UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rock samples from the Sierra Estrella Wilderness Study Area, Maricopa County, Arizona

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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 the results of a geochemical survey of the Sierra Estrella Wilderness Study Area, Maricopa County, Arizona.

INTRODUCTION

In October 1987, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Sierra Estrella Wilderness Study Area (WSA), Maricopa County, Arizona (AZ-020-160).

The Sierra Estrella WSA comprises about 22 mi^2 (58 km^2) (14,190 acres) in Maricopa County, Arizona, and lies roughly 15 mi (24 km) southwest of Phoenix, Arizona. Access to the study area is provided by numerous gravel roads extending eastward from a paved road which intersects State Highway 85 near Liberty, Arizona (see fig. 1). Topographic relief ranges from roughly 4,100 ft in the eastern part of the study area to 1,400 ft in the west. The study area is characterized by steep rugged mountains of the Sierra Estrella Range with fringing pediments to the southwest.

The Sierra Estrella WSA is underlain by foliated schists and gneisses of Precambrian age which have been locally intruded by Precambrian granite and pegmatite dikes. The northern part of the WSA is cut by Tertiary (?) mafic dikes (Spencer et al., 1985). Several small pegmatite bodies have been exploited for mica (Korzeb, 1988), and a number of placer gold claims are located in the pediments near the west boundary of the WSA.

METHODS OF STUDY

Sample Media

Analyses of the 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. Heavy-mineral-concentrate samples 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. On the other hand, analyses of altered or mineralized rocks, where present, may provide useful geochemical information about the major- and trace-element assemblages associated with a mineralizing system.

