UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of heavy-mineral-concentrate and rock samples from the Mount Limbo Wilderness Study Area (NV-020-201), Pershing County, Nevada

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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 Mount Limbo Wilderness Study Area, Pershing County, Nevada.

INTRODUCTION

In May 1984, the U.S. Geological Survey conducted a follow-up geochemical sampling of the Mount Limbo Study Area (NV-020-201), Pershing County, Nevada, because a regional reconnaissance geochemical sampling study contracted to Barringer Resources in 1981 found anomalous concentrations of some metallic elements in samples from the study area (Barringer Resources, Inc., 1982).

The Mount Limbo Wilderness Study Area comprises 23,702 acres, about 37 mi^2 (96 km^2) along the west-central edge of Pershing County, of which the U.S. Geological Survey was asked to study 12,900 acres, about 20 mi^2 (52 Km^2). To study the 12,900 acres, samples were collected by the U.S. Geological Survey in an area of about 5,600 acres where anomalous concentrations of metallic elements were found in the Barringer Resources sampling study (Barringer Resources, Inc., 1982). Throughout this report "Wilderness Study Area" and "study area" refer only to the 12,900-acre area studied by the U.S. Geological Survey. The Mount Limbo Wilderness Study Area is about 17 mi (27 km) south of Gerlach, Nevada (see fig. 1). The study area can be reached by Nevada State Highway 34 which is 1 to 1 1/2 mi west of the area. Dirt roads that connect with Highway 34 border the southeast and southwest sides of the study area. The study area consists of granodiorite which is Cretaceous in age. The topographic relief in the study area is about 3,800 ft (1,158 m). The ground surface rises steeply from 4,400 ft (1,341 m) to over 8,200 ft (2,499 m). The streams are intermittent and have steep gradients. There are conifers at the higher elevations, whereas the lower elevations are sparsely covered with sagebrush, but, in general, the study area is nearly bare of vegetation. The climate is arid to semiarid.

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.

Analyses of unaltered or unmineralized rock samples provide background geochemical data for individual rock units. On the other hand, analyses of altered or mineralized rocks, where present, may provide useful geochemical information about the major- and trace-element assemblages associated with a mineralizing system.

