UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of heavy-mineral-concentrate samples from the Bristol/Granite Mountains (CDCA 256) Wilderness Study Area, San Bernardino 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 Bristol/Granite Mountains Wilderness Study Area, California Desert Conservation Area, San Bernardino County, California.

INTRODUCTION

In April 1984, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Bristol/Granite Mountains Wilderness Study Area, San Bernardino County, California.

The Bristol/Granite Mountains Wilderness Study Area, comprises about 46 mi^2 (120 km^2) in the central part of San Bernardino County, California, and lies about 60 mi (96.5 km) east of Barstow (see figure 1). Access to the study area is provided by a well-graded and largely surfaced desert road which runs south from U.S. Highway 15 near Baker and passes immediately east of the study area.

The oldest rocks in the Bristol/Granite Mountains WSA are Precambrian gneisses and Paleozoic metasedimentary rocks. These units have been intruded by Mesozoic plutonic rocks that range from granite to granodiorite in composition. High-angle faults cut the western margins of the study area.

The Bristol/Granite Mountains WSA encompasses roughly 29,000 acres of predominately rugged terrain. The study area includes parts of the Kerens, Flynn, and Cadiz 15-minute quadrangle maps. Local relief is great, rising from approximately 2,000 feet along Budweiser Wash near the northwest periphery of the study area to 6,786 feet at the summit of an unnamed peak north of Willow Spring Basin. The WSA is flanked by Cottonwood Wash on the east and Budweiser Wash to the west. Bull Canyon cuts across the north-central portion of the WSA. The climate is arid to semiarid with a wide range in temperatures.

METHODS OF STUDY

Sample Media

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.

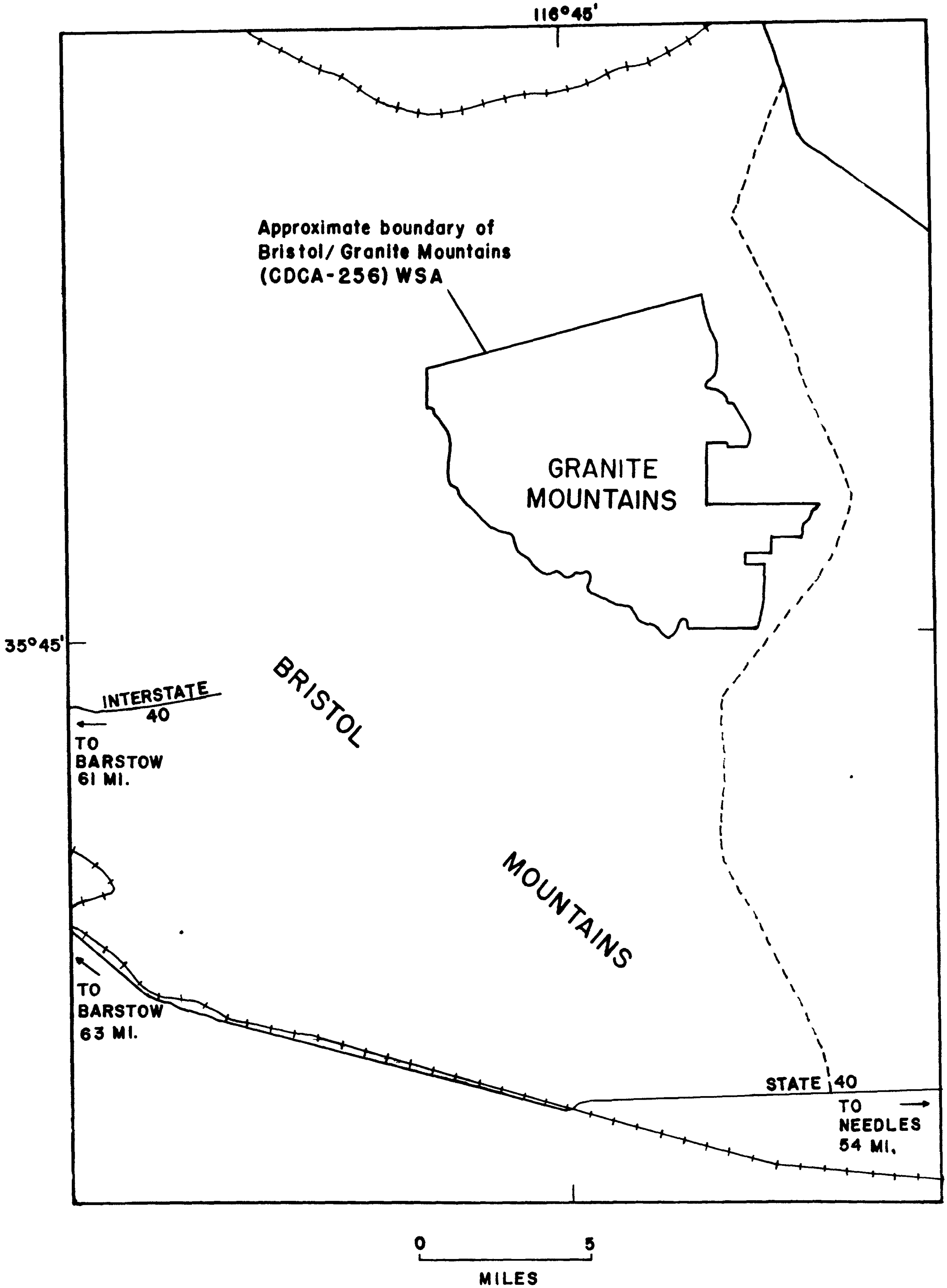

Figure 1. Location map of the Bristol/Granite Mountains Wilderness Study Area, San Bernardino County, California

