UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of stream-sediment and heavy-mineral-concentrate samples from the El Paso Mountains Wilderness Study Area (CDCA 164), Inyo County, California

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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 mineral survey of the El Paso Mountains Wilderness Study Area, California Desert Conservation Area, Inyo County, California.

INTRODUCTION

In the spring 1982 the U.S. Geological Survey conducted a reconnaissance geochemical survey of the El Paso Mountains Wilderness Study Area, Inyo County, California.

The El Paso Mountains Wilderness Study Area comprises about 25 mi^2 (65 km^2) in southeastern California, and lies about 15 mi (24 km) southwest of Ridgecrest (see fig. 1). Access to the study area is provided on the west by Highway 14, and on the east by Interstate 395 (fig. 1).

The El Paso Mountains are located in the Basin and Range Province just north of the Garlock fault. The study area consists of the northern and northwestern portion of the El Paso Mountains known as the Black Hills. The rocks in the area consist of claystone, siltstone, marlstone, arkosic sandstone, and conglomerate of the Goler Formation (Paleocene), which is overlain by ash-flow and airfall tuff, tuffaceous sandstone, andesite breccia, and minor conglomerate of the Ricardo Formation (Miocene), which is overlain by olivine basalt flows of the Black Mountain Basalt (Miocene), and dissected alluvial deposits, younger surficial deposits, and landslide deposits (Pleistocene and Holocene). The individual formations have been described in detail by Cox (1982) and Cox and Morton (1980).

The topographic relief in the study area is about 2200 ft (670.5 m), with a maximum elevation of 5244 ft (1598 m). The ground surface is mountainous grading into pediment veneers, stream-terrace deposits and alluvial fans. The climate is arid to semiarid.

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 a limited number of minerals in rock material eroded from the drainage basin upstream from each sample site. The selective concentration of minerals, many of which are ore-related, permits determination of some elements that are not easily detected in stream-sediment samples.