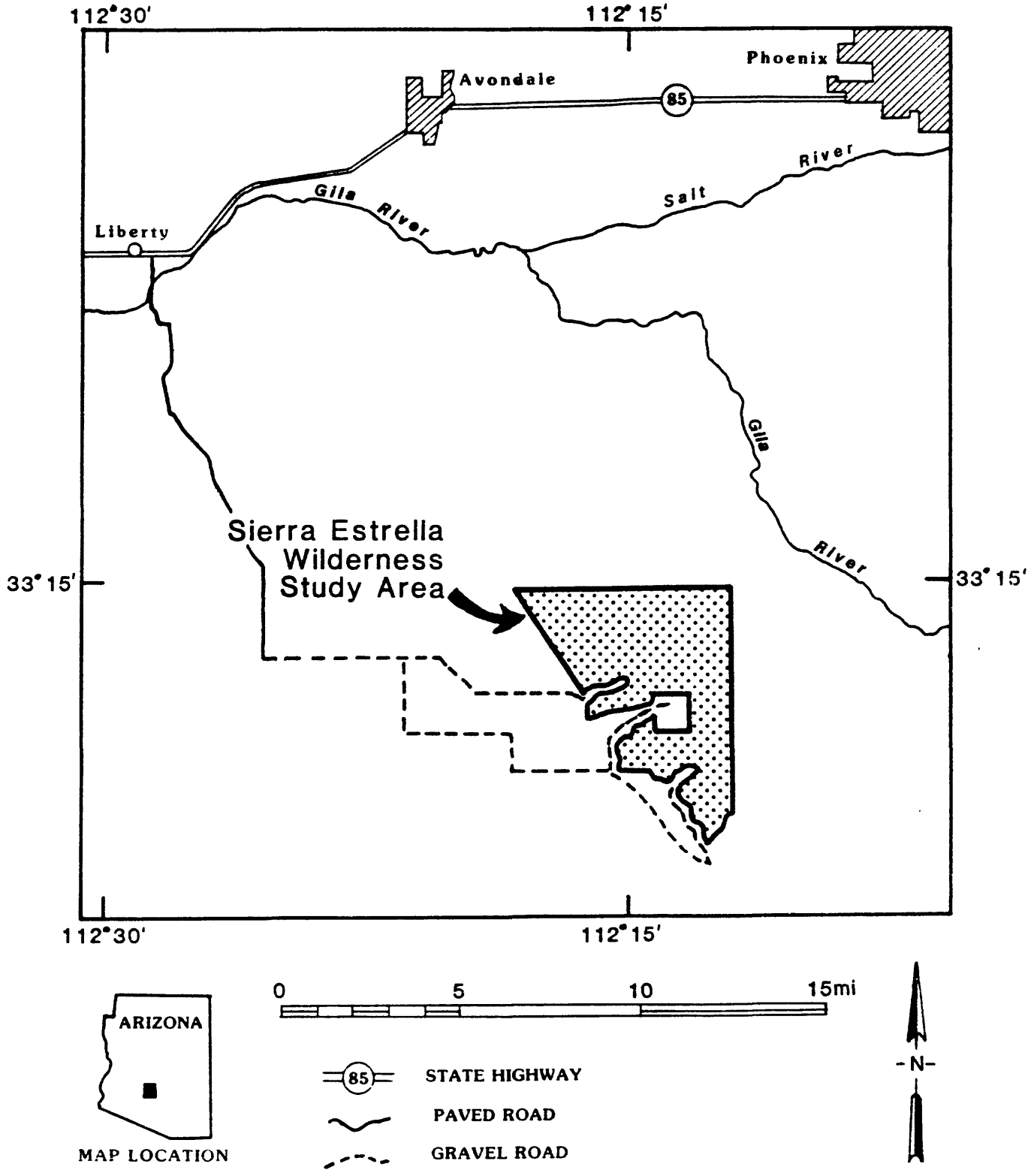

Figure 1. Location map of the Sierra Estrella Wilderness Study Area, Maricopa County, Arizona (modified from Korzeb, 1988).

Sample Collection

Samples were collected at 26 sites (plate 1). Both a stream-sediment sample and a heavy-mineral-concentrate sample were collected at all sites. Where suitable outcrop was available, rock samples were collected. Average sampling density was about one sample site per 0.85 mi^2 for the stream sediments and heavy-mineral concentrates. The area of the drainage basins sampled ranged from 0.3 mi^2 to 2.5 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). Each sample was composited from several localities within an area that may extend as much as 20 ft from the site plotted on the map.

Heavy-mineral-concentrate samples

Heavy-mineral-concentrate samples were collected from the same active alluvium as the stream-sediment samples. Each bulk sample was screened with a 2.0-mm (10-mesh) screen to remove the coarse material. The less than 2.0-mm fraction was panned until most of the quartz, feldspar, organic material, and clay-sized material were removed.

Rock samples

Rock samples were collected from various types of occurrences in the vicinity of the plotted site location. Descriptions of rock samples are in table 6.

Sample Preparation

The stream-sediment samples were air dried, then sieved using 80-mesh (0.17-mm) stainless-steel sieves. The portion of the sediment passing through the sieve was saved for analysis.

After air drying, bromoform (specific gravity 2.8) was used to remove the remaining quartz and feldspar from the heavy-mineral-concentrate samples that had been panned in the field. 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, primarily magnetite, was not analyzed. The second fraction, largely ferromagnesian silicates and iron oxides, was saved for archival storage. The third fraction (the least magnetic 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. These magnetic separates are the same separates that would be produced by using a Frantz Isodynamic Separator set at a slope of 15° and a tilt of 10° with a current of 0.2 ampere to remove the magnetite and ilmenite, and a current of 0.6 ampere to split the remainder of the sample into paramagnetic and nonmagnetic fractions.

Rock samples were crushed and then pulverized to minus 0.15 mm with ceramic plates.

Sample Analysis

Spectrographic method

The stream-sediment, heavy-mineral-concentrate, and rock samples were analyzed for 35 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 1. Spectrographic results were obtained by visual comparison of spectra derived from the sample against spectra obtained from standards made from pure oxides and carbonates. Standard concentrations are geometrically spaced over any given 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, iron, magnesium, calcium, and titanium, are given in weight percent; all others are given in parts per million (micrograms/gram). Analytical data for samples from the Sierra Estrella WSA are listed in tables 3, 4, and 5.

