UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of heavy-mineral-concentrate samples from the Newberry Mountains (CDCA 206) and Rodman Mountains (CDCA 207) Wilderness Study Areas, 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 Newberry Mountains and Rodman Mountains Wilderness Study Areas, California Desert Conservation Area, San Bernardino County, California.

INTRODUCTION

In April 1984 the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Newberry Mountains and Rodman Mountains Wilderness Study Areas, San Bernardino County, California.

The Newberry Mountains WSA comprises about 44 mi^2 (19,340 acres) in San Bernardino County, California, and lies about 12 mi southeast of Barstow. The Rodman Mountains WSA comprises about 37 mi^2 (16,900 acres) in San Barnardino County, California, and lies about 20 mi southeast of Barstow. Access to both study areas is provided by several graded dirt roads which run south from U.S. Highway 40 near the towns of Daggett and Newberry Springs (fig. 1).

The oldest rocks in the Newberry Mountains WSA are Triassic-Jurassic altered adesitic flows, tuffs, and breccias which outcrop near Kane Springs. These units are intruded by younger Mesozoic intrusives which are mostly gabbros and quartz monzonites. Near the center of the WSA is an extensive belt of Tertiary intrusive dacite, rhyolite, and dacite breccia. All these units are overlain by Miocene andesite and basalt which cover most of the higher elevations of the Newberry Mountains. The Miocene section is disrupted by post-volcanic Miocene detachment faulting with syntectonic deposition of coarse-grained sedimentary breccia.

The major feature of the Newberrry Mountain study area is the Newberry Mountains system. These mountains rise to a height of 4,800 feet from the desert floor to the north, which lies at approximately 2,400 feet. Of volcanic origin, the main block of mountains consists of several rugged ridges. Intervening canyons and lower hills are highly eroded. The western portion of these mountains consist of a series of parallel north-south ridges extending onto the alluvial fan, which forms the southern slope of the Mojave River Valley. The climate is arid to semiarid with a wide range in temperatures.

The Rodman Mountains study area is underlain by Mesozoic plutonic rocks that are mostly quartz monzonites in composition. Tertiary fanglomerate deposits locally overlie the Mesozoic rocks. The central part of the study area is covered by a large Quaternary basalt flow. Quaternary alluvial deposits in places cover the older units. The study area is bounded by the Calico fault which cuts the eastern portion of the WSA, and the Camp Rock fault which is just to the southwest.

Elevations in the Rodman Mountains WSA range from roughly 2,400 feet along the northern periphery of the WSA to almost 5,000 feet at the summit of a number of peaks along the southern margin of the study area. The climate is arid to semiarid, with temperatures reaching upwards of 100 degrees in summer, and below freezing in the winter months.