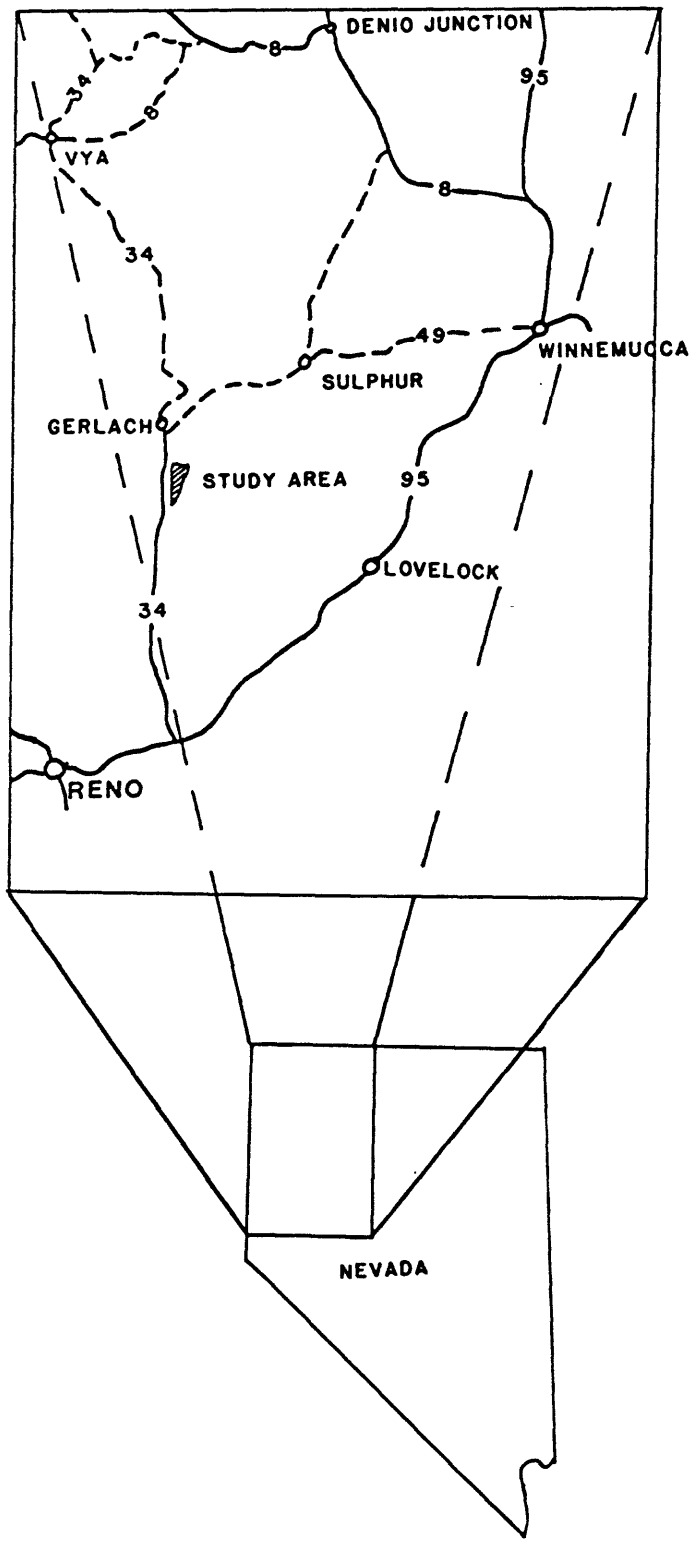

Figure 1. Location of Mount Limbo Wilderness Study Area (NV-020-201), Pershing County, Nevada.

Sample Collection

Rock samples were collected at 39 sites and heavy-mineral concentrates were collected at 18 sites (plate 1). The rock samples were collected where suitable outcrop was available. The average sampling density is about one sample site per 0.5 mi^2 for the heavy-mineral concentrates, and about one sample site per 0.2 mi^2 for the rocks, based on the 9 mi^2 area sampled. 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 = 1:24,000). Each sample was composited from several localities within an area that may extend as much as 30 ft from the site plotted on the map. Each bulk sample was sieved 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.

Rock samples

Rock samples were collected from outcrops or exposures in the vicinity of the plotted site location. Samples were collected from unaltered, altered, and mineralized rocks (table 5).

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 spectrographic 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.

Rock samples were crushed and then pulverized to minus 0.15 mm with ceramic plates.

Sample Analysis

Spectrographic method

The heavy-mineral-concentrate samples were analyzed by the Branch of Exploration Geochemistry for 31 elements using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). The rock samples were analyzed by the Branch of Analytical Chemistry for 31

elements using a semiquantitative, direct-current arc emission spectrographic method (Myers and others, 1961). The elements analyzed and their lower limits of determination are listed in table 1. For arsenic (As), gold (Au), cadmium (Cd), and thorium (Th), the lower limit of determination by the two methods varies. The values in the parentheses are the limits of determination for the Myers and others method. Spectrographic results were obtained by visual comparison of spectra derived from the samples 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 for the rock samples 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 Mount Limbo Wilderness Study Area are listed in tables 3 and 4.

Chemical methods

Other methods of analysis used on samples from the Mount Limbo Wilderness Study Area are summarized in table 2 (Crock and others, 1983; O'Leary and Viets, 1986).

Analytical results for rock samples are listed in table 4.

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, 1977).

DESCRIPTION OF DATA TABLES

Tables 3 and 4 list the results of analyses for the heavy-mineral concentrate and rock, respectively. 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 (plate 1). Columns in which the element headings show the letter "s" below the element symbol are emission spectrographic analyses; "icp" indicates inductively coupled plasma. A letter "N" in table 3 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. For table 4, the letter "N" is not used and a "less than" symbol (<) indicates that an element, observed or not observed, is below the detection limit in table 1. 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 3 and 4, 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.

