UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical data report for a pilot-study of twenty stream-sediment, heavy-mineral concentrate, and rock samples from the Sangre de Cristo Wilderness Study Area, south-central Colorado

By

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STUDIES RELATED TO WILDERNESS

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands to determine their mineral resource potential. 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 Sangre de Cristo Wilderness Study Area, Rio Grande and San Isabel National Forests, south-central Colorado. The Sangre de Cristo WSA was established under Public Law 96-560.

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Purpose of study

Samples of -80 mesh stream sediments, heavy-mineral concentrates, and rocks were collected in June, 1982, as part of a preliminary pilot study to determine effective sample media for a mineral resource appraisal of the Sangre de Cristo Wilderness Study Area, Saguache, Alamosa, Fremont, Custer, and Huerfano Counties, Colorado. Chemical data for all samples are listed in Tables 3-5, but no data interpretation is included in this report. The purpose of this report is to make the data available to the public in a timely manner and to allow users to make their own interpretations.

Location

The Sangre de Cristo Wilderness Study Area occupies most of the northern part of the Sangre de Cristo Mountain Range, south-central Colorado (fig. 1). Much of the study area occupies rugged mountainous terrain bounded by the San Luis Valley to the west and the Wet Mountain Valley to the east. Altitudes range from 14,363 feet at Blanca Peak to about 8,000 feet along the southwest portion of the boundary.

Geology

The Sangre de Cristo Wilderness Study Area is composed mostly of Precambrian crystalline rocks and upper Paleozoic clastic sedimentary rocks. Middle Tertiary stocks, sills, and dikes intrude the older rocks.

The Precambrian crystalline rocks consist of a wide variety of dominantly potassium-poor gneisses. Most of the gneisses are of probable volcanic or volcaniclastic protolith and are intruded by several large plutons and numerous smaller bodies of Precambrian igneous rocks. The upper Paleozoic clastic rocks comprise thick sequences of near-source conglomerate and conglomeratic sandstone red beds.

The structure of the study area is dominated by rifting along the eastern and western borders of the range and west-dipping arcuate thrust plates exposed in the range. The pre-Tertiary rocks have been folded and faulted by Laramide compressional forces from late Cretaceous to Eocene time and subsequently intruded by mid-Tertiary igneous rocks ranging in composition from mafic to felsic.

Mineral occurrences

Gold, copper, and uranium were mined during the twentieth century in the study area but there has been no significant production. Iron was produced from the Orient Mine, west of the study area until 1931. Within the study area is a single known molybdenum porphyry system (Toulmin, 1953) and numerous base and (or) precious-metal quartz vein and fault-related occurrences. Also present are generally thin, discontinuous zones of stratabound uraniferous copper in upper Paleozoic clastic sedimentary rocks.

SAMPLE COLLECTION AND ANALYTICAL TECHNIQUES

Stream sediments

Composite stream sediment samples were collected at twenty sites within or adjacent to the study area on first- and second-order drainages as defined by 1:24,000 topographic maps. Approximately 5 pounds of sediment was collected for each sample, air-dried, and then sieved through an 80 mesh sieve. The coarse fraction was then discarded and the fines saved for analysis.

Each sample was semiquantitatively analyzed for 31 elements using a six-step, d.c. arc, optical-emission spectrographic method (Grimes and Marranzino, 1968). The spectrographic results are reported as the approximate geometric midpoints: 1.0, 0.7, 0.5, 0.3, 0.2, 0.15 (or appropriate powers of ten) of ranges whose respective boundaries are: 1.2, 0.83, 0.56, 0.38, 0.26, 0.18, 0.12 (or appropriate multiples). The lower limits of determination for the emission spectrographic data are given in table 1.

The precision of the results of the semiquantitative spectrographic analyses is, in general, plus or minus one reporting value of the actual value given approximately 83 percent of the time or within two intervals 96 percent of the time (Motooka and Grimes, 1976).