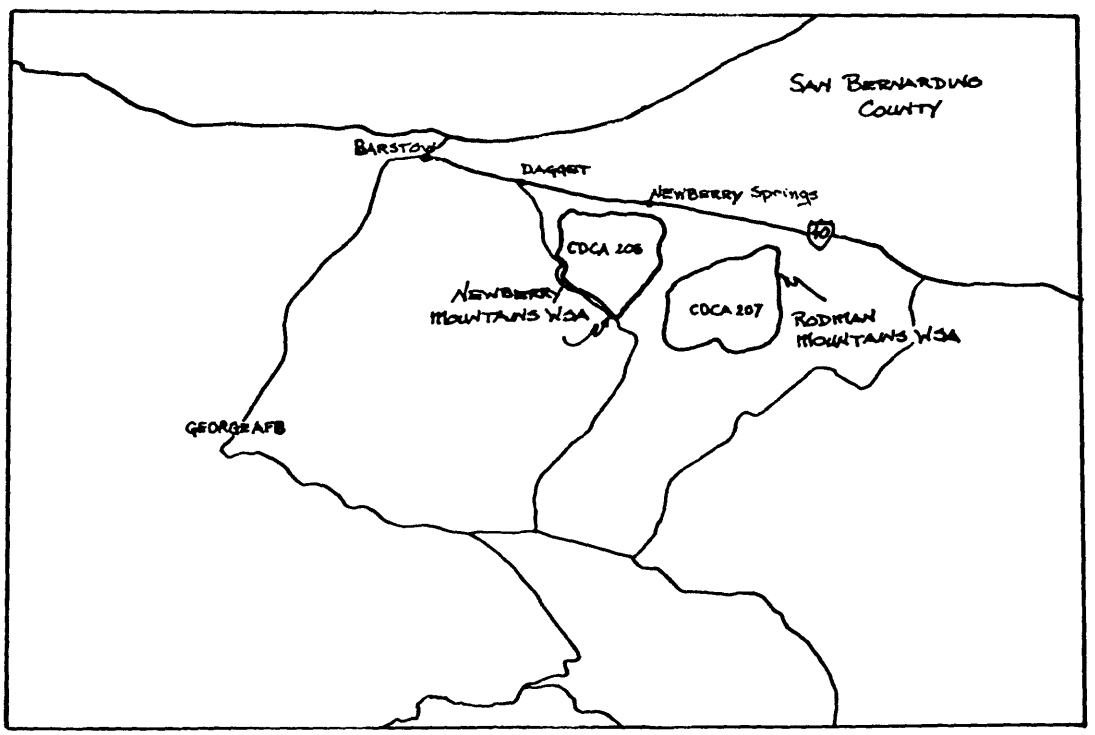

Figure 1. Location map of the Newberry Mountains and Rodman Mountains Wilderness Study Areas, San Bernardino County, California.

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 53 and 42 sites in the Newberry Mountains and Rodman Mountains Wilderness Study Areas, respectively (figs. 2 and fig. 3). At all of those sites a heavy-mineral-concentrate sample was collected. Sampling density was about 1 sample site per square mile for heavy-mineral-concentrate samples. The area of the drainage basins sampled ranged from .5 mi^2 to 2.5 mi^2.

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 topographic maps (scale = 1:62,500). 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