The spectrographic determinations for Th in rock samples were all below the lower limits of determinations shown in table 1; consequently, the column for this element has been deleted from table 4. Descriptions of rock samples are listed in table 5.

REFERENCES CITED

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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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Myers, A. T., Havens, R. G., and Dunton, P. J., 1961, A spectrochemical method for the semiquantitative analyses of rocks, minerals, and ores: U.S. Geological Survey Bulletin 1084-I, p. 1207-1229.

O'Leary, R. M., and Viets, J. G., 1986, Determination of antimony, arsenic, bismuth, cadmium, copper, lead, molybdenum, silver, and zinc in geological materials by atomic absorption spectrometry using a hydrochloric acid-hydrogen peroxide digestion: Atomic Spectroscopy, 7, p. 4-8.

VanTrump, George, Jr., and Miesch, A. T., 1977, 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 rocks, based on a 10-mg sample

[The values shown are the lower limits of determination assigned by the Grimes and Marranzino method, except for those values in parentheses, which are the lower values assigned by the Myers and others method. The spectrographic limits of determination for heavy-mineral-concentrate samples (Grimes and Marranzino) are based on a 5-mg sample, and are therefore two reporting intervals higher than the limits given for rocks and stream sediments. Analysts: Nancy M. Conklin (rocks); Gordon W. Day (heavy-mineral concentrates)]

Elements	Lower determination limit		Upper determination limit
	Percent		
Iron (Fe)	0.05		20
Magnesium (Mg)	.02		10
Calcium (Ca)	.05		20
Titanium (Ti)	.002		1
	Parts per million		
Manganese (Mn)	10		5,000
Silver (Ag)	0.5		5,000
Arsenic (As)	200	(700)	10,000
Gold (Au)	10	(15)	500
Boron (B)	10		2,000
Barium (Ba)	20		5,000
Beryllium (Be)	1		1,000
Bismuth (Bi)	10		1,000
Cadmium (Cd)	20	(30)	500
Cobalt (Co)	5		2,000
Chromium (Cr)	10		5,000
Copper (Cu)	5		20,000
Lanthanum (La)	20	(30)	1,000
Molybdenum (Mo)	5		2,000
Niobium (Nb)	20		2,000
Nickel (Ni)	5		5,000
Lead (Pb)	10		20,000
Antimony (Sb)	100		10,000
Scandium (Sc)	5		100
Tin (Sn)	10		1,000
Strontium (Sr)	100		5,000
Vanadium (V)	10		10,000
Tungsten (W)	50		10,000
Yttrium (Y)	10		2,000
Zinc (Zn)	200		10,000
Zirconium (Zr)	10		1,000
Thorium (Th)	100	(200)	2,000

TABLE 2.--Commonly used chemical methods

[ICP = inductively coupled plasma]

Element or constituent determined	Sample Type	Method	Determination limit (micrograms/ gram or ppm)	Analyst	Reference
Arsenic (As)	Rock	ICP	5	Paul H. Briggs	Crock and others, 1983, and modification of O'Leary and Viets, 1986.
Bismuth (Bi)	Rock	ICP	2		
Cadmium (Cd)	Rock	ICP	0.1		
Antimony (Sb)	Rock	ICP	2		
Zinc (Zn)	Rock	ICP	2		