Sample Collection

Samples were collected at 28 sites (plate 1). At nearly all of those sites a heavy-mineral-concentrate sample was collected. Sampling density was about 1 sample site per 1.6 mi^2 for the heavy-mineral concentrates. The area of the drainage basins sampled ranged from .5 mi^2 to 3 mi^2.

Heavy-mineral-concentrate samples

The heavy-mineral-concentrate 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 of the plotted sample site (plate 1). 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.

Sample Preparation

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 analysis/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 0.1 ampere to remove the magnetite and ilmenite, and a current of 1.0 ampere to split the remainder of the sample into paramagnetic and nonmagnetic fractions.

Sample Analysis

Spectrographic method

The heavy-mineral-concentrate samples were analyzed for 30 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 Bristol/Granite Mountains Wilderness Study Area, are listed in Table 2.

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

Table 2 contains analytical data from the analysis of the heavy-mineral-concentrate samples. For the table, 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. 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. Because of the formatting used in the computer program that produced table 2, 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.

REFERENCES CITED

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 heavy-mineral concentrates based on a 5-mg sample

Elements	Lower determination limit	Upper determination limit
	Percent	
Iron (Fe)	0.1	50
Magnesium (Mg)	.05	20
Calcium (Ca)	.1	50
Titanium (Ti)	.005	2
	Parts per million	
Manganese (Mn)	20	10,000
Silver (Ag)	1	10,000
Arsenic (As)	500	20,000
Gold (Au)	20	1,000
Boron (B)	20	5,000
Barium (Ba)	50	10,000
Beryllium (Be)	2	2,000
Bismuth (Bi)	20	2,000
Cadmium (Cd)	50	1,000
Cobalt (Co)	10	5,000
Chromium (Cr)	20	10,000
Copper (Cu)	10	50,000
Lanthanum (La)	50	2,000
Molybdenum (Mo)	10	5,000
Niobium (Nb)	50	5,000
Nickel (Ni)	10	10,000
Lead (Pb)	20	50,000
Antimony (Sb)	200	20,000
Tin (Sn)	20	2,000
Strontium (Sr)	200	10,000
Vanadium (V)	20	20,000
Tungsten (W)	100	20,000
Yttrium (Y)	20	5,000
Zinc (Zn)	500	20,000
Zirconium (Zr)	20	2,000
Thorium (Th)	200	5,000

TABLE 2.--Spectrographic results from the analysis of heavy-mineral-concentrate samples from the Bristol/Granite Mountains Wilderness Study Area, California

Sample	Latitude	Longitude	Fe-pct. s	Mg-pct. s	Ca-pct. s	Ti-pct. s	Mn-ppm s	Ag-ppm s	As-ppm s	Au-ppm s	B-ppm s
BG300	34 50 58	115 40 22	.7	.50	15	>2.0	1,000	N	N	N	20
BG301	34 48 45	115 39 20	.3	.15	30	>2.0	1,000	N	N	N	<20
BG302	34 50 57	115 41 24	.5	1.50	20	>2.0	700	N	N	N	50
BG303	34 52 45	115 42 18	.5	2.00	20	>2.0	700	N	N	N	30
BG304	34 51 33	115 49 46	.3	.20	10	>2.0	700	N	N	N	<20
BG305	34 49 7	115 44 1	.5	.15	15	>2.0	1,000	N	N	N	<20
BG306	34 49 33	115 43 40	.7	.30	15	>2.0	700	N	N	N	20
BG307	34 51 28	115 44 30	.3	.30	15	>2.0	700	N	N	N	20
BG308	34 46 27	115 45 40	.5	.10	15	>2.0	1,000	N	N	N	20
BG309	34 47 2	115 46 29	.5	.20	15	>2.0	700	N	N	N	20
BG310	34 49 45	115 47 57	.5	.15	10	>2.0	700	N	N	N	30
BG312	34 50 37	115 46 29	.5	.20	10	>2.0	1,000	N	N	N	<20
BG314	34 50 58	115 41 17	5.0	.10	7	2.0	300	N	N	N	20
BG315	34 45 40	115 42 26	1.0	.20	15	>2.0	1,000	N	N	N	<20
BG318	34 48 26	115 39 20	20.0	.20	2	.5	1,500	500	N	N	20
BG400	34 51 15	115 40 43	1.0	10.00	10	>2.0	1,000	N	N	N	30
BG401	34 47 42	115 37 24	.5	.20	10	>2.0	1,000	N	N	N	20
BG402	37 52 15	115 43 15	.5	.30	7	>2.0	700	N	N	N	20
BG403	34 51 45	115 43 45	.7	.30	10	>2.0	1,000	N	N	N	20
BG404	34 52 15	115 46 15	.7	.30	7	>2.0	700	N	N	N	20
BG405	34 49 12	115 48 55	.3	.70	20	>2.0	700	N	N	N	20
BG406	34 50 22	115 44 6	.3	.20	15	>2.0	500	N	N	N	20
BG407	34 46 28	115 44 38	.5	.15	15	>2.0	1,000	N	N	N	30
BG408	34 47 40	115 47 0	.7	1.00	10	>2.0	500	N	N	N	30
BG409	34 50 9	115 47 15	.3	.15	10	>2.0	700	N	N	N	20
BG410	34 46 2	115 41 18	.5	.15	5	2.0	500	N	N	N	30
BG411	34 44 16	115 40 47	.2	.15	20	>2.0	700	N	N	N	<20
BG311C	34 50 31	115 46 46	.7	.50	15	>2.0	700	N	N	N	20