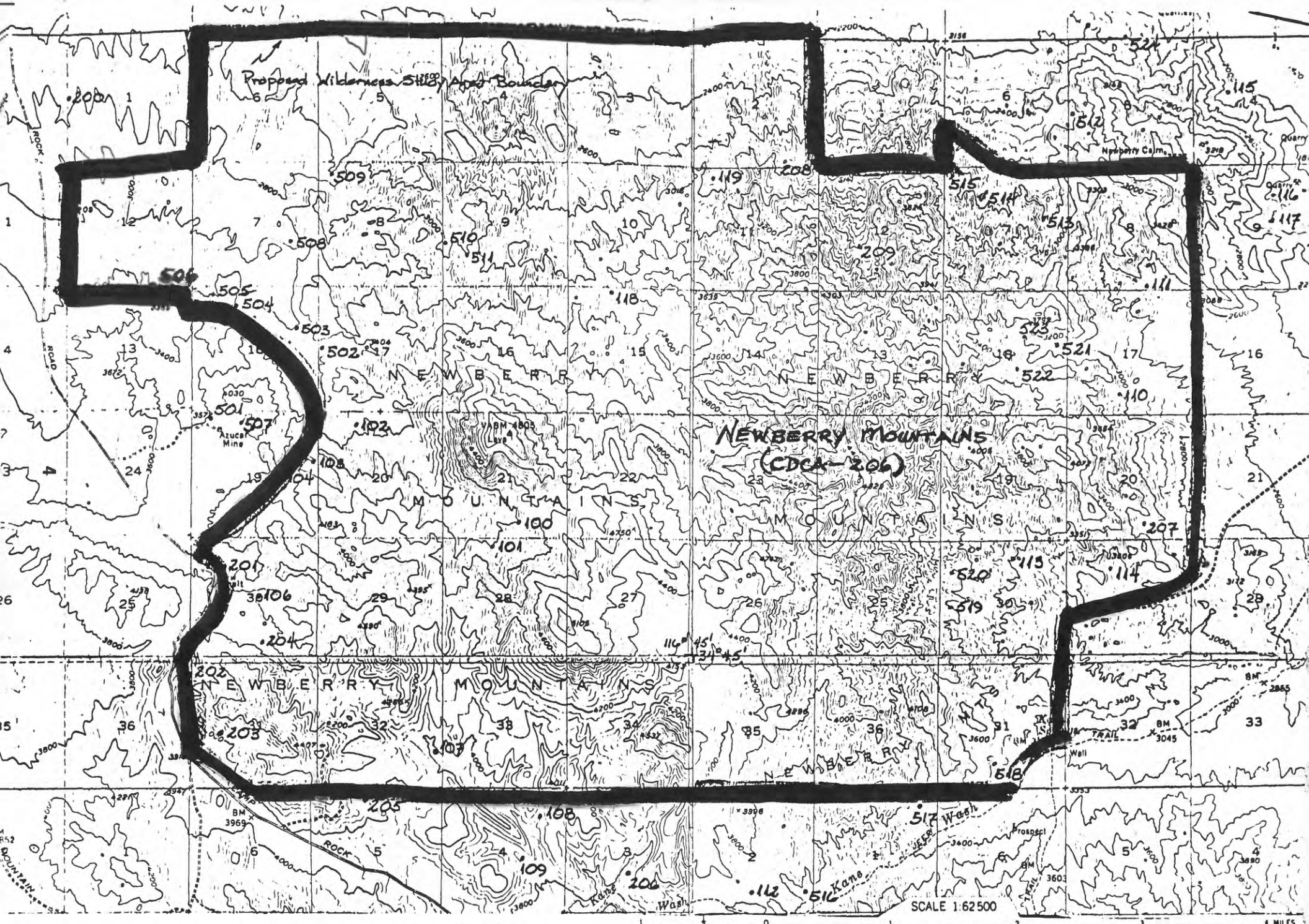

Figure 2. Map showing geochemical sample sites from Newberry Mountains Wilderness Study Area, California.

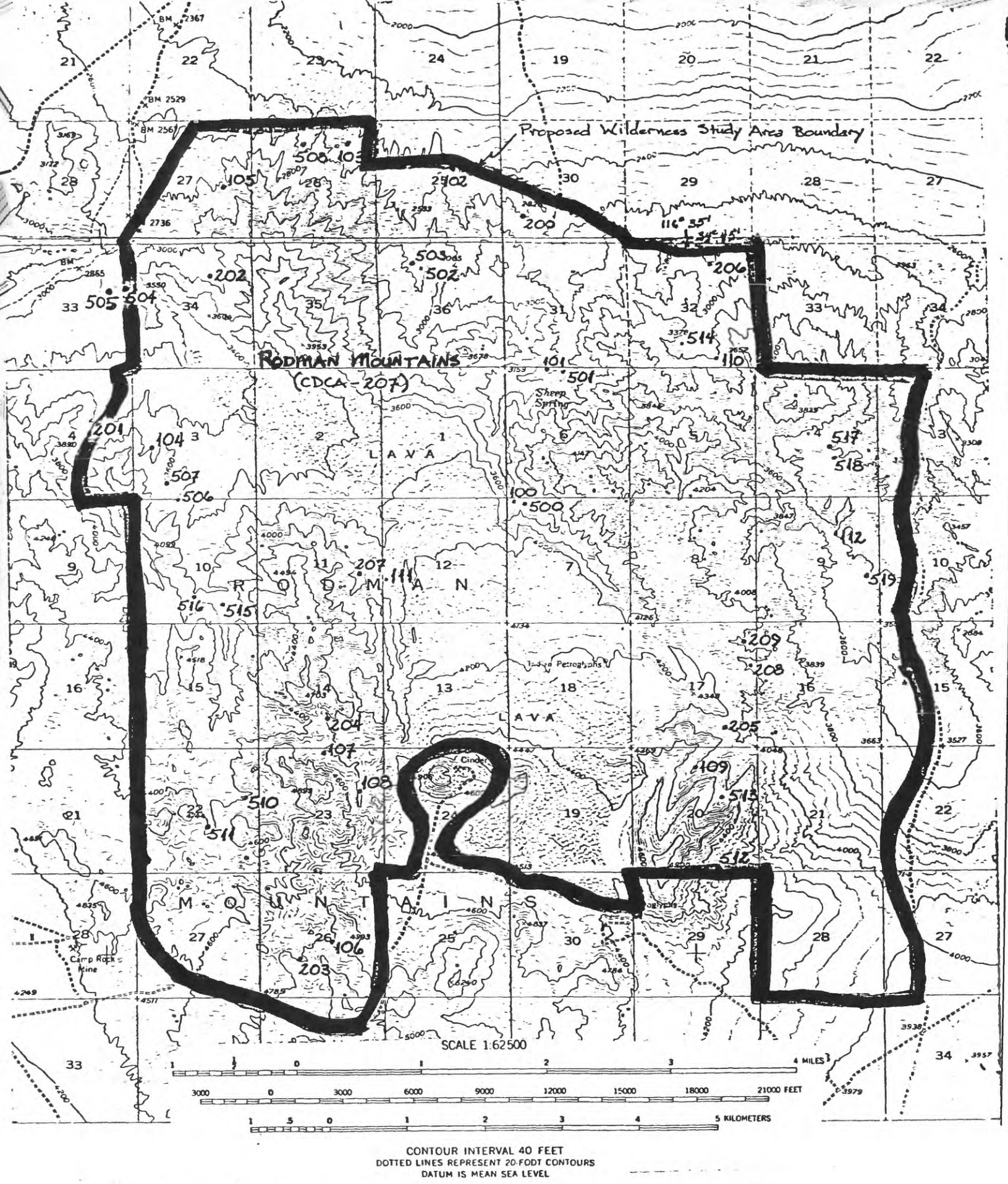

Figure 3. Map showing geochemical sample sites from Rodman Mountains Wilderness Study Area, California.