Chemical methods

Samples from this study area were also analyzed by other analytical methods. Rocks and stream sediments were analyzed for gold (Au) using flameless atomic absorption spectroscopy, and for arsenic (As), bismuth (Bi), cadmium (Cd), and zinc (Zn) using inductively coupled plasma-atomic emission spectroscopy (ICP). Selected rocks were analyzed for gold using atomic absorption spectroscopy. See table 2 for a more detailed summary of these other chemical methods used. Analytical results for stream-sediment, heavy-mineral-concentrate, and rock samples are listed in tables 3, 4, and 5, respectively.

DATA STORAGE SYSTEM

Upon completion of all analytical work, the analytical results were entered into either the Branch of Geochemistry computer base called PLUTO or RASS (Rock Analysis Storage System). These data bases contain 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 3-5 list the results of analyses for the samples of stream sediment, heavy-mineral concentrate, and rock, respectively. For the three tables, the data are arranged so that column 1 contains the USGS-assigned sample numbers. These numbers correspond to the numbers shown on the site location map (plate 1). Columns in which the element headings show the letter "s" below the element symbol are emission spectrographic analyses, and "icp" indicates inductively coupled plasma-atomic emission spectroscopy. A letter "N" in the tables indicates that a given element was looked for but not detected at the lower limit of determination shown for that element in

table 1. For emission spectrographic analyses, a "less than" symbol (<) entered in the tables in front of the lower limit of determination indicates that an element was observed but was below the lowest reporting value. For ICP analyses, a "less than" symbol (<) entered in the tables in front of the lower limit of determination indicates that an element was below the lowest reporting value. If an element was observed but was above the highest reporting value, a "greater than" symbol (>) was entered in the tables in front of the upper limit of determination. Because of the formatting used in the computer program that produced tables 3-5, some of the elements listed in these tables (Fe, Mg, Ca, Ti, Ag, and Be) carry one or more nonsignificant digits to the right of the significant digits. The analysts did not determine these elements to the accuracy suggested by the extra zeros.

The spectrographic determinations for As, Au, Bi, Cd, Mo, Sb, W, Zn, Th, and Ge in stream-sediment samples; for Ag, As, Au, Bi Cd, Ge, Ni, Sb, Pd, and Pt in heavy-mineral-concentrate samples; and for As, Au, Cd, Mo, Nb, Sb, W, Zn, Th, Ge, and P in rock samples were all below the lower limits of determinations shown in table 1. Consequently, the columns for these elements have been deleted from tables 3, 4, and 5, respectively. All of the spectrographic determinations for Zr in heavy-mineral-concentrate samples were all above the upper limit of determination shown in table 1, and therefore Zr was omitted from table 4. Stream-sediment samples were analyzed for gold by the atomic absorption method described by Thompson et al. (1968). No detectable amounts were found; consequently Au was omitted from table 3.

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TABLE 1.--Limits of determination for the spectrographic analysis of rocks and 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 given for rocks and stream sediments]

Elements	Lower determination limit	Upper determination limit
	Percent	
Iron (Fe)	0.05	20
Magnesium (Mg)	.02	10
Calcium (Ca)	.05	20
Titanium (Ti)	.002	1
Sodium (Na)	.2	5
Phosphorus (P)	.2	10
	Parts per million	
Manganese (Mn)	10	5,000
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)	5	2,000
Chromium (Cr)	10	5,000
Copper (Cu)	5	20,000
Lanthanum (La)	20	1,000
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
Vanadium (V)	10	10,000
Tungsten (W)	50	10,000
Yttrium (Y)	10	2,000
Zinc (Zn)	200	10,000
Zirconium (Zr)	10	1,000
Thorium (Th)	100	2,000
Gallium (Ga)	5	500
Germanium (Ge)	10	100
Palladium (Pd)	5	500
Platinum (Pt)	20	500

TABLE 2.--Commonly used chemical methods

[AA = atomic absorption; ICP = inductively coupled plasma spectroscopy]

