UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of heavy-mineral-concentrate samples from the Roberts Wilderness Study Area (NV-060-541), Eureka County, Nevada

By

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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 geochemical survey of the Roberts Wilderness Study Area, Eureka County, Nevada.

INTRODUCTION

In May to August 1984, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Roberts Wilderness Study Area (NV-060-541), Eureka County, Nevada.

The Roberts Wilderness Study Area comprises 15,090 acres, about 24 mi^2 (61 km^2) near the center of Eureka County, Nevada.

The Roberts Mountains are about 30 miles NW of Eureka, Nevada, and 50 mi south of Carlin, Nevada (fig. 1). The wilderness study area can be reached at many places by unimproved dirt roads that branch from maintained county roads that run along the north edge of the Roberts Mountains or along Roberts Creek in the southern part of these mountains. There are no maintained roads within the wilderness study area although four-wheel-drive vehicle trails reach high elevations near Roberts Creek Mountain.

The rocks in the Roberts Mountains range in age from Cambrian to Holocene; most of the area is comprised of lower Paleozoic strata and some Tertiary volcanic rocks, primarily basalt dikes and lava flows.

The Paleozoic rocks are of two contrasting assemblages deposited in different marine environments. One assemblage, consisting mostly of carbonate rocks, was deposited on a broad continental shelf. Variation in these carbonate strata are related to the distribution of reefs, shallow-subtidal regions and deeper basins on the shelf. A complex, intertonguing relationship between coarse-grained algal and coral rich limestone-dolomite (ancient reef) and thin-bedded, finely laminated, lime mudstones with interbeds rich in reef debris (shelf basin deposits) clearly define the continental shelf with its great variety of subenvironments. The other assemblage consists of dark graptolite-bearing shale, bedded chert, thin clean sandstone beds, thin dark fine-grained limestones, a small amount of bedded barite, and some massive, lenticular volcanic breccias. These rocks were deposited in deep water, probably many miles beyond the edge of the continental shelf and beyond the continental slope. The two rock assemblages, representing two different environments that must have once been many miles apart, have been brought together in the Roberts Mountains on the Roberts Mountains thrust, which was active in central Nevada in Late Devonian/Mississippian time. A geologic map of the quadrangle was published by Murphy and others (1978) and a summary of the geology is in McKee (1986).

The terrain is rugged and the relief is as much as 3,700 ft. Elevation ranges from 10,133 feet above sea level at Roberts Creek Mountain to about 6,400 geet above sea level along the north edge of the mountains at the mouth of Birch Creek. The climate is semiarid and the vegetation is typical of the transition climatic life zone, which supports pinon pine, juniper and mountain mahogany. Along streams perennial vegetation includes willow, aspen, wild rose, and lush grasses and wildflowers.

METHODS OF STUDY

Sample Medium

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 32 sites (fig. 2). The average sampling density was about one sample site per 0.8 mi^2. The area of the drainage basins sampled ranged from 0.3 mi^2 to 1.5 mi^2.

Heavy-mineral-concentrate samples

Heavy-mineral-concentrate samples were collected from active alluvium primarily from first-order (unbranched) and second-order (below the junction of two first-order) streams as shown on USGS topographic maps (scale = 1:62,500). Each sample was composited from several localities within an area that may extend as much as 100 ft from the site plotted on the map. 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 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