Additional wet-chemical analysis was used to analyze stream sediment samples for Zn, Cd, Bi, As, Sb, Sn, Au, Hg and W. Zinc, Cd, Bi, As, Sb, and Sn were analyzed using a modification of the atomic absorption spectrometry technique described by Viets (1978). The digestion process of this technique does not dissolve cassiterite, and the tin values, therefore, would not include any tin from this mineral. Stream sediment samples were analyzed for gold by the atomic absorption spectrometry method, described by Thompson, Nakagawa, and VanSickle (1968). The instrumental method used for mercury is documented by McNerney, Buseck, and Hanson (1972). Stream sediment samples were analyzed for tungsten by a colorimetric method described by Quin and Brooks (1972). The lower limits of determination for elements determined by these methods are given in table 2.

Heavy-mineral concentrates

Heavy-mineral panned concentrate samples were collected at twenty sites within or adjacent to the study area. Most of these sites are also the location of stream sediment samples. The heavy-mineral concentrate samples were panned in the field, whenever possible, then air-dried. At the laboratory, highly magnetic minerals were removed by a magnet and any remaining low density minerals were removed by allowing the heavier fraction of the sample to settle through bromoform (specific gravity 2.86). The remaining heavy-mineral material was then separated into a magnetic fraction and a nonmagnetic fraction using a Frantz Isodynamic Magnetic Separator set at 0.6 ampere. The nonmagnetic fraction was ground by hand with an agate mortar and pestle and analyzed for 31 elements by the 6-step semiquantitative spectrographic method described above. Lower limits of determination for the concentrate samples are listed in table 1.

Rocks

Twenty rock samples were collected from within or adjacent to the study area. These samples usually represent either mineralized rock or "different" rock types such as dikes, veins, or stained rocks and are not characteristic of the most voluminous rock in any particular area. Rock samples were taken from unweathered outcrops when possible, pulverized to minus-200 mesh, and analyzed for 31 elements using the six-step semiquantitative spectrographic method described above. The lower limits of determination for the rock samples are given in table 1.

Rock samples were also analyzed for Zn, Cd, Bi, As, Sb, Sn, Au, Hg, and W by wet chemical analysis. Zinc, Cd, Bi, As, Sb, and Sn were determined using a modification of the atomic absorption spectrometry technique described above. Rock samples were analyzed for gold by atomic absorption spectrometry, for tungsten by a colorimetric method, and for mercury instrumentally by the methods described above. The lower limits of determination for elements determined by wet-chemical methods are given in table 2.

DESCRIPTION OF DATA TABLES

Data in tables 3, 4, and 5 are so arranged that column 1 contains the field number plotted on the location map (plate 1). Latitude and longitude are given in columns 2 and 3. The remaining columns contain the concentrations of the elements reported. Concentrations for Fe, Mg, Ca, and Ti are reported in terms of weight percent; concentrations for all other elements are in parts per million.

If an element was looked for but not detected, an N is given in place of an analytical value. If an element was detected, but was below the limit of determination, a less than symbol (<) is given in place of an analytical value. If an element was greater than an upper limit of determination used for an element, a greater than sign (>) is given in place of an analytical value.

ACKNOWLEDGMENTS

Jeff Deen and Glenn Rink collected the samples for this report. The emission spectrographic analyses were performed by E. F. Cooley and B. M. Adrian. The wet-chemical analyses were performed by Belinda Arbogast.