Element or constituent determined	Method	Determination limit (micrograms/ gram or ppm)	Reference
Gold (Au)	AA	0.05	Thompson and others, 1968.
Arsenic (As)	ICP	5	Crock and others, 1987.
Zinc (Zn)	ICP	2	
Bismuth (Bi)	ICP	2	
Cadmium (Cd)	ICP	.1	

TABLE 3--ANALYSES OF MINUS-80-MESH STREAM SEDIMENT SAMPLES FROM THE SIERRA ESTRELLA WILDERNESS STUDY AREA, MARICOPA COUNTY, ARIZONA.

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

Sample	Latitude	Longitude	Fe-%	Mg-%	Ca-%	Ti-%	Mn-ppm	Ag-ppm	B-ppm	Ba-ppm	Be-ppm
			S	S	S	S	S	S	S	S	S
1	33 12 16	112 14 10	15	0.7	1.0	1.0	3000	<.5	20	300	2.0
2	33 10 20	112 12 55	5	2.0	2.0	1.0	2000	N	20	700	2.0
3	33 10 04	112 13 32	10	1.5	2.0	0.7	2000	N	20	700	2.0
4	33 09 31	112 12 20	15	1.5	3.0	>1.0	5000	N	<10	500	1.5
5	33 09 57	112 12 45	20	1.5	3.0	>1.0	5000	N	20	500	1.5
6	33 13 10	112 12 07	5	3.0	3.0	0.3	1500	N	<10	700	1.5
7	33 13 31	112 12 06	15	1.5	2.0	1.0	1000	N	10	500	1.5
8	33 14 47	112 12 22	15	5.0	5.0	1.0	5000	N	10	1000	1.5
9	33 14 45	112 13 26	10	2.0	3.0	0.7	2000	N	<10	500	1.5
10	33 12 02	112 13 43	15	1.5	2.0	1.0	3000	N	<10	500	2.0
11	33 11 40	112 13 37	10	1.5	2.0	0.5	3000	N	10	500	2.0
12	33 12 57	112 13 35	10	1.0	2.0	0.7	3000	N	10	500	2.0
13	33 12 57	112 13 31	10	2.0	3.0	0.7	2000	N	<10	500	2.0
14	33 11 33	112 12 17	10	1.5	2.0	0.5	1000	N	10	500	2.0
15	33 10 57	112 13 17	15	1.5	2.0	1.0	2000	N	10	500	1.5
16	33 12 35	112 15 04	10	3.0	3.0	1.0	2000	N	10	500	1.0
17	33 12 32	112 14 47	10	2.0	2.0	0.7	1500	N	20	700	2.0
18	33 12 35	112 15 38	15	2.0	3.0	0.7	2000	N	10	700	1.5
19	33 12 38	112 15 58	5	1.5	2.0	0.5	1000	N	10	300	2.0
20	33 13 17	112 15 48	7	3.0	2.0	0.7	1500	N	20	500	2.0
21	33 14 38	112 15 40	7	3.0	3.0	0.7	1500	N	10	500	1.5
22	33 13 52	112 16 02	10	2.0	3.0	1.0	1000	N	20	700	2.0
23	33 14 03	112 16 10	3	2.0	1.5	0.7	1000	N	50	700	1.5
24	33 13 55	112 16 32	5	2.0	2.0	0.7	2000	N	20	500	2.0
25	33 13 59	112 17 07	5	2.0	2.0	0.5	700	N	30	500	2.0
26	33 14 20	112 17 34	5	3.0	3.0	1.0	2000	N	50	700	1.5

TABLE 3--ANALYSES OF MINUS-80-MESH STREAM SEDIMENT SAMPLES FROM THE SIERRA ESTRELLA WILDERNESS STUDY AREA, MARICOPA COUNTY, ARIZONA (Continued)