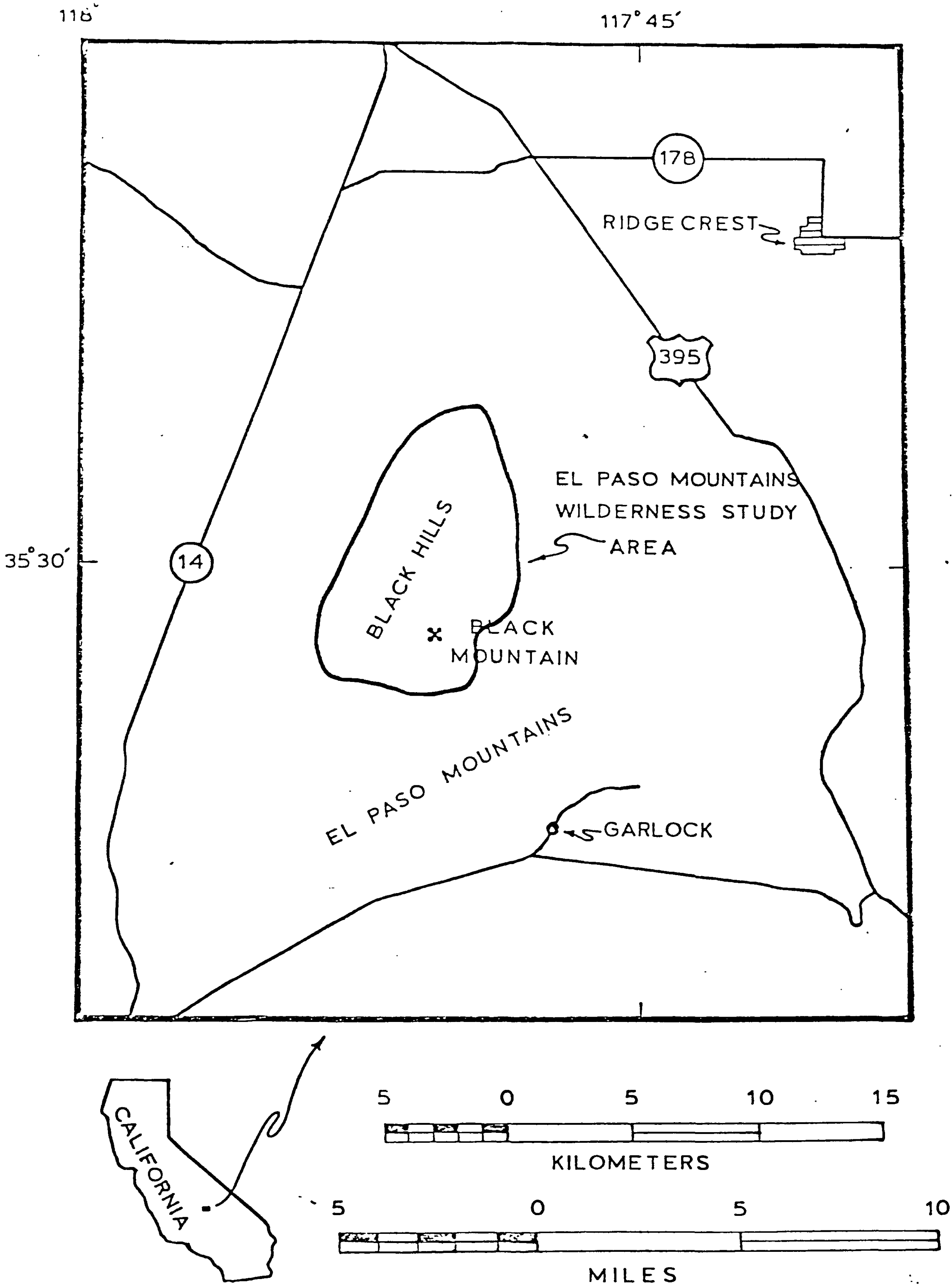

Figure 1.--Location map of the El Paso Mountains Wilderness Study Area, Inyo County, California