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).

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 heavy-mineral-concentrate samples. 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 (figs. 2 and 3). 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 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.

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)	.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 NEWBERRY 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
NB101C	34 45 52	116 46 44	1.0	2.00	20	>2.0	2,000	N	N	N	30
NB102C	34 46 0	116 47 53	.7	.70	15	>2.0	2,000	10	N	700	50
NB103C	34 46 25	116 48 18	.7	.50	15	>2.0	1,000	N	N	N	30
NB104C	34 46 22	116 48 25	1.0	.50	15	>2.0	1,000	N	N	N	30
NB106C	34 45 27	116 48 46	1.0	.50	10	>2.0	700	N	N	N	50
NB107C	34 44 17	116 47 8	.5	.50	10	>2.0	500	N	N	N	30
NB108C	34 43 55	116 46 20	.5	.70	15	>2.0	700	N	N	N	30
NB109C	34 43 38	116 46 31	.5	.50	10	>2.0	1,000	N	N	N	30
NB110C	34 46 47	116 41 17	.2	.20	5	1.5	500	N	N	N	20
NB111C	34 47 33	116 41 13	.5	.50	10	2.0	700	N	N	N	30
NB112C	34 43 20	116 44 25	.5	.50	10	>2.0	300	N	N	N	30
NB113C	34 45 41	116 42 16	.5	.50	10	>2.0	500	N	N	N	20
NB114C	34 45 37	116 41 29	.5	.50	5	1.5	500	N	N	N	50
NB115C	34 48 56	116 40 27	.3	.15	7	1.0	700	N	N	N	20
NB116C	34 48 13	116 40 8	.7	.50	15	>2.0	1,500	N	N	N	30
NB117C	34 48 1	116 40 7	.7	.70	15	>2.0	1,000	N	N	N	30
NB119C	34 48 21	116 44 49	.7	.30	10	>2.0	1,000	N	N	N	20
NB201C	34 45 38	116 48 58	.7	.20	7	>2.0	300	N	N	N	30
NB202C	34 44 52	116 49 5	1.0	.50	5	>2.0	300	1	N	N	20
NB203C	34 44 24	116 48 57	1.0	.50	10	>2.0	700	N	N	N	20
NB204C	34 45 13	116 48 58	1.0	.50	3	>2.0	500	N	N	N	30
NB205C	34 44 3	116 46 47	.7	.70	10	>2.0	500	N	N	N	30
NB206C	34 43 27	116 45 37	.3	.30	10	2.0	300	N	N	N	20
NB207C	34 45 55	116 41 6	.3	.20	7	1.5	300	N	N	N	20
NB208C	34 48 29	116 44 14	1.0	1.50	10	>2.0	1,000	N	N	N	20
NB209C	34 46 55	116 43 39	.5	.50	10	1.5	700	1	N	N	20
NB501C	34 46 39	116 49 5	.3	.20	5	1.0	300	N	N	N	20
NB502C	34 47 8	116 48 11	.5	.30	10	2.0	700	N	N	N	20
NB503C	34 47 17	116 48 23	.3	.20	10	>2.0	500	N	N	N	20
NB505C	34 47 34	116 49 5	1.0	.20	2	1.0	500	N	N	N	20
NB506C	34 47 35	116 49 35	.5	.30	10	1.0	500	N	N	N	20
NB507C	34 46 39	116 48 52	.5	.20	3	>2.0	500	1,000	N	N	20
NB508C	34 47 53	116 48 25	.5	.30	20	>2.0	500	N	N	N	20
NB509C	34 48 22	116 48 5	.5	.20	7	.7	300	N	N	N	20
NB510C	34 47 53	116 47 8	.3	.30	20	.5	1,000	N	N	N	30
NB511C	34 47 52	116 46 58	.5	.20	7	2.0	500	N	N	N	100
NB512C	34 48 46	116 41 53	.7	.50	10	>2.0	700	<1	N	N	20
NB513C	34 48 5	116 42 3	.2	.07	2	2.0	300	N	N	N	20
NB514C	34 48 15	116 42 33	.5	.30	10	>2.0	1,500	N	N	N	30
NB515C	34 48 14	116 42 45	.5	1.00	15	>2.0	1,000	N	N	N	50
NB516C	34 43 22	116 44 5	.5	.30	15	>2.0	500	100	N	N	20
NB518C	34 44 15	116 42 30	.5	.20	7	>2.0	200	N	N	N	20
NB519C	34 45 22	116 42 51	.7	.30	7	2.0	300	N	N	N	30
NB520C	34 45 36	116 42 50	.5	.50	5	>2.0	500	N	N	N	20
NB521C	34 47 13	116 41 55	.5	.15	3	>2.0	300	50	N	N	30
NB523C	34 47 13	116 42 14	1.0	.30	3	>2.0	1,500	N	N	N	20
NB524C	34 49 16	116 12 20	.7	.30	5	>2.0	700	20	N	N	30