TABLE 3. ANALYSES OF THE NONMAGNETIC FRACTION OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM MOUNT LIMBO WILDERNESS STUDY AREA, PERSHING 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
ML001	40 18 51	119 16 21	.20	.05	10	.5	200	N	N	N	<20	700
ML002	40 18 23	119 16 53	.30	.10	10	.5	200	N	N	N	20	500
ML005	40 18 29	119 17 28	.10	.05	5	.1	100	N	N	N	<20	200
ML006	40 18 44	119 17 18	.20	.10	7	.2	150	N	N	N	20	500
ML017	40 19 42	119 17 32	.20	.05	10	.5	150	N	N	N	20	500
ML020	40 19 27	119 17 39	.20	.10	7	.2	150	N	N	N	20	300
ML031	40 20 52	119 18 20	.10	<.05	10	.2	150	N	N	N	20	N
ML032	40 20 26	119 18 15	.15	.05	10	.3	150	N	N	N	20	500
ML033	40 20 18	119 18 5	.15	.05	10	.2	150	N	N	N	20	200
ML034	40 20 9	119 18 3	.15	.05	5	.3	100	N	N	N	20	700
ML062	40 19 44	119 17 32	.20	.05	7	.3	150	N	N	N	20	700
ML064	40 19 33	119 17 24	.20	.05	5	.5	200	N	N	N	20	N
ML065	40 19 35	119 17 23	.20	.05	5	.5	200	N	N	N	20	N
ML066	40 19 18	119 17 57	.20	.05	5	.2	100	N	N	N	30	N
ML079	40 19 2	119 17 21	.20	.10	7	.5	100	N	N	N	20	N
ML080	40 18 45	119 17 21	.30	.10	5	.2	150	N	N	N	20	300
ML082	40 19 4	119 17 47	.20	.05	7	.2	150	N	N	N	20	N
ML077	40 18 38	119 16 31	.30	.05	7	.5	150	N	N	N	<20	200

TABLE 3.--Continued

Sample	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	Pb-ppm s
ML001	N	N	N	N	50	<10	70	N	N	N	N
ML002	N	N	N	N	50	<10	70	N	N	N	N
ML005	N	N	N	N	100	<10	50	N	N	N	150
ML006	N	N	N	N	70	<10	50	N	N	N	50
ML017	N	N	N	N	20	<10	70	N	N	N	N
ML020	N	N	N	N	70	<10	50	N	N	N	N
ML031	N	N	N	N	150	<10	100	N	N	N	N
ML032	N	N	N	N	20	<10	70	N	N	N	N
ML033	N	N	N	N	70	<10	100	N	N	N	N
ML034	N	N	N	N	20	<10	50	N	N	N	N
ML062	N	N	N	N	N	<10	50	N	N	N	N
ML064	N	N	N	N	N	15	50	N	N	N	N
ML065	N	N	N	N	N	<10	50	N	N	N	N
ML066	N	N	N	N	N	<10	50	N	N	N	N
ML079	N	N	N	N	N	<10	50	N	N	N	500
ML080	N	N	N	N	N	<10	<50	N	N	N	N
ML082	N	N	N	N	N	<10	50	N	N	N	<20
ML077	N	N	N	N	N	10	50	N	N	N	<20

TABLE 3.--Continued

Sample	Sb-ppm s	Sc-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
ML001	N	10	N	300	20	N	100	N	>2,000	200
ML002	N	10	N	300	20	N	150	N	>2,000	N
ML005	N	50	N	N	20	N	200	N	>2,000	N
ML006	N	10	N	300	20	N	100	N	>2,000	<200
ML017	N	10	N	500	20	N	100	N	>2,000	500
ML020	N	20	N	200	20	N	150	N	>2,000	<200
ML031	N	30	N	N	<20	N	200	N	>2,000	300
ML032	N	10	N	500	20	N	100	N	>2,000	200
ML033	N	10	N	300	<20	N	200	N	>2,000	500
ML034	N	10	N	500	20	N	100	N	>2,000	700
ML062	N	20	N	500	20	N	70	N	>2,000	200
ML064	N	10	N	300	20	N	100	N	>2,000	<200
ML065	N	15	N	300	20	N	70	N	2,000	N
ML066	N	10	N	300	<20	N	150	N	>2,000	N
ML079	N	10	N	300	<20	N	150	N	>2,000	N
ML080	N	20	N	500	<20	N	70	N	>2,000	N
ML082	N	10	N	300	<20	N	200	N	>2,000	200
ML077	N	20	N	300	<20	N	150	N	>2,000	N