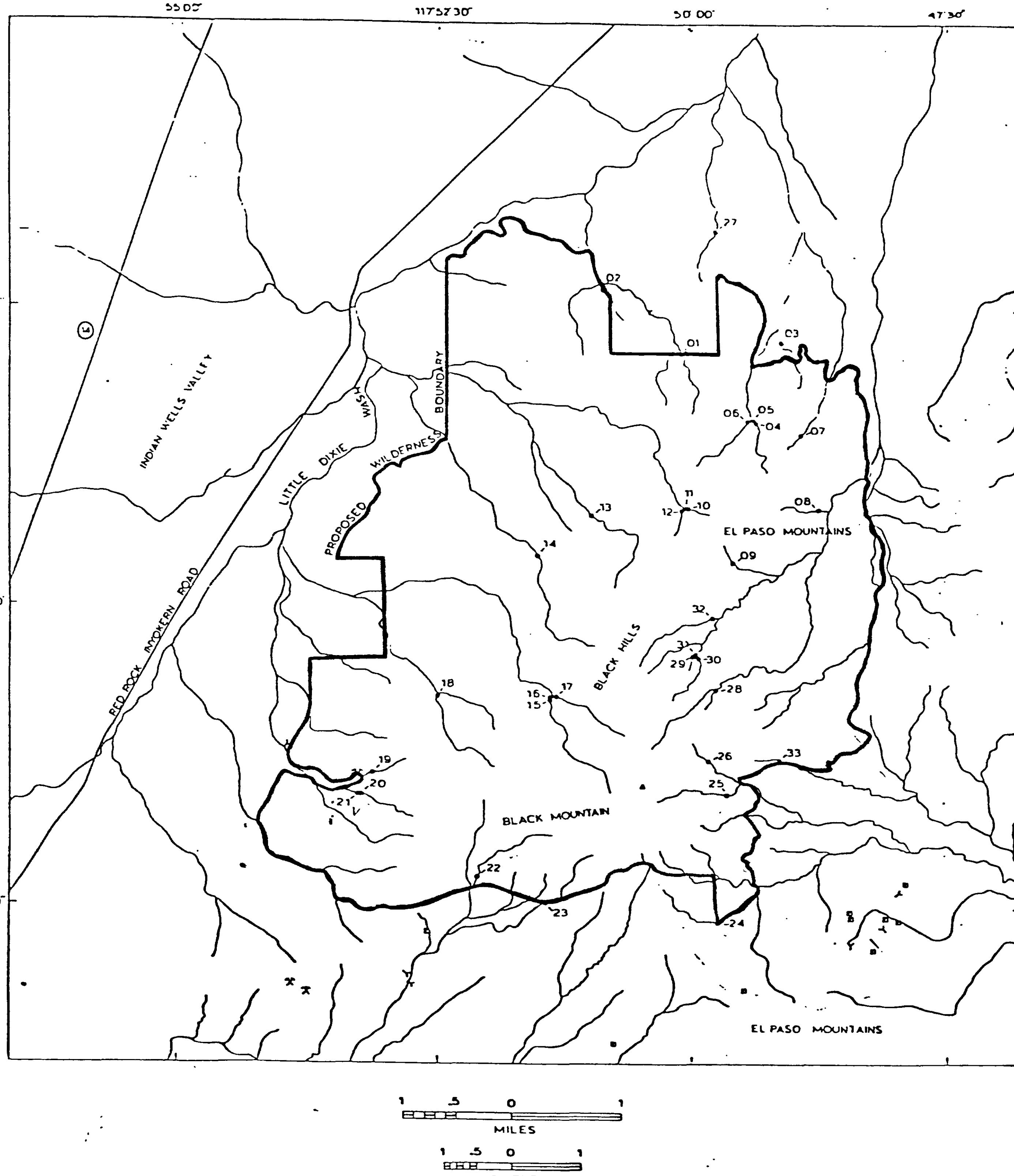

Figure 2. Sampling sites in the El Paso Mountains Wilderness Study Area, Inyo County, California.

Sample Analysis

Spectrographic method

The stream-sediment, heavy-mineral-concentrate, and rock samples were analyzed for 31 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 El Paso Mountains Wilderness Study Area are listed in Tables 2 and 3.

ROCK ANALYSIS STORAGE SYSTEM

Upon completion of all analytical work, the analytical results were entered into a computer-based file called Rock Analysis Storage System (RASS). 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, 1976).

DESCRIPTION OF DATA TABLES

Tables 2 and 3 list the analyses for the samples of stream sediment and heavy-mineral concentrate, respectively. For the two 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 maps (plate 1). Columns in which the element headings show the letter "s" below the element symbol are emission spectrographic analyses; "aa" indicates atomic absorption analyses. 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. If an element 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. 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. If an element was not looked for in a sample, two dashes (--) are entered in tables 3-6 in place of an analytical value. Because of the formatting used in the computer program that produced tables 2 and 3, 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 Ag, As, Au, Bi, Cd, Sn, W, Zn, and Th in stream-sediment samples, and for As, Au, Bi, Cd, Sb, and Zn in heavy-mineral-concentrate samples, were all below the lower limits of determinations shown in table 1. Two samples contained less than 1 ppm Be concentrations (006 and 030) and one less than 5 ppm Mo value was reported in sample 023 in stream-sediment samples. In the heavy-mineral-concentrate data set all Ti values were reported as greater than 2%. One sample contained Ag (010, 1 ppm) and one W value was reported (025, <100 ppm). The columns for all elements listed above have been deleted from tables 3 and 4.

REFERENCES CITED

Cox, B. F., 1982, Stratigraphy, sedimentology, and structure of the Goler Formation (Paleocene), El Paso Mountains, California: Implications for Paleocene tectonism on the Garlock Fault zone: Ph.D. thesis, University of California, Riverside, 248 p.