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

Sample	Co-ppm S	Cr-ppm S	Cu-ppm S	La-ppm S	Nb-ppm S	Ni-ppm S	Pb-ppm S	Sc-ppm S	Sn-ppm S	Sr-ppm S
1	10	200	30	100	N	10	50	15	10	300
2	10	200	50	70	<20	10	50	15	N	500
3	15	300	30	<50	<20	20	50	15	N	500
4	20	100	70	150	20	15	50	50	N	500
5	50	150	100	70	<20	20	30	50	N	300
6	<10	70	70	50	N	5	70	10	N	500
7	20	200	50	100	<20	30	50	15	N	300
8	20	150	70	70	N	20	50	20	N	500
9	15	100	70	100	N	30	30	15	N	300
10	10	200	50	100	<20	7	50	15	N	300
11	10	200	10	<50	N	10	50	10	N	300
12	10	150	70	100	<20	10	50	15	N	300
13	20	100	30	50	<20	20	50	15	N	300
14	<10	200	20	N	N	7	50	10	10	500
15	10	300	50	200	<20	10	70	15	10	300
16	10	200	15	150	<20	15	70	20	N	500
17	15	200	50	50	<20	20	70	15	<10	500
18	15	200	30	200	<20	20	50	15	<10	500
19	10	100	20	100	<20	10	50	10	N	300
20	20	150	50	<50	<20	30	50	10	N	300
21	15	70	30	70	<20	20	50	15	N	300
22	15	100	30	100	20.0	20	50	15	N	500
23	10	70	20	150	<20	15	30	10	N	300
24	30	70	70	100	<20	20	70	15	N	300
25	20	70	70	50	<20	20	50	10	N	300
26	15	100	70	100	<20	20	70	10	N	500

TABLE 3--ANALYSES OF MINUS-80-MESH STREAM SEDIMENT SAMPLES FROM THE SIERRA ESTRELLA WILDERNESS STUDY AREA, MARICOPA COUNTY, ARIZONA (Continued)

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

Sample	V-ppm S	Y-ppm S	Zr-ppm S	Ga-ppm S	Na-% S	P-% S	Th-ppm S	As-ppm ICP	Bi-ppm ICP	Cd-ppm ICP	Zn-ppm ICP
1	200	50	200	20	1.5	N	N	<5	<2	0.5	21
2	200	100	200	20	2.0	<0.2	N	<5	<2	0.5	36
3	200	200	150	20	2.0	<0.2	N	<5	<2	0.6	33
4	200	150	1000	20	1.5	0.5	N	<5	3	0.9	33
5	200	150	1000	30	1.5	0.2	N	<5	2	1.0	32
6	100	150	150	50	3.0	<0.2	N	<5	<2	0.2	51
7	200	50	700	20	2.0	<0.2	N	<5	<2	0.4	33
8	500	50	200	20	3.0	<0.2	N	5	<2	0.5	36
9	200	100	200	15	1.5	0.2	N	<5	<2	0.4	33
10	300	100	500	10	1.5	<0.2	N	<5	<2	0.5	27
11	150	20	100	20	2.0	<0.2	N	<5	2	0.5	25
12	150	200	700	20	1.5	<0.2	N	<5	<2	0.4	27
13	200	30	200	30	2.0	<0.2	N	<5	<2	0.5	31
14	150	50	150	20	1.5	<0.2	N	<5	3	0.4	23
15	200	50	700	30	1.5	<0.2	N	<5	<2	0.3	25
16	150	50	200	30	2.0	N	N	<5	<2	0.4	35
17	200	50	200	30	2.0	<0.2	N	<5	3	0.5	40
18	200	200	500	30	1.5	<0.2	100	<5	<2	0.5	30
19	100	100	700	20	1.5	<0.2	N	<5	<2	0.5	33
20	150	100	300	20	1.5	0.2	N	<5	<2	0.3	34
21	150	70	700	30	2.0	0.2	N	<5	<2	0.3	31
22	150	70	1000	20	2.0	0.2	N	<5	<2	0.3	23
23	100	30	700	15	1.5	<0.2	N	<5	<2	0.3	31
24	100	50	500	30	1.5	0.2	N	<5	<2	0.3	33
25	100	70	200	20	1.5	<0.2	N	<5	<2	0.3	38
26	150	70	700	30	1.5	0.2	N	<5	<2	0.3	35