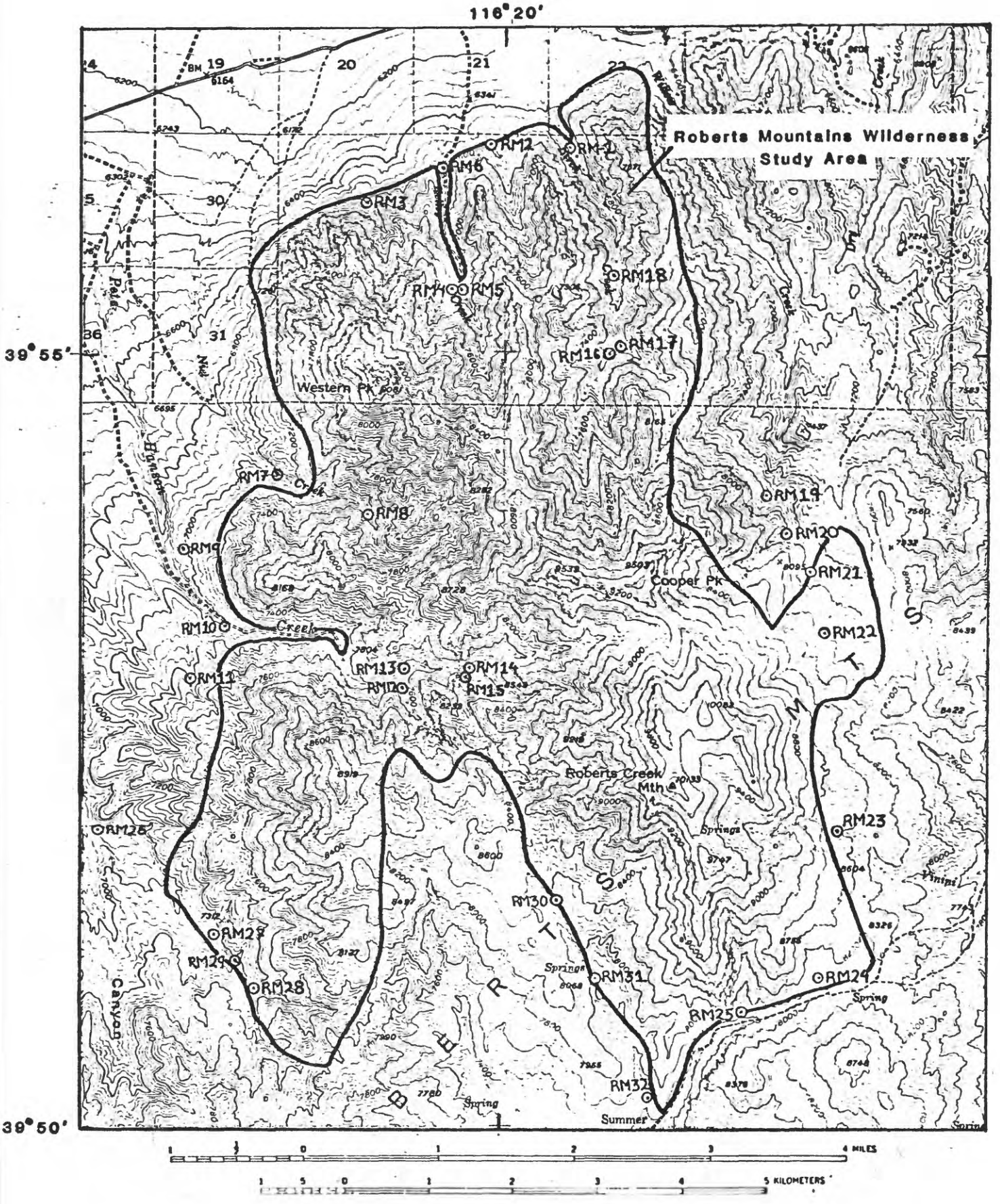

Figure 2. Localities of heavy-mineral-concentrate samples, Roberts Mountains Wilderness Study Area (NV-060-541), Eureka County, Nevada

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. 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 Roberts 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 results of the analyses of the heavy-mineral-concentrate samples. 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 map (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 the table, some of the elements listed in the 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.

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Murphy, M. A., McKee, E. H., Winterer, E. L., Matti, J. C., and Dunham, J. B., 1978, Preliminary geologic map of the Roberts Creek Mountain quadrangle, Nevada: U.S. Geological Survey Open-File Map 78-316, scale 1:31,250.