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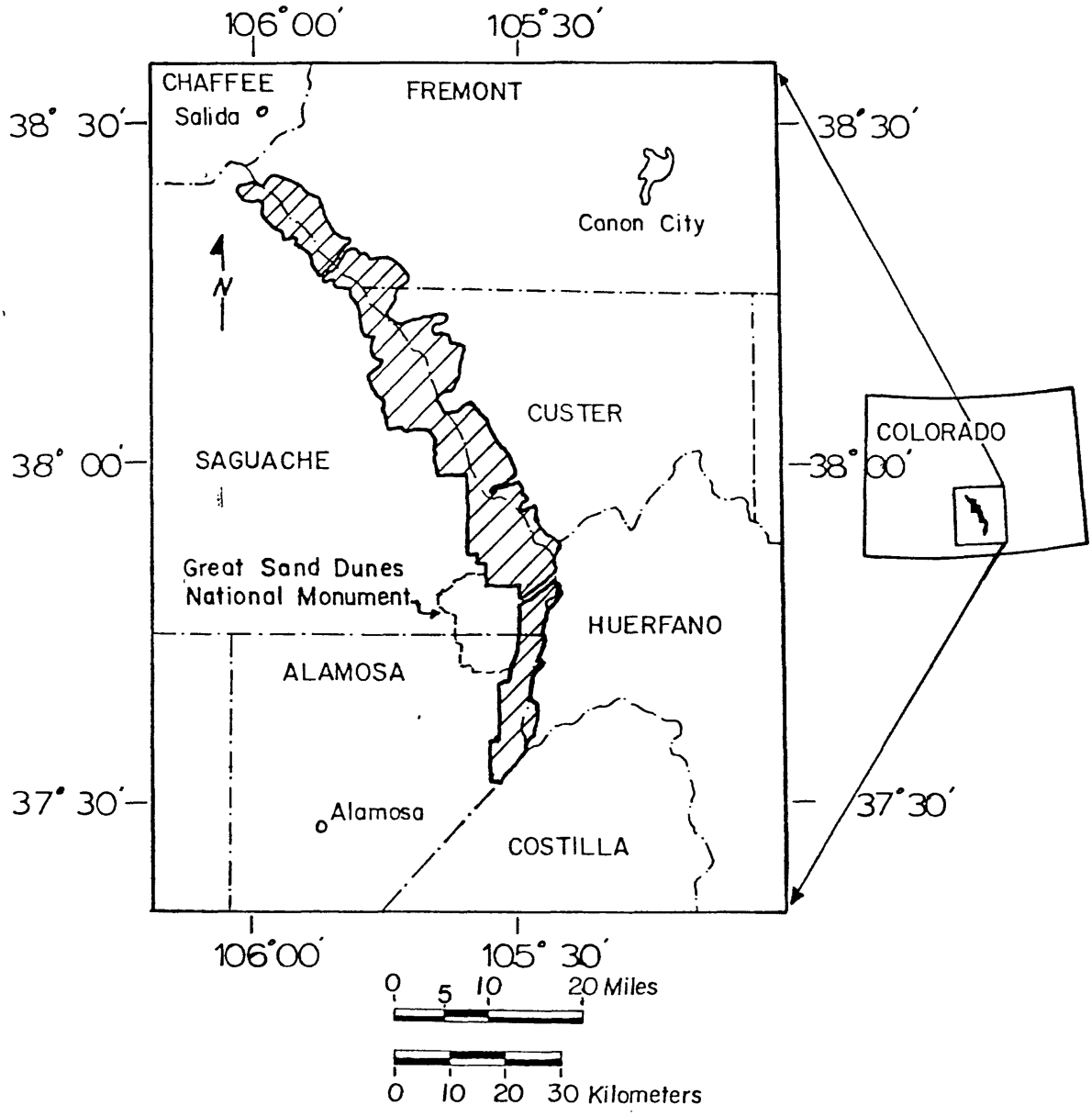

Figure 1.--Index map showing location and approximate boundaries of Sangre de Cristo Wilderness Study Area, south-central Colorado.

Table 1.--Lower limits of analytical determination for elements in rock, stream-sediment, and heavy-mineral concentrate samples analyzed by semiquantitative emission spectrometry.

[The values listed for Fe, Mg, Ca, and Ti are in weight percent; all others in parts per million]

Element	Rock and Stream Sediment	Heavy-Mineral Concentrate	Element	Rock and Stream Sediment	Heavy-Mineral Concentrate
Iron	0.05	0.1	Lanthanum	20	50
Magnesium	0.02	0.05	Molybdenum	5	10
Calcium	0.05	0.1	Niobium	20	50
Titanium	0.002	0.005	Nickel	5	10
Manganese	10	20	Lead	10	20
Silver	0.5	1.0	Antimony	100	200
Arsenic	200	500	Scandium	5	10
Gold	10	20	Tin	10	20
Boron	10	20	Strontium	100	200
Barium	20	50	Vanadium	10	20
Beryllium	1	2	Tungsten	50	100
Bismuth	10	20	Yttrium	10	20
Cadmium	20	50	Zinc	200	500
Cobalt	5	10	Zirconium	10	20
Chromium	10	20	Thorium	100	200
Copper	5	10			

Table 2.--Lower limits of determination for elements in stream-sediment samples determined by atomic-absorption spectrometry.