TABLE 4. ANALYSES OF THE ROCK SAMPLES FROM MOUNT LIMBO WILDERNESS STUDY AREA, PERSHING 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
LK8404	40 20 23	119 17 13	3.00	2.00	3.00	.300	500	<.5	<700	<15	10	1,000
LK8408	40 21 5	119 16 12	1.50	.20	1.50	.200	500	<.5	<700	<15	<10	3,000
LK8411	40 21 10	119 17 45	.30	.10	.50	.030	50	<.5	<700	<15	20	3,000
LK8415	40 21 8	119 18 6	.50	.20	.15	.030	30	<.5	<700	<15	1,500	150
LK8416	40 22 16	119 18 0	5.00	1.50	3.00	.300	700	<.5	<700	<15	<10	1,500
LK8419	40 22 25	119 16 36	5.00	2.00	3.00	.300	700	<.5	<700	<15	10	1,500
LK8425	40 23 7	119 16 15	5.00	2.00	3.00	.300	700	<.5	<700	<15	10	1,500
LK8427	40 23 35	119 16 58	5.00	3.00	3.00	.300	700	<.5	<700	<15	<10	1,000
LK8432	40 24 40	119 16 58	7.00	7.00	5.00	.500	700	<.5	<700	<15	10	700
LK8441	40 23 5	119 15 15	.70	.10	1.00	.050	150	<.5	<700	<15	10	300
LK8442	40 23 5	119 15 15	7.00	7.00	5.00	.700	1,000	<.5	<700	<15	<10	500
LK8443	40 19 28	119 18 6	.05	.70	15.00	.003	20	<.5	<700	<15	<10	700
ML001R	40 18 51	119 16 21	3.00	3.00	3.00	.300	700	<.5	<700	<15	15	700
ML002R1	40 18 23	119 16 53	1.50	1.00	1.50	.150	300	<.5	<700	<15	30	3,000
ML002R2	40 18 23	119 16 53	.70	.70	>20.00	.030	3,000	<.5	<700	<15	10	150
ML003R	40 18 14	119 17 4	1.50	7.00	.30	.150	200	3.0	1,500	<15	>2,000	30
ML004R1	40 18 15	119 17 8	.30	.10	.70	.070	1,500	<.5	<700	<15	700	500
ML004R2	40 18 15	119 17 8	3.00	2.00	3.00	.300	700	<.5	<700	<15	20	1,000
ML005R1	40 18 29	119 17 27	5.00	3.00	3.00	.300	1,000	<.5	<700	<15	30	1,000
ML005R2	40 18 29	119 17 27	.20	1.50	>20.00	.015	70	<.5	<700	<15	<10	700
ML006R	40 18 44	119 17 18	3.00	2.00	3.00	.300	700	<.5	<700	<15	15	700
ML007R1	40 18 42	119 17 40	3.00	2.00	3.00	.300	700	<.5	<700	<15	30	1,000
ML007R2	40 18 42	119 17 40	.50	1.50	>20.00	.070	200	<.5	<700	<15	<10	1,000
ML016R	40 19 42	119 17 51	3.00	1.50	3.00	.300	500	<.5	<700	<15	30	1,500
ML017R1	40 19 42	119 17 18	3.00	3.00	3.00	.300	500	<.5	<700	<15	20	1,500
ML017R2	40 19 42	119 17 32	.70	.70	.70	.100	200	<.5	<700	<15	1,500	300
ML018R	40 19 38	119 17 46	1.50	1.50	3.00	.150	300	<.5	<700	<15	20	1,500
ML019R	40 19 32	119 17 30	7.00	3.00	3.00	.500	1,000	<.5	<700	<15	<10	700
ML020R	40 19 27	119 17 39	3.00	1.50	3.00	.300	300	<.5	<700	<15	30	1,500
ML021R	40 19 28	119 17 47	.15	.07	1.50	.003	15	<.5	<700	<15	<10	70
ML031R1	40 20 52	119 18 20	5.00	3.00	3.00	.300	700	<.5	<700	<15	30	700
ML031R2	40 19 28	119 17 47	3.00	2.00	3.00	.300	300	<.5	<700	<15	150	2,000
ML032R1	40 20 26	119 18 15	3.00	3.00	3.00	.300	700	<.5	<700	<15	15	1,500
ML032R2	40 20 26	119 18 15	5.00	3.00	3.00	.300	700	<.5	<700	<15	50	1,000
ML033R	40 20 18	119 18 5	3.00	2.00	3.00	.300	500	<.5	<700	<15	30	1,500
ML034R1	40 20 9	119 18 3	3.00	2.00	3.00	.300	700	<.5	<700	<15	20	1,500
ML034R2	40 20 9	119 18 3	.70	1.50	>20.00	.070	150	<.5	<700	<15	<10	500
ML035R	40 18 8	119 17 29	5.00	2.00	3.00	.300	700	<.5	<700	<15	<10	1,000
ML061R1	40 19 48	119 17 57	3.00	2.00	3.00	.300	700	<.5	<700	<15	30	1,500
ML061R2	40 19 48	119 17 57	.30	1.50	>20.00	.070	150	<.5	<700	<15	<10	700
ML061R3	40 19 48	119 17 57	.15	.03	.70	.015	10	<.5	<700	<15	<10	70
ML062R1	40 19 44	119 17 32	3.00	1.50	3.00	.300	500	<.5	<700	<15	30	700
ML062R2	40 19 42	119 17 32	3.00	2.00	3.00	.300	700	<.5	<700	<15	70	1,000
ML063R1	40 19 39	119 17 42	3.00	2.00	3.00	.300	700	<.5	<700	<15	<10	1,000
ML063R2	40 19 39	119 17 42	3.00	3.00	3.00	.300	700	<.5	<700	<15	15	700