TABLE 2.--SPECTROGRAPHIC RESULTS FROM THE ANALYSIS OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE NEWBERRY MOUNTAINS WILDERNESS STUDY AREA, CALIFORNIA.--Continued

Sample	Pa-ppm s	Pe-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
NB101C	2,000	<2	N	N	15	100	N	200	N	<50	10
NB102C	1,500	<2	N	N	15	70	<10	200	N	<50	15
NB103C	1,500	2	N	N	N	50	N	150	N	<50	10
NB104C	1,500	<2	N	N	10	70	N	200	N	N	10
NB106C	1,500	<2	N	N	10	100	100	100	N	<50	10
NB107C	3,000	2	N	N	N	50	N	100	N	N	N
NB108C	5,000	<2	N	N	10	70	N	100	N	50	N
NB109C	>10,000	N	N	N	10	50	N	200	N	<50	10
NB110C	>10,000	<2	N	N	N	30	30	N	N	<50	N
NB111C	>10,000	2	N	N	N	30	N	150	N	<50	10
NB112C	2,000	2	N	N	N	20	N	200	N	<50	10
NB113C	10,000	2	N	N	N	20	N	150	20	<50	15
NB114C	>10,000	<2	N	N	N	30	N	50	N	<50	N
NB115C	>10,000	2	N	N	N	20	N	50	N	N	N
NB116C	>10,000	3	N	N	N	30	N	200	N	<50	10
NB117C	>10,000	2	N	N	N	50	10	150	N	50	10
NB119C	1,500	2	N	N	N	20	10	100	N	50	10
NB201C	1,000	2	N	N	N	70	10	100	N	<50	10
NB202C	>10,000	2	N	N	N	30	10	100	N	N	20
NB203C	10,000	<2	N	N	10	50	N	300	N	<50	20
NB204C	5,000	2	N	N	N	30	<10	100	N	N	15
NB205C	2,000	<2	200	N	N	30	N	300	N	50	10
NB206C	1,000	2	N	N	N	20	N	200	N	N	N
NB207C	5,000	2	N	N	N	20	N	150	N	N	N
NB208C	>10,000	<2	N	N	10	100	100	200	N	50	15
NB209C	1,500	3	N	N	N	30	N	100	N	N	10
NB501C	1,000	2	N	N	N	20	15	100	N	N	10
NB502C	1,500	2	N	N	N	20	N	100	N	N	10
NB503C	1,000	2	N	N	N	30	N	150	N	N	10
NB505C	1,000	2	N	N	N	30	N	100	N	N	10
NB506C	1,500	2	N	N	N	20	N	100	N	N	10
NB507C	1,000	<2	N	N	N	20	20	200	N	N	15
NB508C	1,000	3	N	N	N	50	N	200	N	50	10
NB509C	1,000	3	N	N	N	20	N	50	N	N	10
NB510C	1,000	2	N	N	N	20	15	100	N	N	10
NB511C	1,000	3	N	N	N	20	N	50	N	<50	10
NB512C	10,000	3	N	N	N	30	N	100	N	N	N
NB513C	>10,000	2	N	N	N	30	N	100	N	50	10
NB514C	>10,000	2	N	N	N	30	10	200	30	50	N
NB515C	>10,000	2	N	N	N	50	20	200	N	50	10
NB516C	1,500	3	N	N	N	20	15	500	N	<50	N
NB518C	>10,000	2	N	N	N	20	N	200	N	50	10
NB519C	2,000	3	N	N	N	20	N	100	N	N	N
NB520C	5,000	2	N	N	N	<20	N	200	N	N	10
NB521C	>10,000	2	N	N	N	30	N	100	N	50	10
NB523C	>10,000	2	N	N	N	50	10	200	N	70	N
NB524C	>10,000	3	N	N	N	30	10	150	N	<50	10