[Values are in parts per million]

Element	Limit of Determination
Zn	10.0
Cd	0.1
Bi	1.0
As	5.0
Sb	1.0
Sn	2.0
Au	0.05
Hg	0.02
W	1.0

Table 3.--Data for minus-80 mesh stream sediment samples, pilot study Sangre de Cristo Wilderness Study Area

[An "S" prefix designates elements analyzed by emission spectrographic methods. An "AA" prefix designates elements analyzed by atomic absorption methods. Hg was analyzed by instrumental methods and W was analyzed by a colorimetric method.]

Sample	LATITUDE	LONGITUDE	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-AS	S-AU	S-B	S-BA	S-BE	S-BI	S-CD
00038E	38 1 4	105 41 16	10	1.5	1.5	.7	5,000	N	N	N	300	1,000	2	N	N
00108E	38 8 0	105 47 7	5	1.5	.7	.5	1,500	N	N	N	200	1,000	2	N	N
00128E	38 8 14	105 45 46	5	2.0	.5	.5	1,000	N	N	N	200	700	2	N	N
00168E	38 10 52	105 44 46	5	1.5	1.0	.5	500	N	N	N	200	700	2	N	N
00238E	38 9 2	105 47 39	5	1.5	1.0	.7	300	N	N	N	200	500	2	N	N
00288E	38 11 32	105 46 18	3	2.0	1.0	.5	700	N	N	N	200	300	2	N	N
00298E	38 11 31	105 46 14	5	2.0	1.5	.5	500	N	N	N	200	500	2	N	N
00308E	38 11 0	105 47 11	5	1.0	1.5	.7	700	N	N	N	200	700	2	N	N
00348E	38 11 16	105 48 20	5	2.0	.5	.7	1,000	N	N	N	200	500	2	N	N
00358E	38 13 21	105 48 7	7	1.0	1.5	.5	1,000	N	N	N	200	500	2	N	N
00438E	38 15 56	105 51 18	5	1.0	.5	.5	2,000	N	N	N	100	500	2	N	N
00578E	38 8 11	105 35 33	10	1.0	1.5	.7	1,000	N	N	N	100	700	2	N	N
00588E	38 8 5	105 35 41	10	7.0	1.0	.7	500	3	N	N	150	1,000	2	N	N
00598E	38 15 55	105 45 44	5	1.0	1.0	.5	1,000	N	N	N	150	700	2	N	N
00608E	38 15 54	105 45 46	5	1.0	1.0	.5	1,000	N	N	N	500	700	2	N	N
00618E	38 16 1	105 45 48	7	1.0	1.0	.5	1,500	N	N	N	500	700	2	N	N
00908E	38 13 58	105 44 0	7	2.0	2.0	.7	1,500	N	N	N	100	700	2	N	N
00938E	38 14 59	105 42 49	5	2.0	2.0	.5	1,500	N	N	N	100	700	2	N	N
01068E	37 55 54	105 39 0	10	1.0	2.0	.7	1,500	N	N	N	100	700	2	N	N
00488E	38 18 42	105 57 0	7	1.0	2.0	1.0	2,000	3	N	N	20	700	2	N	N

Table 3.--Data for minus-80 mesh stream sediment samples, pilot study Sangre de Cristo Wilderness Study Area--Continued