TABLE 4--ANALYSES OF NONMAGNETIC HEAVY-MINERAL COMCENTRATE SAMPLES FROM THE SIERRA ESTRELLA WILDERNESS STUDY AREA, MARICOPA 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-%	Fe-%	Mg-%	Na-%	P-%	Ti-%	B-ppm	Ba-ppm	Be-ppm	Co-ppm	Cr-ppm
			S	S	S	S	S	S	S	S	S	S	S
1	33 12 16	112 14 10	7	1.0	0.50	1.5	3	1.5	<20	300	N	N	50
2	33 10 20	112 12 55	20	0.7	0.30	<0.5	15	2.0	N	150	N	50	70
3	33 10 04	112 13 32	7	0.7	0.30	1.5	3	1.5	N	500	N	N	50
4	33 09 31	112 12 20	30	0.3	0.15	0.7	20	2.0	N	100	N	N	<20
5	33 09 57	112 12 45	15	0.3	0.15	0.7	15	2.0	N	300	N	N	<20
6	33 13 10	112 12 07	30	0.7	1.00	N	20	2.0	20	150	N	N	20
7	33 13 31	112 12 06	7	1.0	1.00	1.0	7	2.0	<20	200	N	N	70
8	33 14 47	112 12 22	15	0.7	0.70	1.0	7	1.5	N	200	N	N	50
9	33 14 45	112 13 26	15	1.0	1.50	0.7	10	>2.0	N	150	N	N	50
10	33 12 02	112 13 43	15	0.7	0.30	1.5	7	2.0	N	200	<2	N	30
11	33 11 40	112 13 37	20	1.5	0.30	0.7	15	1.5	20	150	3	N	70
12	33 12 57	112 13 35	30	0.7	0.30	1.5	15	2.0	N	200	<2	N	30
13	33 12 57	112 13 31	20	1.5	0.30	1.5	15	1.0	N	150	<2	N	50
14	33 11 33	112 12 17	7	2.0	0.50	2.0	3	1.5	30	300	<2	N	70
15	33 10 57	112 13 17	15	0.7	0.30	0.7	7	2.0	50	150	N	N	50
16	33 12 35	112 15 04	20	1.5	2.00	1.0	7	2.0	<20	150	<2	N	30
17	33 12 32	112 14 47	10	1.5	0.50	2.0	7	>2.0	20	300	N	N	70
18	33 12 35	112 15 38	15	1.5	1.00	<0.5	7	2.0	N	200	N	N	20
19	33 12 38	112 15 58	15	1.5	1.00	N	7	>2.0	N	150	N	N	30
20	33 13 17	112 15 48	7	0.7	0.50	1.5	7	>2.0	N	200	N	N	30
21	33 14 38	112 15 40	15	0.5	0.20	N	10	>2.0	N	50	N	N	30
22	33 13 52	112 16 02	15	0.5	0.30	N	10	>2.0	N	100	N	N	50
23	33 14 03	112 16 10	15	0.3	0.15	N	10	>2.0	N	100	N	N	30
24	33 13 55	112 16 32	15	0.3	0.20	N	10	>2.0	N	700	N	N	50
25	33 13 59	112 17 07	15	0.5	0.50	<0.5	7	>2.0	N	150	N	N	100
26	33 14 20	112 17 34	15	0.5	0.30	<0.5	7	>2.0	N	200	N	N	70

TABLE 4--ANALYSES OF NONMAGNETIC HEAVY-MINERAL COMCENTRATE SAMPLES FROM THE SIERRA ESTRELLA WILDERNESS STUDY AREA, MARICOPA COUNTY, ARIZONA (Continued)