TABLE 2.--SPECTROGRAPHIC RESULTS FROM THE ANALYSIS OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE NEWBERRY MOUNTAINS WILDERNESS STUDY AREA, CALIFORNIA.--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
NB101C	500	N	N	500	500	N	700	N	>2,000	500
NB102C	300	N	300	200	500	500	1,000	N	>2,000	2,000
NB103C	700	N	N	700	100	<100	300	N	>2,000	500
NB104C	1,500	N	N	200	700	N	500	N	>2,000	2,000
NB106C	2,000	N	N	1,000	500	100	500	N	>2,000	1,000
NB107C	50	N	N	500	200	N	300	N	>2,000	500
NB108C	30	N	N	500	200	N	300	N	>2,000	700
NB109C	300	N	N	200	300	N	1,000	N	>2,000	500
NB110C	5,000	N	N	1,500	700	N	100	N	>2,000	N
NB111C	500	N	N	1,000	100	N	200	N	>2,000	N
NB112C	150	N	N	500	200	N	200	N	>2,000	300
NB113C	300	N	N	700	150	N	200	N	>2,000	300
NB114C	30	N	N	1,000	50	N	100	N	>2,000	N
NB115C	30	N	N	700	70	N	70	N	>2,000	N
NB116C	15,000	N	N	1,000	100	N	200	N	>2,000	N
NB117C	300	N	N	1,000	150	N	300	N	>2,000	N
NB119C	20	N	N	700	100	N	200	N	>2,000	N
NB201C	5,000	N	300	1,000	150	N	200	N	>2,000	<200
NB202C	30	N	N	1,000	100	N	300	N	>2,000	<200
NB203C	200	N	20	200	500	N	700	N	>2,000	1,000
NB204C	50	N	N	1,000	100	N	300	N	>2,000	<200
NB205C	300	N	30	500	700	N	700	N	>2,000	700
NB206C	50	N	N	1,000	100	N	500	N	>2,000	300
NB207C	100	N	N	1,000	70	N	300	N	>2,000	N
NB208C	50,000	N	30	1,000	5,000	N	500	N	>2,000	200
NB209C	200	N	N	1,500	50	N	200	N	>2,000	N
NB501C	7,000	700	200	500	150	N	500	N	>2,000	2,000
NB502C	50	N	N	700	50	N	300	N	>2,000	<200
NB503C	20	N	N	1,000	100	N	300	N	>2,000	300
NB505C	50	N	70	500	70	N	700	N	>2,000	200
NB506C	50	N	N	500	100	N	500	N	>2,000	1,000
NB507C	50	N	N	200	200	N	1,000	N	>2,000	2,000
NB508C	50	N	300	500	100	N	700	N	>2,000	500
NB509C	50	N	N	200	70	N	700	N	>2,000	<200
NB510C	30	N	N	700	70	N	200	N	>2,000	N
NB511C	N	N	N	500	100	N	500	N	>2,000	200
NB512C	100	N	N	700	100	N	200	N	>2,000	<200
NB513C	500	N	N	3,000	150	N	500	N	>2,000	N
NB514C	10,000	N	N	1,500	1,000	N	200	N	>2,000	200
NB515C	30,000	N	N	1,000	2,000	N	500	N	>2,000	200
NB516C	70	N	N	1,000	100	N	500	N	>2,000	200
NB518C	N	N	N	700	150	N	500	N	>2,000	500
NB519C	N	N	N	1,000	100	N	150	N	>2,000	N
NB520C	30	N	N	1,500	150	N	100	N	>2,000	500
NB521C	3,000	N	N	7,000	700	N	200	N	>2,000	500
NB523C	5,000	N	N	3,000	1,000	N	300	N	>2,000	1,000
NB524C	300	N	N	3,000	500	N	200	N	>2,000	200