TABLE 4.--Continued

Sample	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	Pb-ppm s	Sb-ppm s
LK8404	1.0	<10	<30	15	10	15	<30	<5	<20	7	10	<100
LK8408	1.5	<10	<30	<5	<10	<5	50	<5	<20	<5	20	<100
LK8411	<1.0	<10	<30	<5	<10	<5	<30	<5	<20	<5	30	<100
LK8415	<1.0	<10	<30	<5	<10	<5	<30	<5	<20	<5	<10	<100
LK8416	1.5	<10	<30	15	15	20	<30	<5	<20	7	10	<100
LK8419	1.0	<10	<30	15	15	20	<30	<5	<20	10	10	<100
LK8425	1.0	<10	<30	15	15	20	<30	<5	<20	10	10	<100
LK8427	1.0	<10	<30	15	50	150	<30	<5	<20	20	10	<100
LK8432	<1.0	<10	<30	30	150	70	<30	<5	<20	50	10	<100
LK8441	1.0	<10	<30	<5	<10	7	<30	<5	<20	<5	50	<100
LK8442	<1.0	<10	<30	50	70	30	<30	<5	<20	150	10	<100
LK8443	<1.0	<10	<30	<5	<10	5	<30	<5	<20	<5	<10	<100
ML001R	1.5	<10	<30	15	15	15	<30	<5	<20	10	15	<100
ML002R1	<1.0	<10	<30	7	<10	15	<30	<5	<20	<5	30	<100
ML002R2	<1.0	<10	<30	<5	<10	20	<30	<5	20	<5	10	<100
ML003R	<1.0	<10	50	<5	<10	20	<30	7	<20	<5	50	<100
ML004R1	7.0	<10	<30	<5	<10	<5	<30	<5	<20	<5	50	<100
ML004R2	1.0	<10	<30	10	15	7	50	<5	<20	10	15	<100
ML005R1	1.0	<10	<30	15	30	30	30	<5	<20	10	15	<100
ML005R2	<1.0	<10	<30	<5	<10	7	<30	<5	<20	<5	<10	<100
ML006R	1.5	<10	<30	15	10	15	<30	<5	<20	7	15	<100
ML007R1	1.5	<10	<30	15	15	30	<30	<5	<20	7	15	<100
ML007R2	<1.0	<10	<30	<5	10	10	<30	<5	<20	5	<10	<100
ML016R	1.5	<10	<30	7	15	20	<30	<5	<20	5	15	<100
ML017R1	1.5	<10	<30	15	15	15	<30	<5	<20	7	15	<100
ML017R2	1.0	<10	<30	<5	<10	15	<30	7	<20	<5	<10	<100
ML018R	<1.0	<10	<30	7	<10	15	<30	<5	<20	5	10	<100
ML019R	1.5	<10	<30	20	15	70	30	<5	<20	15	15	<100
ML020R	1.5	<10	<30	10	15	15	<30	<5	<20	7	15	<100
ML021R	<1.0	<10	<30	<5	<10	10	<30	<5	<20	<5	<10	<100
ML031R1	1.5	<10	<30	15	30	50	<30	<5	<20	15	10	<100
ML031R2	1.5	<10	<30	7	30	15	50	<5	<20	20	10	<100
ML032R1	1.5	<10	<30	15	15	30	<30	<5	<20	7	15	<100
ML032R2	1.5	<10	<30	15	20	70	<30	<5	<20	15	15	<100
ML033R	1.0	<10	<30	10	15	30	<30	<5	<20	7	15	<100
ML034R1	1.5	<10	30	15	10	15	30	<5	<20	10	15	<100
ML034R2	<1.0	<10	<30	<5	10	15	<30	<5	<20	7	<10	<100
ML035R	1.5	<10	<30	15	<10	7	30	<5	<20	<5	15	<100
ML061R1	1.5	<10	<30	15	15	15	<30	<5	<20	7	15	<100
ML061R2	<1.0	<10	<30	<5	<10	7	<30	<5	<20	5	<10	<100
ML061R3	<1.0	<10	<30	<5	<10	7	<30	<5	<20	<5	<10	<100
ML062R1	1.5	<10	<30	15	15	10	30	<5	<20	7	15	<100
ML062R2	1.5	<10	<30	15	15	100	50	<5	<20	7	15	<100
ML063R1	<1.0	<10	<30	15	20	70	<30	<5	<20	15	10	<100
ML063R2	1.5	<10	<30	15	15	70	<30	<5	<20	7	15	<100

