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Analytical results and sample locality map of heavy-mineral-concentrate samples from the Fish Creek Mountains Wilderness Study Area (CDCA 372), Imperial County, California

By

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature. Any use of trade names is for descriptive purposes only and does not imply endorsement by the USGS.

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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 Fish Creek Mountains Wilderness Study Area, California Desert Conservation Area, Imperial County, California.

INTRODUCTION

In April 1984, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Fish Creek Mountains Wilderness Study Area Imperial County, California.

The Fish Creek Mountains Wilderness Study Area comprises about 15 mi^2 (39 km^2) (9,581 acres) in west-central Imperial County, California. Access to the study area is provided by the Split Mountain Road which runs south from Highway 78 at Ocotillo Wells (figure 1).

The study area is underlain by Mesozoic granitic rocks that are locally covered by Tertiary sedimentary and volcanic units. Some limestone units contain gypsum and celestite. Two mines, the Imperial Gypsum King and the Bonanza Queen (Cu) are located within the proposed confines of the WSA.

The study area includes parts of the Carrizo Mountain, northeast; Plaster City, northwest; and Harpers Well and Borrego Mountain, southeast, 7.5-minute quadrangles. The area encompasses 9,581 acres of predominately rugged terrain. Local relief is great, rising from near sea level along the north-east periphery of the WSA to greater than 2,200 feet at a number of localities within the study area. The WSA is bounded by Carrizo Wash to the east and south, and the Anza-Borrego Desert State Park to the west.

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.

Sample Collection

Samples were collected at 22 sites (plate 1). At all of those sites, a heavy-mineral-concentrate sample was collected. Sampling density was about 1 sample site per .7 mi^2 for the heavy-mineral concentrates. The area of the drainage basins sampled ranged from .5 mi^2 to 2 mi^2.

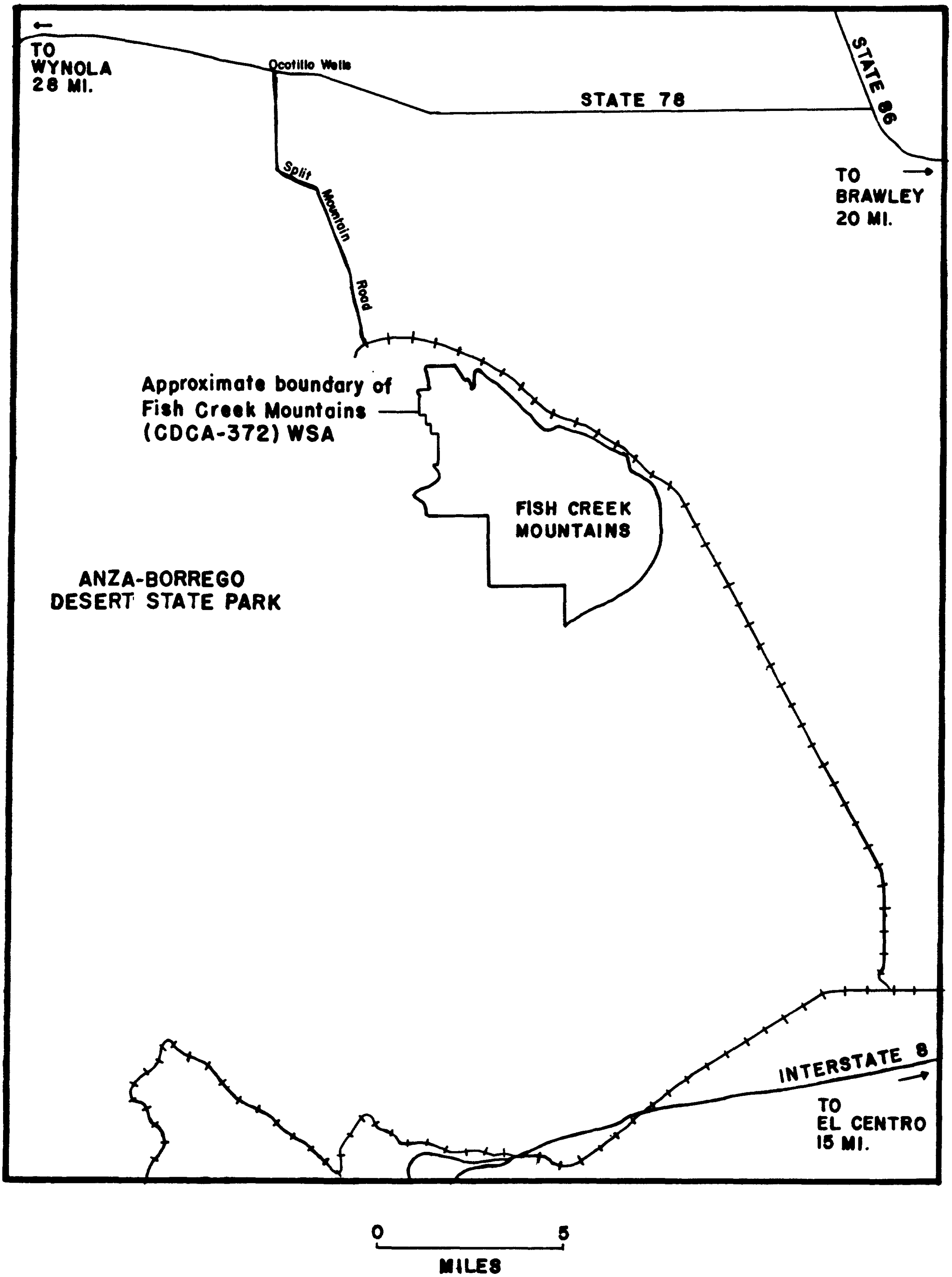

Figure 1. Location map of the Fish Creek Mountains Wilderness Study Area, Imperial County, California.