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

Sample	Ga-ppm S	La-ppm S	Mn-ppm S	Mo-ppm S	Nb-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
1	20	<100	300	N	50	30	20	N	N	N	150	<50	300
2	15	<100	700	20	50	100	20	200	N	N	150	500	500
3	15	<100	300	70	<50	20	20	N	N	N	70	300	150
4	<10	<100	300	N	<50	30	70	N	N	N	70	N	700
5	10	N	300	N	<50	20	50	N	N	N	70	N	700
6	<10	<100	500	15	70	30	15	<20	N	N	50	N	1000
7	15	<100	700	300	50	30	10	N	N	N	70	150	300
8	10	100	300	100	<50	50	20	N	N	N	70	1000	300
9	20	<100	700	200	100	50	15	20	N	N	150	700	700
10	10	<100	500	30	70	30	20	N	N	N	100	300	300
11	30	<100	700	N	50	30	15	N	N	N	100	N	500
12	15	<100	1000	N	70	30	15	N	N	N	100	N	500
13	20	<100	1000	N	50	30	15	N	N	N	100	N	500
14	50	100	500	N	50	50	20	N	N	N	100	N	300
15	10	<100	300	N	50	70	50	N	N	N	100	300	300
16	20	<100	1500	N	70	30	10	N	<200	N	150	N	500
17	30	100	500	30	70	70	15	N	200	N	200	300	500
18	15	<100	1000	<10	70	70	15	N	N	N	150	300	500
19	20	100	1000	20	150	100	15	20	N	N	200	N	700
20	10	<100	300	<10	100	30	<10	N	N	N	150	300	500
21	N	200	500	30	150	50	15	70	N	N	200	N	1000
22	<10	200	700	30	150	70	15	70	N	N	200	N	1500
23	<10	150	300	<10	70	70	30	20	N	N	200	N	1000
24	<10	150	300	30	150	50	30	70	N	N	200	N	1000
25	<10	200	300	30	150	100	30	70	N	200	200	N	1000
26	<10	200	500	30	200	70	50	70	N	<200	200	70	1000

TABLE 5--ANALYSES OF ROCK SAMPLES FROM THE SIERRA ESTRELLA WILDERNESS STUDY AREA, MARICOPA COUNTY, ARIZONA.
(N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown.)

Sample	Latitude	Longitude	Fe-% S	Mg-% S	Ca-% S	Ti-% S	Mn-ppm S	Ag-ppm S	B-ppm S	Ba-ppm S	Be-ppm S	Bi-ppm S	Co-ppm S
SE01R	33 12 16	112 14 10	20.0	0.05	<.05	1.000	500	N	N	500	N	N	10
SE02R	33 10 20	112 12 55	5.0	0.50	1.00	0.300	700	N	10	500	<1	N	10
SE06R	33 13 10	112 12 07	0.5	0.03	0.50	0.005	200	<0.5	10	700	1.0	N	N
SE10R	33 12 02	112 13 43	5.0	0.07	0.50	0.100	1000	2	<10	200	1.0	20	<10
SE16R	33 12 27	112 15 24	1.0	0.20	0.30	0.200	500	N	10	500	<1	N	<10

Sample	Cr-ppm S	Cu-ppm S	La-ppm S	Ni-ppm S	Pb-ppm S	Sc-ppm S	Sn-ppm S	Sr-ppm S	V-ppm S	Y-ppm S	Zr-ppm S	Ga-ppm S	Na-% S
SE01R	N	<5	N	20	N	30	30	N	70	N	<10	20	0.2
SE02R	50	<5	50	20	30	10	N	500	70	30	70	30	1.5
SE06R	N	5	N	<5	20	<5	N	200	10	<10	<10	20	2.0
SE10R	15	10000	70	5	30	5	N	200	100	15	100	30	1.5
SE16R	<10	50	<50	5	30	7	N	150	20	15	70	30	2.0

Table 6.--Description of rock samples

01R	Pegmatite
02R	Gneiss with epidote veins
06R	Foliated biotite granite with accessory fluorite
10R	Copper-stained quartz vein in granite
16R	Silicified intrusive