Cox, B. F., and Morton, J. L., 1980, Late Permian plutonism, El Paso Mountains, California [abs.]: Geological Society of America Abstracts with Programs, v. 12, no. 3, p. 103.

Grimes, D. J., and Marranzino, A. P., 1968, Direct-current arc and alternating-current spark emission spectrographic field methods for the semiquantitative analysis of geologic materials: U.S. Geological Survey Circular 591, 6 p.

Motooka, J. M., and Grimes, D. J., 1976, Analytical precision of one-sixth order semiquantitative spectrographic analyses: U.S. Geological Survey Circular 738, 25 p.

VanTrump, George, Jr., and Miesch, A. T., 1976, The U.S. Geological Survey RASS-STATPAC system for management and statistical reduction of geochemical data: Computers and Geosciences, v. 3, p. 475-488.

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
	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

Table 2.--Analytical results from the minus-80-mesh stream-sediment samples from the El Paso Mountains Wilderness Study Area, California

Sample	LATITUDE	LONGITUD	Fe-.05%	Mg-.02%	Ca-.05%	Ti-.002%	Mn-10ppm	B-10ppm	Ba-20ppm	Co-5ppm	Cr-10ppm
EP001	35 32 8	117 50 6	5	3.0	15.0	1.0	1,000	70	1,000	10	150
EP002	35 32 40	117 50 53	10	1.5	5.0	>1.0	1,500	30	1,500	20	150
EP003	35 32 14	117 49 6	7	1.5	5.0	1.0	1,000	20	1,000	15	50
EP006	35 31 34	117 49 27	5	2.0	5.0	1.0	1,000	70	1,000	15	100
05BD06	35 31 35	117 49 27	5	1.5	3.0	>1.0	1,000	50	1,000	20	70
04SD05	35 31 34	117 49 21	10	3.0	10.0	1.0	1,000	30	1,500	15	50
4andup	35 31 34	117 49 21	7	2.0	5.0	1.0	1,000	70	1,000	15	70
EP007	35 31 27	117 48 55	20	1.0	1.5	>1.0	1,000	10	1,000	20	300
EP008	35 30 49	117 48 44	10	2.0	5.0	>1.0	1,000	50	1,500	20	50
EP009	35 30 23	117 49 36	10	1.5	5.0	>1.0	1,000	70	700	20	100
EP012	35 30 49	117 50 6	10	2.0	5.0	>1.0	1,500	20	1,000	30	150
11BD12	35 30 50	117 50 4	>20	1.5	5.0	>1.0	2,000	15	700	50	200
10SD12	35 30 50	117 50 2	20	2.0	7.0	>1.0	2,000	20	1,000	50	200
10andup	35 30 50	117 50 2	20	1.0	3.0	>1.0	2,000	30	1,000	20	200
EP013	35 30 46	117 51 0	15	2.0	5.0	1.0	2,000	20	700	20	200
EP014	35 30 26	117 51 31	10	3.0	5.0	>1.0	2,000	30	1,000	50	500
EP017	35 29 15	117 51 20	20	2.0	3.0	>1.0	1,500	10	700	50	200
16BD17	35 29 14	117 51 24	>20	2.0	5.0	>1.0	2,000	15	700	50	200
15SD16	35 29 13	117 51 24	20	2.0	5.0	>1.0	2,000	20	1,000	30	150
15andup	35 29 13	117 51 24	15	1.5	3.0	>1.0	2,000	50	1,000	20	100
EP018	35 29 15	117 52 29	15	1.0	3.0	1.0	1,000	50	1,000	20	70
EP019	35 28 36	117 53 7	10	1.0	5.0	1.0	1,000	50	1,000	20	100
21BD19	35 28 25	117 53 16	>20	2.0	5.0	>1.0	1,500	15	700	20	100
20SD21	35 28 25	117 53 14	20	2.0	7.0	>1.0	2,000	15	1,000	15	200
20andup	35 28 25	117 53 14	10	1.0	10.0	.7	500	30	700	10	100
EP022	35 27 45	117 52 5	10	1.5	5.0	.7	1,500	30	1,000	15	50
EP023	35 27 32	117 51 26	7	1.5	10.0	1.0	1,000	20	1,000	15	50
EP024	35 27 22	117 49 44	15	1.0	3.0	1.0	1,000	50	1,000	20	50
EP025	35 28 26	117 49 38	20	1.0	2.0	1.0	1,500	15	700	15	100
EP026	35 28 43	117 49 49	7	1.5	2.0	1.0	1,000	50	700	15	50
EP027	35 33 9	117 49 46	10	1.0	3.0	1.0	1,000	50	1,000	20	70
EP028	35 29 18	117 49 45	5	2.0	5.0	1.0	1,000	50	1,000	20	50
EP030	35 29 34	117 49 56	7	2.0	2.0	1.0	1,000	50	1,000	20	50
31+031	35 29 36	117 49 58	7	2.0	3.0	1.0	1,000	50	1,000	20	50
29SD31	35 29 35	117 49 59	10	1.5	5.0	>1.0	1,000	30	700	20	70
29andup	35 29 35	117 49 59	10	1.0	10.0	1.0	1,500	70	1,000	15	100
EP032	35 29 55	117 49 47	15	2.0	5.0	>1.0	1,500	30	1,000	30	200
EP033	35 28 44	117 49 7	10	1.5	2.0	>1.0	1,000	50	1,000	20	70