TABLE 4.--Continued

Sample	Sc-ppm s	Sn-ppm s	Sr-ppm s	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	AS ICP	BI ICP	CD ICP	SB ICP	ZN ICP
LK8404	15	<10	1,000	150	<50	<10	<200	30	<5	<2	.1	2	37
LK8408	<5	<10	700	10	<50	20	<200	200	<5	<2	<.1	<2	63
LK8411	<5	<10	700	10	<50	<10	<200	<10	<5	<2	<.1	<2	5
LK8415	<5	<10	<100	15	<50	<10	<200	<10	63	<2	<.1	<2	<2
LK8416	20	<10	2,000	200	<50	15	<200	50	<5	<2	.2	<2	43
LK8419	15	<10	1,500	200	<50	15	<200	20	<5	<2	.1	<2	49
LK8425	15	<10	1,500	150	<50	15	<200	70	<5	<2	.1	<2	49
LK8427	20	<10	1,500	200	<50	15	<200	20	<5	<2	.2	<2	46
LK8432	70	<10	700	500	<50	15	<200	30	<5	<2	.1	<2	28
LK8441	<5	<10	200	10	<50	<10	<200	30	<5	<2	<.1	<2	6
LK8442	100	<10	700	500	<50	10	<200	50	<5	<2	<.1	<2	25
LK8443	<5	<10	1,500	<10	<50	<10	<200	<10	10	<2	.1	4	<2
ML001R	15	<10	700	150	<50	30	<200	150	<5	9	<.1	3	37
ML002R1	7	<10	700	70	<50	<10	<200	50	6	3	<.1	3	23
ML002R2	15	<10	1,000	30	<50	30	<200	<10	71	<2	1.1	4	5
ML003R	7	15	500	100	<50	<10	<200	150	2,160	<2	20.7	25	20
ML004R1	<5	<10	150	<10	<50	10	<200	15	31	<2	<.1	4	<2
ML004R2	15	<10	700	150	<50	15	<200	70	18	<2	<.1	7	37
ML005R1	30	<10	700	150	<50	30	<200	150	8	<2	.1	4	33
ML005R2	<5	<10	3,000	15	<50	15	<200	30	6	<2	.2	<2	2
ML006R	15	<10	1,000	150	<50	15	<200	30	<5	<2	<.1	3	32
ML007R1	15	<10	1,000	150	<50	15	<200	70	<5	<2	<.1	4	36
ML007R2	<10	<10	3,000	30	<50	15	<200	70	<5	<2	<.1	<2	9
ML016R	15	<10	1,000	150	<50	30	<200	70	<5	<2	<.1	<2	21
ML017R1	20	<10	1,000	150	<50	30	<200	30	<5	<2	.2	2	29
ML017R2	5	<10	150	30	<50	<10	<200	15	16	<2	.4	2	20
ML018R	10	<10	700	70	<50	30	<200	70	9	<2	.1	2	18
ML019R	30	<10	700	150	<50	30	<200	150	12	<2	.3	4	82
ML020R	15	<10	700	150	<50	30	<200	150	<5	<2	<.1	2	28
ML021R	<5	<10	<100	<10	<50	<10	<200	<10	<5	<2	<.1	<2	<2
ML031R1	30	<10	700	150	<50	30	<200	150	<5	<2	.1	<2	36
ML031R2	15	<10	150	150	<50	50	<200	200	268	<2	<.1	3	3
ML032R1	20	<10	700	150	<50	20	<200	150	<5	<2	<.1	<2	35
ML032R2	30	<10	700	150	<50	30	<200	200	<5	<2	<.1	<2	38
ML033R	15	<10	700	150	<50	20	<200	150	<5	<2	<.1	<2	24
ML034R1	15	<10	700	150	<50	15	<200	150	<5	<2	<.1	<2	33
ML034R2	5	<10	3,000	30	<50	15	<200	20	6	<2	.2	2	68
ML035R	15	<10	1,500	150	<50	30	<200	150	<5	<2	<.1	<2	25
ML061R1	30	<10	700	150	<50	30	<200	150	7	<2	.2	<2	12
ML061R2	<10	<10	3,000	20	<50	15	<200	30	<5	<2	<.1	<2	<2
ML061R3	<5	<10	<100	<10	<50	<10	<200	<10	<5	<2	.1	<2	23
ML062R1	15	<10	700	150	<50	30	<200	150	8	<2	.3	2	6
ML062R2	15	<10	700	150	<50	30	<200	30	19	<2	<.1	<2	29
ML063R1	15	<10	1,500	150	<50	15	<200	150	<5	<2	<.1	<2	29
ML063R2	15	<10	1,000	150	<50	15	<200	30	10	<2	.2	2	39