Heavy-mineral-concentrate samples

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 area of the plotted site. 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 Fish Creek 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 lists the analyses for the samples of heavy-mineral concentrate. 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 this table (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 Fish Creek Mountains Wilderness Study Area, California

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

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
FC100C	32 59 40	116 1 30	.3	2.00	10	>2	500	N	N	N	200
FC101C	32 59 40	116 1 42	.7	10.00	30	>2	2,000	N	N	N	300
FC200C	33 0 24	116 2 5	.3	5.00	20	>2	1,000	N	N	N	100
FC202C	33 1 7	116 2 26	.3	5.00	20	>2	1,000	N	N	N	200
FC300C	32 59 5	116 3 19	.3	.10	20	>2	1,000	N	N	N	20
FC301C	33 0 10	116 3 35	.2	.05	10	>2	700	300	N	N	20
FC302C	33 1 6	116 1 24	.3	2.00	15	>2	700	N	N	N	100
FC303C	33 0 52	116 1 3	.3	.50	10	>2	500	N	N	N	20
FC304C	33 1 45	116 3 24	.5	7.00	20	>2	700	N	N	N	500
FC400C	32 59 27	116 2 56	.2	.05	15	>2	1,000	N	N	N	20
FC401C	33 0 40	116 4 28	.2	.30	10	>2	700	N	N	N	20
FC402C	33 0 32	116 0 36	.3	.10	20	>2	1,000	N	N	N	30
FC403C	33 0 24	116 0 16	.5	1.50	20	>2	1,500	N	N	N	100
FC404C	32 59 48	115 58 25	.2	.10	15	>2	700	N	N	N	20
FC405C	32 59 16	115 57 43	.2	.50	20	>2	1,000	N	N	N	70
FC406C	32 58 3	115 57 22	.2	.30	20	>2	700	N	N	N	20
FC407C	32 56 44	115 58 25	.2	.20	15	>2	700	N	N	N	30
FC500C	32 59 55	115 59 24	.3	1.50	20	>2	1,000	N	N	N	70
FC501C	32 59 29	115 57 59	.2	.50	15	>2	500	N	N	N	30
FC502C	32 58 37	115 57 19	.2	.30	15	>2	500	N	N	N	20
FC503C	32 57 3	115 57 51	.2	.20	15	>2	500	N	N	N	50
FC504C	32 56 20	115 58 32	.2	.15	15	>2	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
FC100C	150	N	100	>10,000	200	2,000	300	N	>2,000	N
FC101C	2,000	N	300	>10,000	300	700	700	N	>2,000	N
FC200C	700	N	100	>10,000	200	500	500	N	>2,000	N
FC202C	100	N	150	1,000	200	200	500	N	>2,000	N
FC300C	100	N	500	700	300	N	1,000	N	>2,000	N
FC301C	20,000	N	150	>10,000	500	N	1,000	N	>2,000	N
FC302C	50	N	100	1,000	150	300	300	N	>2,000	N
FC303C	20	N	100	1,000	300	150	500	N	>2,000	N
FC304C	30	N	200	1,000	200	2,000	500	N	>2,000	N
FC400C	N	N	200	>10,000	200	1,000	700	N	>2,000	N
FC401C	7,000	N	300	>10,000	200	N	500	N	>2,000	N
FC402C	N	N	300	500	150	<100	700	N	>2,000	N
FC403C	150	N	300	200	200	2,000	700	N	>2,000	N
FC404C	50	N	100	N	200	N	300	N	>2,000	N
FC405C	50	N	200	500	300	N	700	N	>2,000	N
FC406C	20	N	100	500	200	<100	500	N	>2,000	<200
FC407C	20	N	200	500	200	N	700	N	>2,000	N
FC500C	20	N	150	700	200	500	300	N	>2,000	N
FC501C	50	N	50	500	200	100	500	N	>2,000	N
FC502C	5,000	N	150	700	200	N	500	N	>2,000	<200
FC503C	20	N	100	1,000	150	N	700	N	>2,000	<200
FC504C	50	N	100	200	200	N	700	N	>2,000	N

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
FC100C	>10,000	2	N	N	N	150	N	150	N	50	N
FC101C	>10,000	3	N	N	N	200	N	200	100	150	N
FC200C	>10,000	2	N	N	N	100	20	100	20	100	N
FC202C	>10,000	2	N	N	N	150	N	200	N	100	N
FC300C	7,000	<2	N	N	10	100	N	500	N	150	N
FC301C	>10,000	<2	N	N	10	100	N	200	300	70	10
FC302C	>10,000	2	N	N	N	100	N	150	N	70	N
FC303C	>10,000	<2	N	N	10	150	N	200	N	200	N
FC304C	>10,000	2	N	N	10	200	<10	150	N	100	N
FC400C	>10,000	<2	N	N	10	100	N	200	N	100	N
FC401C	>10,000	<2	N	N	10	100	N	200	100	100	N
FC402C	2,000	2	N	N	10	70	N	200	N	300	N
FC403C	2,000	2	N	N	10	700	N	100	N	150	N
FC404C	3,000	<2	N	N	10	100	N	300	N	<50	N
FC405C	7,000	<2	N	N	N	200	N	200	N	70	10
FC406C	5,000	<2	N	N	10	150	N	200	N	50	N
FC407C	10,000	<2	N	N	N	150	N	100	N	50	N
FC500C	10,000	<2	N	N	N	150	N	200	30	150	N
FC501C	10,000	2	N	N	N	100	N	200	N	<50	N
FC502C	>10,000	<2	N	N	10	100	N	200	N	N	N
FC503C	>10,000	<2	N	N	N	70	N	100	N	<50	N
FC504C	5,000	<2	N	N	10	100	N	100	N	N	10