Table 2.--Analytical results from the minus-80-mesh stream-sediment samples from th El Paso Mountains Wilderness Study Area, California (continued)

Sample	Cu-5ppm	La-20ppm	Nb-20ppm	Ni-5ppm	Pb-10ppm	Sr-100pp	V-10ppm	Y-10ppm
EP001	30	70	<20	20	70	500	200	50
EP002	30	150	50	20	30	500	200	70
EP003	20	70	<20	15	50	200	200	30
EP006	30	20	<20	20	50	300	100	50
05SD06	20	70	20	15	30	200	150	30
04SD05	30	100	<20	20	50	200	200	50
4andup	30	70	N	20	70	200	200	30
EP007	30	70	20	20	30	100	300	30
EP008	50	100	<20	20	50	500	200	30
EP009	30	100	20	20	70	500	200	50
EP012	30	70	<20	20	50	500	300	50
11SD12	50	100	<20	30	50	300	700	50
10SD12	50	100	<20	30	50	500	500	50
10andup	100	70	<20	30	20	300	500	50
EP013	30	50	<20	50	20	500	200	50
EP014	50	70	<20	70	30	500	200	50
EP017	50	200	<20	20	30	300	500	50
16SD17	50	200	20	30	30	500	700	70
15SD15	50	100	<20	30	50	500	500	50
15andup	30	100	N	20	30	500	500	50
EP018	30	50	20	15	50	300	200	50
EP019	30	50	20	20	30	500	200	50
21SD19	30	200	30	10	50	700	500	70
20SD21	50	200	20	10	30	700	500	70
20andup	20	70	N	7	20	200	200	30
EP022	30	100	<20	15	70	500	200	50
EP023	30	50	<20	15	30	500	200	50
EP024	30	100	<20	15	30	300	500	70
EP025	30	100	20	15	30	300	300	50
EP026	30	50	<20	15	30	500	200	50
EP027	30	200	30	15	30	500	200	70
EP028	30	70	<20	15	30	500	150	30
EP030	50	100	<20	20	30	500	150	50
31SD30	30	100	<20	20	50	500	200	70
29SD31	30	100	20	20	50	500	200	50
29andup	50	100	N	20	50	500	300	50
EP032	50	150	20	20	50	500	300	70
EP033	30	70	<20	20	30	300	200	50