Sample	S-CO	S-CR	S-CU	S-LA	S-MO	S-NB	S-NI	S-PB	S-SB	S-SC	S-SN	S-SR	S-V	S-W	S-Y
0003E	20	70	30	70	N	20	20	50	N	20	N	500	300	N	100
0010E	15	50	30	50	N	<20	20	50	N	10	N	300	200	N	70
0012E	20	70	30	70	N	<20	30	50	N	15	N	300	150	N	70
0016E	20	70	50	70	N	<20	20	50	N	15	N	200	150	N	100
0023E	20	50	30	100	N	20	30	50	N	15	N	200	150	N	200
0028E	10	50	30	70	N	20	20	20	N	10	N	200	150	N	70
0029E	20	50	30	70	10	20	20	30	N	10	N	200	150	N	50
0030E	20	70	50	100	10	20	30	20	N	20	N	300	150	N	70
0034E	20	70	50	500	N	20	30	30	N	20	N	200	100	N	70
0035E	20	50	50	100	5	20	20	20	N	20	N	300	200	N	70
0043E	20	100	50	70	N	20	30	50	N	20	N	200	200	N	70
0057E	20	150	50	70	N	20	50	50	N	30	N	300	300	N	50
0058E	20	150	70	100	N	20	50	100	N	20	N	300	300	N	100
0059E	10	50	20	100	N	20	15	30	N	10	N	300	200	N	70
0060E	20	30	50	100	N	20	20	30	N	10	N	300	200	N	50
0061E	20	70	70	100	N	20	30	50	N	10	N	200	200	N	50
0090E	20	50	70	150	30	20	20	30	N	20	N	300	200	N	70
0093E	20	50	50	70	30	20	20	30	N	20	N	500	150	N	50
0106E	20	100	30	50	N	20	20	50	N	20	N	500	300	N	70
0048E	15	150	100	100	N	20	20	30	N	20	N	300	200	N	100

Table 3.--Data for minus-80 mesh stream sediment samples, pilot study Sangre de Cristo Wilderness Study Area--Continued

Sample	S-ZN	S-ZR	S-TH	AA-AU	AA-HG	AA-ZN	AA-CD	AA-BI	AA-SB	color-W	AA-AS	AA-SN
00038E	N	70	N	--	<.02	60	.5	<2	N	1	<5	2
00108E	N	70	N	--	<.02	45	.6	<2	N	N	<5	<2
00128E	N	50	N	--	<.02	70	.6	<2	N	<1	<5	4
00148E	N	100	N	--	<.02	35	.5	N	N	1	5	6
00238E	N	150	N	--	<.02	40	.5	N	N	3	10	4
00288E	N	100	N	--	<.02	25	.6	N	N	<1	<5	<2
00298E	N	50	N	--	<.02	40	.5	N	N	1	N	N
00308E	N	50	N	--	<.02	25	.4	N	N	2	<5	2
00348E	N	70	N	--	<.02	45	.6	N	N	1	5	2
00358E	N	50	N	--	<.02	35	.4	N	1	3	5	<2
00438E	N	70	N	--	<.02	80	.7	N	1	1	N	4
00578E	N	70	N	--	<.02	100	.6	N	2	1	<5	2
00588E	N	100	N	N	.04	120	.7	N	4	1	<5	6
00598E	N	50	N	--	.02	35	.5	N	N	1	N	N
00608E	N	50	N	--	.04	45	.5	N	N	2	5	2
00618E	N	50	N	--	.04	50	.4	N	N	1	<5	2
00908E	N	70	N	--	.04	60	.6	N	N	6	5	2
00938E	N	50	N	--	.02	55	.5	N	1	3	<5	<2
01068E	N	70	N	--	<.02	50	.5	N	N	<1	<5	<2
00488E	N	150	N	N	N	65	.6	N	N	4	5	2

Table 4.--Data for heavy mineral panned concentrate samples, pilot study Sangre de Cristo Wilderness Study Area

[All elements were determined by emission spectrographic methods, designated by an "S" prefix.]