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

[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)	0.1	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
Scandium (Sc)	10	200
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.--Analyses of heavy-mineral-concentrate samples from the Roberts Study Area, Eureka County, Nevada
[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	Ba-ppm s	Be-ppm s
RM01	39 56 19	116 19 28	.10	2.00	5.0	.010	50	N	N	N	<20	>10,000	N
RM02	39 56 20	116 20 7	.10	.20	.7	.005	20	N	N	N	<20	>10,000	N
RM03	39 55 58	116 21 10	2.00	7.00	10.0	.200	300	N	N	N	20	7,000	N
RM04	39 55 24	116 20 27	1.50	2.00	10.0	.100	200	N	N	N	20	>10,000	N
RM05	39 55 24	116 20 22	1.00	2.00	5.0	.050	150	3	N	N	<20	>10,000	N
RM06	39 56 11	116 20 32	2.00	2.00	7.0	.100	200	N	N	N	20	>10,000	N
RM07	39 54 12	116 21 55	7.00	7.00	7.0	.500	1,000	N	N	N	<20	10,000	N
RM08	39 53 57	116 21 8	.20	5.00	5.0	.050	100	N	N	N	<20	>10,000	N
RM09	39 53 43	116 22 43	1.00	2.00	5.0	.200	200	N	N	N	<20	>10,000	N
RM10	39 53 14	116 22 21	2.00	2.00	5.0	.100	200	N	N	N	<20	>10,000	N
RM11	39 52 54	116 22 39	.30	.05	.1	.020	100	N	N	N	<20	>10,000	N
RM12	39 52 50	116 20 50	1.50	2.00	5.0	.100	200	N	N	N	<20	>10,000	N
RM13	39 52 56	116 20 50	.50	1.00	2.0	.020	100	N	N	N	<20	>10,000	N
RM14	39 52 58	116 20 18	.50	1.00	2.0	.020	100	N	N	N	<20	>10,000	N
RM15	39 52 54	116 20 19	.50	1.00	2.0	.020	150	N	N	N	<20	>10,000	N
RM16	39 54 59	116 19 8	.70	2.00	5.0	.050	150	N	N	N	<20	>10,000	N
RM17	39 55 2	116 18 59	.10	.20	1.0	.010	20	N	N	N	<20	>10,000	N
RM18	39 55 29	116 19 3	.15	5.00	5.0	.010	50	N	N	N	<20	>10,000	N
RM19	39 54 4	116 17 48	2.00	10.00	15.0	.200	300	N	N	N	<20	>10,000	N
RM20	39 53 49	116 17 38	.50	2.00	5.0	.070	70	N	N	N	<20	>10,000	N
RM21	39 53 34	116 17 23	.10	.05	1.0	.005	50	N	N	N	<20	>10,000	N
RM22	39 53 9	116 17 18	.10	2.00	5.0	.050	50	N	N	N	<20	>10,000	N
RM23	39 51 54	116 17 11	.10	<.05	.2	.010	20	N	N	N	<20	>10,000	N
RM24	39 50 57	116 17 20	.10	<.05	5.0	.100	50	N	N	N	<20	>10,000	N
RM25	39 50 44	116 17 59	.15	10.00	20.0	.010	150	N	N	N	<20	>10,000	N
RM26	39 51 55	116 23 25	.20	.05	7.0	.150	50	N	N	N	<20	>10,000	N
RM27	39 51 14	116 22 26	.10	<.05	.2	.015	<20	N	N	N	<20	>10,000	N
RM28	39 50 53	116 22 6	<.10	<.05	.5	.010	20	N	N	N	<20	>10,000	N
RM29	39 51 4	116 22 16	.10	.05	5.0	.020	70	N	N	N	<20	>10,000	N
RM30	39 51 28	116 19 33	<.10	5.00	5.0	.005	50	N	N	N	<20	>10,000	N
RM31	39 50 57	116 19 13	.20	5.00	10.0	.050	100	N	N	N	20	>10,000	N
RM32	39 50 11	116 18 46	.10	5.00	10.0	.010	100	N	N	N	<20	>10,000	N

TABLE 2.--Analyses of heavy-mineral-concentrate samples from the Roberts Study Area, Eureka County, Nevada--Continued