TABLE 2.--continued

Sample	Pb-ppm s	Sb-ppm s	Sn-ppm s	Sr-ppm s	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s
BG300	N	N	N	500	300	<100	700	N	>2,000	500
BG301	N	N	N	700	200	N	500	N	>2,000	500
BG302	N	N	N	500	200	150	700	N	>2,000	200
BG303	N	N	N	700	200	N	500	N	>2,000	<200
BG304	N	N	N	500	300	N	500	N	>2,000	<200
BG305	N	N	N	500	500	N	700	N	>2,000	N
BG306	N	N	N	700	150	N	700	N	>2,000	200
BG307	50	N	N	700	300	500	700	N	>2,000	200
BG308	N	N	N	700	300	N	500	N	>2,000	N
BG309	N	N	N	700	200	N	500	N	>2,000	N
BG310	N	N	N	1,000	200	N	300	N	>2,000	N
BG312	N	N	N	700	500	N	700	N	>2,000	N
BG314	2,000	N	150	1,000	70	N	200	700	>2,000	N
BG315	N	N	N	1,000	150	<100	500	N	>2,000	300
BG318	>50,000	N	N	N	50	N	50	>20,000	>2,000	N
BG400	500	N	N	500	200	700	300	N	>2,000	200
BG401	200	N	N	500	150	N	500	N	>2,000	>5,000
BG402	100	N	N	700	200	N	500	N	>2,000	300
BG403	50	N	N	700	300	N	500	N	>2,000	200
BG404	20	N	N	500	300	N	700	N	>2,000	300
BG405	20	N	N	500	200	100	500	N	>2,000	<200
BG406	30	N	N	200	200	150	700	N	>2,000	700
BG407	20	N	N	500	150	N	500	N	>2,000	N
BG408	20	N	N	700	150	<100	300	N	>2,000	500
BG409	20	N	N	700	300	N	300	N	>2,000	N
BG410	20	N	N	1,000	50	100	300	N	>2,000	700
BG411	70	N	N	700	100	N	700	N	>2,000	200
BG311C	N	N	N	1,000	300	N	300	N	>2,000	<200

TABLE 2.--continued

Sample	Ba-ppm s	Be-ppm s	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s
BG300	2,000	2	N	N	10	30	N	700	N	<50	N
BG301	1,000	2	N	N	N	20	N	300	N	50	N
BG302	1,500	<2	N	N	N	30	N	300	30	N	N
BG303	1,000	<2	N	N	N	30	N	200	N	<50	N
BG304	500	<2	N	N	N	20	N	200	N	N	N
BG305	200	<2	N	N	N	20	N	500	30	50	N
BG306	700	2	N	N	N	20	N	200	N	<50	N
BG307	1,000	<2	N	N	N	20	15	300	20	<50	N
BG308	700	<2	N	N	N	<20	N	500	N	50	N
BG309	700	<2	N	N	N	20	N	500	N	<50	N
BG310	700	2	N	N	N	<20	N	200	N	50	N
BG312	700	<2	N	N	N	20	N	500	15	150	N
BG314	1,500	2	N	N	100	N	200	50	N	N	100
BG315	3,000	2	N	N	N	<20	N	1,500	N	100	N
BG318	3,000	2	500	>1,000	100	<20	10,000	500	N	N	20
BG400	700	2	N	N	N	100	10	200	N	100	15
BG401	2,000	2	N	N	10	<20	20	200	N	50	N
BG402	700	<2	N	N	N	20	N	300	N	50	N
BG403	1,000	<2	N	N	N	20	N	300	N	70	N
BG404	1,000	<2	N	N	N	30	N	500	N	50	N
BG405	1,000	<2	N	N	N	20	N	200	N	N	10
BG406	700	<2	N	N	N	30	N	200	N	N	10
BG407	1,500	<2	N	N	N	20	N	500	N	70	N
BG408	700	2	N	N	N	20	10	200	N	50	N
BG409	500	<2	N	N	N	<20	N	100	N	70	N
BG410	10,000	2	N	N	N	<20	N	>2,000	N	<50	N
BG411	500	2	N	N	N	<20	N	200	N	50	N
BG311C	700	<2	N	N	N	20	N	200	N	100	N