Sample	LATITUDE	LONGITUDE	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-AS	S-AU	S-B	S-BA
0003-c	38 1 0	105 41 17	5	.20	5	>.005	700	N	N	N	100	100
0010-c	38 8 0	105 47 7	10	.20	5	>.005	500	N	N	N	500	>5,000
0012-c	38 8 14	105 45 46	5	.30	7	>.005	500	N	N	N	200	>5,000
0016-c	38 10 52	105 44 46	2	2.00	7	>.005	300	N	N	N	150	700
0023-c	38 9 2	105 47 39	10	.50	2	>.005	200	N	N	N	200	>5,000
0028-c	38 11 32	105 46 18	5	1.50	5	>.005	500	N	N	N	700	>5,000
0029-c	38 11 31	105 46 14	15	1.50	5	>.005	300	N	N	N	500	>5,000
0030-c	38 11 0	105 47 11	10	1.50	5	>.005	500	N	N	N	500	>5,000
0035-c	38 13 21	105 48 7	5	.50	7	>.005	500	N	N	<20	200	500
0043-c	38 15 56	105 51 18	10	.50	5	>.005	1,000	N	N	N	50	300
0046-c	38 20 20	105 56 33	5	.50	10	>.005	1,000	N	N	<20	20	200
0048-c	38 18 42	105 57 0	5	.15	10	>.005	1,000	N	N	N	20	100
0057-c	38 8 11	105 35 33	10	.30	5	>.005	700	N	N	N	50	700
0058-c	38 8 5	105 35 41	15	.50	7	>.005	500	N	N	N	50	>5,000
0059-c	38 15 55	105 45 44	5	.50	5	>.005	500	15	N	200	100	>5,000
0060-c	38 15 54	105 45 46	10	.50	5	>.005	700	N	N	N	100	>5,000
0061-c	38 16 1	105 45 48	5	.50	2	>.005	200	N	N	N	200	>5,000
0090-c	38 13 58	105 44 0	5	3.00	10	>.005	1,500	N	N	N	200	1,000
0093-c	38 14 59	105 42 49	5	5.00	10	>.005	1,500	N	N	N	200	500
0106-c	37 55 54	105 39 0	10	1.00	7	>.005	2,000	N	N	N	100	500

Table 4.--Data for heavy mineral panned concentrate samples, pilot study Sangre de Cristo Wilderness Study Area--Continued

Sample	S-BE	S-BI	S-CD	S-CO	S-CR	S-CU	S-LA	S-MO	S-NB	S-NI	S-PB
0003-c	N	N	N	N	70	50	700	N	<50	20	50
0010-c	N	N	N	500	100	300	1,000	N	<50	200	1,500
0012-c	N	N	N	50	50	100	200	N	<50	50	200
0016-c	N	N	N	10	100	50	300	N	70	20	30
0023-c	N	N	N	10	100	100	700	N	50	20	50
0028-c	N	N	N	10	100	100	500	N	50	20	50
0029-c	N	50	N	150	100	100	700	20	70	100	500
0030-c	N	50	N	50	100	100	1,000	<10	50	70	<20
0035-c	N	70	N	10	100	50	1,000	N	50	10	<20
0043-c	7	N	N	10	100	70	500	N	50	20	200
0046-c	N	N	N	<10	50	30	500	N	200	10	100
0048-c	<2	N	N	<10	20	20	300	N	100	10	100
0057-c	<2	N	N	15	100	20	200	200	<50	50	70
0058-c	N	N	N	10	100	300	1,000	N	50	20	1,500
0059-c	N	200	N	10	70	150	700	<10	150	20	1,500
0060-c	N	200	N	100	150	150	1,000	20	150	50	100
0061-c	N	N	N	20	200	150	200	N	100	30	200
0090-c	N	100	N	10	50	30	500	N	50	20	50
0093-c	N	N	N	<10	30	30	200	N	70	10	<20
0106-c	N	N	N	15	100	50	500	N	70	20	70

Table 4.--Data for heavy mineral panned concentrate samples, pilot study Sangre de Cristo Wilderness Study Area--Continue