Table 3.--Analytical results from the nonmagnetic-heavy-mineral-concentrate samples from the El Paso Mountains Wilderness Study Area, California

Sample	LATITUDE	LONGITUD	Fe0.1%	Mg0.05%	Ca0.1%	Mn20ppm	B20ppm	Ba50ppm	Be2ppm	Co10ppm	Cr20ppm
EP001	35 32 8	117 50 6	5.0	.70	10	2,000	100	500	2	N	70
EP002	35 32 40	117 50 53	5.0	.50	10	1,500	70	200	N	N	30
EP003	35 32 14	117 49 6	7.0	.70	10	2,000	100	200	7	N	50
EP006	35 31 34	117 49 27	3.0	.30	7	1,000	100	2,000	2	N	30
05BD06	35 31 35	117 49 22	3.0	.50	10	1,500	100	500	<2	N	30
04SD05	35 31 34	117 49 21	5.0	.20	7	1,000	100	1,500	3	N	30
04andup	35 31 34	117 49 21	3.0	.15	7	700	70	700	N	N	70
EP007	35 31 27	117 48 55	5.0	.50	15	1,500	100	200	2	N	50
EP008	35 30 49	117 48 44	5.0	.30	10	2,000	200	>10,000	2	N	30
EP009	35 30.23	117 49 36	5.0	.50	15	2,000	150	100	<2	N	50
EP012	35 30 49	117 50 6	2.0	.20	15	2,000	20	300	N	N	20
10BD12	35 30 50	117 50 2	2.0	.30	10	1,500	20	200	N	N	20
11SD10	35 30 50	117 50 4	2.0	.20	10	1,000	20	500	<2	N	<20
11andup	35 30 50	117 50 4	1.0	<.05	7	500	<20	300	N	N	<20
EP013	35 30 46	117 51 0	5.0	.50	15	1,500	30	200	N	10	30
EP014	35 30 26	117 51 31	5.0	1.50	15	3,000	50	1,000	<2	15	150
EP017	35 29 15	117 51 20	5.0	.50	20	3,000	20	300	3	10	<20
16BD17	35 29 14	117 51 24	2.0	.20	15	2,000	20	200	N	10	30
15andup	35 29 13	117 51 24	1.5	.07	10	1,000	20	200	N	N	<20
15SD16	35 29 13	117 51 24	2.0	.20	15	1,500	20	200	N	N	20
EP018	35 29 15	117 52 29	2.0	.10	10	1,000	20	150	N	N	<20
EP019	35 28 36	117 53 7	7.0	1.00	20	3,000	20	200	5	10	50
21BD19	35 28 25	117 53 16	3.0	.50	15	2,000	20	300	N	N	<20
20SD21	35 28 25	117 53 14	7.0	.50	15	2,000	50	200	N	15	20
20andup	35 28 25	117 53 14	5.0	.10	10	1,000	<20	50	N	10	<20
EP022	35 27 45	117 52 5	5.0	.30	15	2,000	30	5,000	N	10	<20
EP023	39 27 32	117 51 26	5.0	.30	15	3,000	30	500	N	10	<20
EP024	35 27 22	117 49 44	5.0	.20	7	1,000	100	3,000	2	10	20
EP025	35 28 26	117 49 38	3.0	.20	15	2,000	20	2,000	N	10	20
EP026	35 28 43	117 49 49	2.0	.15	10	1,500	30	10,000	N	10	20
EP027	35 33 9	117 49 46	2.0	.20	10	1,000	20	200	2	N	30
EP028	35 29 18	117 49 45	2.0	.10	10	1,000	70	>10,000	2	N	20
EP030	35 29 34	117 49 56	5.0	.50	10	1,500	300	>10,000	<2	N	20
31BD30	35 29 36	117 49 58	3.0	.20	10	1,000	100	>10,000	<2	N	20
29SD31	35 29 35	117 49 59	2.0	.20	10	1,000	50	500	N	N	20
29andup	35 29 35	117 49 59	1.0	<.05	10	500	<20	150	N	N	<20
EP032	35 29 55	117 49 47	5.0	.50	15	2,000	30	200	N	N	50
EP033	35 28 44	117 49 7	5.0	.50	10	1,000	100	>10,000	2	N	50