TABLE 3.--SPECTROGRAPHIC RESULTS FROM THE ANALYSIS OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE RODMAN 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
RD101C	34 44 6	116 36 12	1.0	.70	15	1.0	1,000	N	N	N	20
RD102C	34 45 29	116 37 0	1.0	.20	10	2.0	700	N	N	N	<20
RD103C	34 45 40	116 37 52	1.5	.20	15	>2.0	1,000	N	N	N	20
RD104C	34 43 33	116 39 34	1.0	.30	20	>2.0	700	N	N	N	20
RD105C	34 45 22	116 38 55	.7	.20	10	>2.0	700	N	N	N	20
RD106C	34 40 6	116 38 5	1.0	.20	10	>2.0	500	N	N	N	<20
RD107C	34 41 27	116 38 8	1.5	.30	20	>2.0	1,000	N	N	N	20
RD108C	34 41 8	116 37 50	1.0	.30	10	>2.0	500	N	N	N	30
RD109C	34 41 16	116 35 0	1.0	.30	7	1.0	300	N	N	N	30
RD111C	34 42 36	116 37 37	1.0	.30	15	>2.0	700	N	N	N	20
RD112C	34 42 57	116 33 46	.7	.30	15	>2.0	700	N	N	N	20
RD200C	34 45 11	116 36 23	1.0	.20	7	>2.0	500	N	N	N	20
RD201C	34 43 41	116 40 3	1.5	.50	20	>2.0	1,000	N	N	N	20
RD202C	34 44 43	116 39 5	1.0	.20	10	>2.0	1,500	N	N	N	20
RD203C	34 39 58	116 38 20	1.5	.50	10	>2.0	700	N	N	N	30
RD204C	34 41 38	116 38 6	1.0	.30	15	>2.0	500	N	N	N	<20
RD205C	34 41 35	116 34 47	1.0	.50	3	.7	200	N	N	N	20
RD206C	34 44 47	116 34 49	.5	.15	15	>2.0	1,500	10	N	N	<20
RD207C	34 42 40	116 37 51	1.0	.30	10	>2.0	200	N	N	N	<20
RD208C	34 42 0	116 34 31	.7	.70	15	>2.0	1,000	N	N	N	50
RD209C	34 42 10	116 34 35	.3	.30	30	2.0	1,500	N	N	N	20
RD501C	34 44 0	116 36 5	.2	.10	20	.5	2,000	N	N	N	20
RD503C	34 44 50	116 37 22	.5	.50	15	>2.0	1,000	N	N	N	20
RD505C	34 44 37	116 39 56	.5	.20	10	>2.0	500	N	N	N	20
RD506C	34 43 12	116 39 20	.5	.50	20	>2.0	700	N	N	N	50
RD507C	34 43 18	116 39 28	.3	.30	15	>2.0	700	N	N	N	30
RD508C	34 45 37	116 38 17	.2	.20	7	>2.0	500	N	N	N	20
RD510C	34 41 7	116 38 51	.7	.50	15	>2.0	1,000	N	N	N	30
RD511C	34 40 55	116 39 8	.2	.30	30	>2.0	700	N	N	N	30
RD512C	34 40 33	116 34 50	.3	.70	20	.5	700	N	N	N	30
RD513C	34 41 2	116 34 48	.7	1.00	30	2.0	700	N	N	N	70
RD514C	34 44 15	116 35 3	.2	.10	15	2.0	700	N	N	N	30
RD515C	34 42 27	116 39 0	.7	.50	20	>2.0	1,000	N	N	N	30
RD517C	34 43 31	116 33 50	.7	.30	30	>2.0	1,000	N	N	N	20
RD519C	34 42 37	116 33 31	.7	.50	20	>2.0	1,000	N	N	N	20

