50	N	N	150	.440
BQR148DA	5	1,000	N	N	N	N	100	50	N	N	30	10.000
BQR148EA	<5	70	N	N	N	<100	10	N	N	N	50	.009
BQR153AA	N	N	N	N	N	N	N	N	N	N	N	.022
BQR153BA	10	30	20	N	N	N	150	30	70	<200	100	.007
BQR154AA	<5	500	5	N	N	N	15	N	<10	N	150	.006
BQR154BA	5	300	20	N	N	N	70	N	20	200	200	.003
BQR154CA	<5	200	5	N	N	N	50	<20	30	N	300	.140
BQR155AA	<5	10	<5	N	N	N	30	N	20	N	200	.002
BQR155BA	<5	30	N	N	<100	N	30	N	<10	N	200	.013
BQR157AA	<5	N	N	N	N	<100	10	N	N	N	N	.001
BQR157BA	<5	N	N	N	N	N	20	N	N	N	30	.001
BQR162AA	5	50	N	N	N	N	15	N	<10	N	2[illegible]	.001