Table 3.--Analytical results from the nonmagnetic-heavy-mineral-concentrate samples from the El Paso Mountains Wilderness Study Area, California (continued)

Sample	La50ppm	Mo10ppm	Nb50ppm	Ni10ppm	Pb20ppm	Sn20ppm	Sr200ppm	V20ppm	Y20ppm	Zr20ppm	Th200ppm
EP001	1,000	50	200	10	70	70	1,000	300	700	>2,000	200
EP002	1,000	20	300	15	50	50	1,000	200	700	>2,000	500
EP003	1,000	15	200	10	70	50	2,000	300	700	>2,000	<200
EP006	700	10	200	15	100	30	500	200	500	1,500	<200
05BD06	1,000	20	200	10	50	50	500	200	1,000	>2,000	200
04SD05	500	10	200	10	50	30	500	200	700	>2,000	<200
04andup	300	<10	150	N	N	<20	200	300	300	>2,000	N
EP007	2,000	<10	50	10	50	70	500	200	700	>2,000	300
EP008	500	15	200	10	50	50	700	200	700	>2,000	300
EP009	1,000	50	200	15	50	70	1,000	200	700	>2,000	300
EP012	2,000	50	200	20	30	100	500	300	1,000	500	N
10BD12	1,000	50	200	10	20	50	500	200	700	2,000	<200
11SD10	1,000	20	200	15	20	50	500	200	500	>2,000	200
11andup	700	20	200	N	N	20	N	300	500	>2,000	N
EP013	2,000	70	200	10	20	100	200	300	1,000	>2,000	200
EP014	1,000	30	150	20	70	100	500	200	700	>2,000	200
EP017	>2,000	50	300	10	30	100	1,000	500	2,000	>2,000	<200
16BD17	2,000	30	200	10	20	70	700	300	1,000	>2,000	<200
15andup	700	30	500	N	N	<20	N	700	1,000	>2,000	N
15SD16	1,000	50	300	15	30	70	300	300	700	>2,000	300
EP018	1,000	20	200	10	<20	50	500	300	700	1,000	<200
EP019	1,500	50	200	10	30	70	2,000	500	1,000	>2,000	<200
21BD19	1,500	20	200	10	<20	70	1,000	500	700	>2,000	N
20SD21	1,000	30	150	20	50	70	1,000	500	500	1,000	N
20andup	500	30	300	N	N	30	300	500	700	2,000	N
EP022	1,500	50	300	15	20	70	500	300	1,000	500	<200
EP023	1,500	50	200	15	<20	50	700	300	1,000	500	<200
EP024	500	10	100	10	50	30	500	200	500	>2,000	<200
EP025	1,500	70	200	10	20	100	200	300	1,500	1,000	<200
EP026	1,500	15	200	10	50	50	1,500	300	700	>2,000	<200
EP027	1,000	20	200	10	30	100	500	200	700	500	<200
EP028	1,000	15	200	10	20	50	1,000	200	700	>2,000	200
EP030	2,000	50	300	10	70	70	2,000	200	1,000	>2,000	300
31BD30	1,000	50	300	15	50	100	1,000	300	700	>2,000	<200
29SD31	1,500	20	200	15	20	100	200	300	700	>2,000	300
29andup	700	30	300	N	N	20	N	500	1,000	>2,000	N
EP032	1,500	30	200	15	100	70	500	300	1,500	>2,000	300
EP033	2,000	10	200	10	70	50	500	200	1,000	>2,000	500