Sample	S-SB	S-SC	S-SN	S-SR	S-V	S-W	S-Y	S-ZN	S-ZR	S-TH
0003-c	N	50	30	<200	200	N	1,500	N	>1,000	<200
0010-c	N	50	150	300	150	N	2,000	N	>1,000	200
0012-c	N	50	70	<200	150	N	1,500	N	>1,000	<200
0016-c	N	30	100	1,000	200	200	700	N	>1,000	<200
0023-c	N	50	30	<200	200	700	2,000	N	>1,000	<200
0028-c	N	20	30	300	200	500	1,000	N	>1,000	N
0029-c	N	30	30	500	200	500	1,000	N	>1,000	<200
0030-c	N	20	30	<200	200	150	1,000	N	>1,000	N
0035-c	N	70	70	<200	300	200	1,000	N	>1,000	N
0043-c	N	100	20	<200	200	<100	2,000	N	>1,000	500
0046-c	N	20	70	<200	200	100	1,500	N	>1,000	<200
0048-c	N	20	100	<200	150	<100	1,000	N	>1,000	300
0057-c	N	50	N	<200	200	300	1,500	N	>1,000	N
0058-c	N	50	300	1,000	200	N	2,000	N	>1,000	<200
0059-c	N	20	300	500	200	500	700	N	>1,000	N
0060-c	N	20	70	1,000	300	1,000	700	N	>1,000	N
0061-c	N	50	50	700	200	200	1,000	N	>1,000	N
0090-c	N	15	30	200	200	1,000	700	N	>1,000	N
0093-c	N	10	N	200	150	300	300	N	>1,000	N
0106-c	N	15	30	200	200	N	1,000	N	>1,000	N

Table 5.--Data for rock samples, pilot study, Sangre de Cristo, Wilderness Study Area

[An "S" indicates emission spectrographic analysis. An "AA" indicates atomic absorption analyses. Hg was determined by an instrumental method and W was determined by a colorimetric method.]

Sample	LATITUDE	LONGITUDE	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-AS	S-AU	S-B
0005	38 0 54	105 41 50	3.0	.05	<.05	.015	100	N	N	N	10
0007	38 2 57	105 44 8	.2	.02	.15	.002	150	N	N	N	50
0014	38 7 54	105 46 31	5.0	.70	10.00	.500	2,000	2.0	N	N	100
0026	38 11 28	105 46 27	5.0	2.00	10.00	.500	1,500	N	N	N	300
0032	38 11 22	105 47 51	20.0	.50	.20	.500	700	50.0	N	N	50
0033	38 11 17	105 48 21	15.0	.15	.05	.010	5,000	3.0	N	N	20
0038	38 17 5	105 51 52	3.0	.10	.15	.100	1,000	20.0	N	N	10
0041	38 15 59	105 51 13	10.0	.70	.30	.500	2,000	N	N	N	10
0044	38 20 48	105 56 29	2.0	.20	.20	.070	200	N	N	N	10
0052	38 7 50	105 35 50	3.0	.70	.70	.500	500	200.0	<200	N	200
0055	38 8 8	105 36 55	5.0	.10	1.50	.300	700	500.0	N	N	100
0075	38 13 55	105 44 42	2.0	.50	.50	.200	500	N	N	N	20
0080	38 13 18	105 45 20	5.0	.50	<.05	.200	700	N	N	N	20
0081	38 13 17	105 45 20	2.0	.50	.05	.200	300	N	N	N	20
0083	38 13 10	105 45 22	20.0	.50	.05	.100	2,000	N	N	N	20
0088	38 13 28	105 44 38	7.0	2.00	2.00	.700	1,500	N	N	N	10
0089	38 13 28	105 44 34	1.5	.10	.10	.200	100	N	N	N	50
0094	37 56 57	105 39 15	20.0	.70	<.05	.700	300	N	N	N	10
0097	37 56 43	105 39 2	3.0	.20	.20	.150	100	10.0	N	5	10
0104	38 13 11	105 45 6	1.0	.20	.20	.200	500	N	N	N	10

Table 5.--Data for rock samples, pilot study, Sangre de Cristo, Wilderness Study Area--Continued