Sample	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	Pb-ppm s	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s
RM01	N	N	N	N	<10	<50	N	N	N	500	N	N	N	2,000
RM02	N	N	N	N	<10	<50	N	N	N	70	N	N	N	2,000
RM03	N	N	10	300	<10	<50	N	N	10	N	N	20	N	200
RM04	N	<50	10	200	<10	50	N	N	20	2,000	N	20	N	1,000
RM05	N	300	10	100	<10	<50	N	N	<10	10,000	N	10	<20	1,500
RM06	N	<50	10	200	<10	<50	N	N	<10	1,000	N	20	N	1,000
RM07	N	N	50	500	10	<50	N	N	30	100	N	70	N	200
RM08	N	N	N	50	<10	<50	N	N	N	70	N	<10	N	1,500
RM09	N	N	10	50	<10	<50	N	N	<10	50	N	<10	N	1,500
RM10	N	N	10	200	<10	<50	N	N	<10	200	N	20	N	1,500
RM11	N	N	N	N	<10	50	N	N	N	N	N	N	N	1,500
RM12	N	N	10	200	<10	<50	N	N	N	70	N	20	70	1,000
RM13	N	N	N	100	<10	<50	N	N	<10	<20	N	10	N	2,000
RM14	N	N	N	70	10	<50	N	N	<10	<20	N	10	N	2,000
RM15	N	N	N	150	<10	<50	N	N	<10	150	N	10	N	2,000
RM16	N	N	N	100	<10	<50	N	N	<10	20	1,000	10	N	2,000
RM17	N	N	N	N	15	<50	N	N	<10	N	N	N	N	3,000
RM18	N	N	N	50	<10	<50	N	N	<10	200	N	N	N	1,500
RM19	N	N	10	150	10	<50	N	N	10	20	N	15	N	500
RM20	N	N	N	20	<10	<50	N	N	<10	150	N	N	N	1,000
RM21	N	N	N	N	<10	<50	N	N	<10	N	N	N	N	1,500
RM22	N	N	N	N	<10	<50	10	N	N	N	N	20	N	1,500
RM23	N	N	N	N	<10	<50	N	N	N	N	N	30	N	1,500
RM24	N	N	N	N	<10	50	N	N	N	N	N	30	N	2,000
RM25	N	N	N	N	<10	<50	N	N	N	200	N	<10	N	700
RM26	N	N	N	N	10	50	N	N	N	150	N	<10	N	2,000
RM27	N	N	N	N	<10	<50	N	N	N	N	N	N	N	1,000
RM28	N	N	N	N	<10	<50	N	N	N	N	N	N	N	10,000
RM29	N	N	N	N	10	50	N	N	N	N	N	N	N	2,000
RM30	N	N	N	N	<10	<50	N	N	N	N	N	N	N	1,000
RM31	N	N	N	N	<10	<50	N	N	N	50	700	15	N	1,000
RM32	N	N	N	N	<10	<50	N	N	N	70	N	N	N	1,000

TABLE 2.--Analyses of heavy-mineral-concentrate samples from the Roberts Study Area, Eureka County, Nevada--Continued

Sample	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s
RM01	20	N	<20	N	200	N
RM02	<20	N	<20	N	50	N
RM03	100	N	30	N	200	N
RM04	100	N	70	1,500	2,000	N
RM05	50	N	<20	20,000	70	N
RM06	100	N	50	1,500	2,000	N
RM07	200	N	30	N	2,000	N
RM08	20	N	<20	N	500	N
RM09	20	N	20	N	200	N
RM10	50	100	20	N	700	N
RM11	20	N	<20	N	N	N
RM12	50	N	30	N	2,000	N
RM13	20	N	<20	N	70	N
RM14	20	N	N	N	<20	N
RM15	20	N	N	N	<20	N
RM16	20	N	N	N	<20	N
RM17	<20	N	<20	N	150	N
RM18	<20	N	N	N	70	N
RM19	100	N	20	N	500	N
RM20	N	N	<20	N	200	N
RM21	N	N	<20	N	20	N
RM22	N	N	100	N	>2,000	N
RM23	N	N	150	N	>2,000	N
RM24	N	N	150	N	>2,000	N
RM25	N	N	30	1,000	2,000	N
RM26	20	N	150	N	2,000	N
RM27	N	N	<20	N	50	N
RM28	N	N	<20	N	1,000	N
RM29	20	N	100	N	1,500	N
RM30	N	N	<20	N	200	N
RM31	N	N	100	<500	>2,000	N
RM32	N	N	20	N	700	N