TABLE 3.--SPECTROGRAPHIC RESULTS FROM THE ANALYSIS OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE RODMAN MOUNTAINS WILDERNESS STUDY AREA, CALIFORNIA.--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
RD101C	>10,000	2	150	N	<10	20	150	300	N	<50	10
RD102C	2,000	2	N	N	N	20	N	300	N	N	N
RD103C	1,000	N	N	N	<10	30	70	700	N	N	20
RD104C	>10,000	<2	N	N	10	20	N	2,000	N	<50	N
RD105C	1,500	2	N	N	10	20	<10	500	N	50	N
RD106C	10,000	<2	N	N	N	20	N	200	N	N	N
RD107C	500	<2	N	N	10	30	10	1,500	N	150	N
RD108C	>10,000	<2	N	N	10	20	N	200	N	<50	10
RD109C	>10,000	3	N	N	N	20	N	100	N	N	N
RD111C	2,000	<2	N	N	N	20	N	500	N	100	N
RD112C	>10,000	2	700	N	N	50	N	500	N	50	10
RD200C	10,000	2	N	N	N	30	<10	700	N	70	N
RD201C	10,000	<2	N	N	10	20	N	1,000	N	N	10
RD202C	>10,000	N	N	N	10	N	N	300	N	N	15
RD203C	3,000	2	500	N	N	20	N	300	N	50	N
RD204C	>10,000	N	N	N	10	30	10	500	30	50	N
RD205C	5,000	3	N	N	N	20	10	100	N	N	N
RD206C	>10,000	<2	N	N	N	30	N	500	N	50	N
RD207C	700	<2	N	N	10	30	N	300	N	N	10
RD208C	1,000	3	N	N	N	20	10	1,500	N	70	N
RD209C	700	2	1,000	N	N	20	20	2,000	N	50	N
RD501C	>10,000	<2	N	N	N	<20	<10	700	N	<50	N
RD503C	5,000	<2	N	N	10	30	<10	500	N	50	10
RD505C	3,000	2	<20	N	N	30	150	300	<10	100	N
RD506C	10,000	<2	N	N	10	20	N	1,000	10	N	15
RD507C	>10,000	2	N	N	N	30	N	1,000	N	50	N
RD508C	2,000	3	N	N	N	30	10	300	N	<50	N
RD510C	>10,000	<2	N	N	N	50	N	700	N	150	N
RD511C	2,000	<2	N	N	N	50	<10	1,500	N	50	N
RD512C	>10,000	2	N	N	N	20	N	500	N	N	N
RD513C	1,500	2	N	N	N	50	200	700	N	<50	N
RD514C	>10,000	3	N	N	N	<20	<10	500	N	<50	N
RD515C	5,000	2	N	N	N	30	N	700	N	70	N
RD517C	1,500	2	N	N	N	30	N	500	N	50	N
RD519C	10,000	2	N	N	N	100	N	500	N	50	N

TABLE 3.--SPECTROGRAPHIC RESULTS FROM THE ANALYSIS OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE RODMAN MOUNTAINS WILDERNESS STUDY AREA, CALIFORNIA.--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
RD101C	5,000	N	N	500	100	1,000	500	N	>2,000	500
RD102C	100	N	N	500	100	N	500	N	>2,000	1,000
RD103C	50	N	N	300	300	200	1,000	N	>2,000	2,000
RD104C	N	N	N	200	150	N	700	N	>2,000	300
RD105C	100	N	N	500	150	<100	300	N	>2,000	1,000
RD106C	N	N	N	200	100	N	500	N	>2,000	200
RD107C	N	N	20	200	200	N	1,000	N	>2,000	<200
RD108C	N	N	N	200	150	1,000	1,000	N	>2,000	500
RD109C	N	N	N	700	100	N	200	N	>2,000	N
RD111C	100	N	N	N	300	200	700	N	>2,000	500
RD112C	300	N	N	700	200	700	300	N	>2,000	700
RD200C	N	N	N	700	200	100	200	N	>2,000	1,000
RD201C	N	N	N	200	150	N	700	N	>2,000	200
RD202C	N	N	N	N	200	N	1,000	N	>2,000	2,000
RD203C	30	N	N	200	200	500	300	N	>2,000	300
RD204C	N	N	N	N	100	5,000	500	N	>2,000	200
RD205C	20	N	N	200	70	<100	150	N	>2,000	N
RD206C	20	N	N	300	150	N	500	N	>2,000	700
RD207C	20	N	N	N	200	N	500	N	>2,000	300
RD208C	N	N	20	300	300	N	300	N	>2,000	500
RD209C	150	N	N	300	150	7,000	1,000	N	>2,000	500
RD501C	10,000	N	N	>10,000	70	2,000	700	N	>2,000	300
RD503C	200	N	30	300	300	N	500	N	>2,000	500
RD505C	7,000	N	100	200	200	<100	500	N	>2,000	200
RD506C	500	N	N	200	200	150	700	N	>2,000	1,000
RD507C	50	N	N	300	200	N	700	N	>2,000	500
RD508C	50	N	N	500	150	300	200	N	>2,000	1,000
RD510C	100	N	70	300	300	<100	500	N	>2,000	<200
RD511C	20	N	N	200	200	N	500	N	>2,000	<200
RD512C	20	N	N	500	50	N	300	N	>2,000	N
RD513C	150	N	N	300	150	N	500	N	>2,000	300
RD514C	N	N	N	500	150	N	300	N	>2,000	1,500
RD515C	20	N	30	200	200	N	700	N	>2,000	N
RD517C	20	N	20	200	150	150	500	N	>2,000	300
RD519C	200	N	50	300	200	N	700	N	>2,000	2,000