Sample	S-BA	S-BE	S-BI	S-CD	S-CO	S-CR	S-CU	S-LA	S-MO	S-NB	S-NI
0005	20	<1.0	N	N	N	N	5	<20	N	20	<5
0007	200	3.0	N	N	N	N	10	N	N	N	N
0014	300	5.0	N	N	100	70	100	50	N	<20	70
0026	500	2.0	N	N	10	50	50	50	N	<20	20
0032	5,000	5.0	N	N	70	70	>20,000	100	N	<20	70
0033	>5,000	1.0	N	N	15	N	10,000	20	N	<20	50
0038	5,000	2.0	N	N	10	10	500	20	N	<20	10
0041	1,000	10.0	N	N	10	70	100	50	N	100	20
0044	2,000	1.5	N	N	N	N	50	70	N	<20	N
0052	1,500	3.0	N	N	10	150	7,000	70	N	<20	30
0055	1,500	2.0	N	N	10	150	100	70	N	<20	30
0075	700	3.0	N	N	<5	N	50	70	N	20	N
0080	1,000	7.0	N	N	<5	N	20	50	10	20	N
0081	1,000	5.0	N	N	<5	N	20	70	5	30	N
0083	1,500	10.0	N	N	20	10	20	20	15	<20	20
0088	1,500	2.0	N	N	20	<10	50	70	N	<20	15
0089	700	3.0	N	N	N	N	30	5	10	20	N
0094	100	1.0	N	N	10	10	500	5	N	<20	10
0097	1,500	1.0	N	N	30	20	15,000	<20	N	<20	20
0104	500	3.0	N	N	<5	N	150	100	50	20	N

Table 5.--Data for rock samples, pilot study, Sangre de Cristo, Wilderness Study Area--Continued

Sample	S-PB	S-SB	S-SC	S-SN	S-SR	S-V	S-W	S-Y	S-ZN	S-ZR	S-TH
0005	N	N	N	N	N	50	N	10	N	N	N
0007	100	N	N	N	100	10	N	N	N	N	N
0014	150	N	10	N	500	100	N	20	N	150	N
0026	10	N	15	N	<100	100	N	50	N	200	N
0032	20	N	15	N	150	100	N	70	N	500	N
0033	10	N	<5	N	>5,000	15	N	10	N	N	N
0038	20,000	N	5	N	<100	50	N	<10	N	N	N
0041	500	N	50	20	N	150	N	150	<200	1,000	N
0044	150	N	<5	N	100	10	N	20	N	50	N
0052	150	700	15	N	700	100	N	100	500	100	N
0055	50	N	10	N	300	100	N	50	N	200	N
0075	50	N	5	N	200	20	N	10	N	200	N
0080	10	N	10	N	N	50	<5J	20	N	150	N
0081	10	N	5	N	N	20	<5J	20	N	200	N
0083	10	N	10	N	<100	100	N	20	N	20	N
0088	30	N	15	N	1,000	200	N	20	N	200	N
0089	<10	N	5	N	<100	30	N	10	N	150	N
0094	10	N	15	N	N	100	N	10	N	N	N
0097	50	N	7	N	<100	100	N	<10	N	20	N
0104	20	N	5	N	N	20	N	20	N	200	N

Table 5.--Data for rock samples, pilot study, Sangre de Cristo, Wilderness Study Area--Continued

Sample	AA-AU	INST-HG	AA-ZN	AA-CD	AA-BI	AA-SB	COLOR-W	AA-AS	AA-SN
0005	--	<.02	10	.2	N	1	1	N	N
0007	--	<.02	5	.2	N	N	1	N	<2
0014	--	.04	30	.3	<2	N	3	5	<2
0026	--	<.02	30	.2	N	N	1	N	N
0032	--	.02	15	.9	N	N	N	20	N
0033	.30	.02	10	.3	N	N	N	5	N
0038	--	.04	230	2.9	N	5	3	<5	N
0041	--	<.02	170	.3	N	N	4	N	6
0044	<.05	<.02	25	.2	N	1	<1	<5	<2
0052	--	>10.00	450	8.0	N	550	4	400	<2
0055	--	.08	75	.3	N	1	4	<5	N
0075	--	<.02	30	.2	N	N	3	N	N
0080	--	<.02	30	.2	N	1	8	<5	2
0081	--	<.02	15	.3	6	1	5	<5	<2
0083	--	.02	120	.4	4	N	10	N	14
0088	--	<.02	60	.3	N	1	2	<5	N
0089	--	.80	15	.3	N	N	3	<5	N
0094	--	.20	45	.3	N	N	5	<5	2
0097	6.00	.30	15	.4	4	<1	5	<5	N
0104	--	<.02	15	.3	N	<1	3	N	N