TABLE 4.--Continued

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
ML063R3	40 19 39	119 17 42	3.00	3.00	1.00	.300	700	<.5	<700	<15	100	1,000
ML064R1	40 19 32	119 17 24	3.00	3.00	3.00	.300	700	<.5	<700	<15	15	1,500
ML064R2	40 19 32	119 17 24	3.00	2.00	3.00	.300	700	<.5	<700	<15	30	1,500
ML066R1	40 19 18	119 17 56	3.00	3.00	3.00	.300	700	<.5	<700	<15	30	2,000
ML066R2	40 19 18	119 17 56	.30	1.50	>20.00	.030	100	<.5	<700	<15	<10	500
ML066R3	40 19 18	119 17 56	.30	<.02	.15	.010	15	<.5	<700	<15	10	70
ML076R	40 18 38	119 16 21	3.00	2.00	3.00	.150	300	<.5	<700	<15	15	1,000
ML078R	40 18 17	119 17 12	5.00	7.00	.30	.150	150	3.0	7,000	<15	>2,000	<20
ML081R	40 18 45	119 17 22	3.00	2.00	3.00	.300	700	<.5	<700	<15	20	2,000
ML083R1	40 19 3	119 17 48	3.00	2.00	3.00	.300	300	<.5	<700	<15	30	1,500
ML083R2	40 19 3	119 17 48	.70	3.00	>20.00	.100	200	<.5	<700	<15	<10	700

TABLE 4.--Continued

Sample	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	Pb-ppm s	Sb-pp s
ML063R3	1.0	<10	<30	15	20	70	<30	<5	<20	15	<10	<10
ML064R1	1.5	<10	<30	15	15	15	<30	<5	<20	7	15	<10
ML064R2	1.5	<10	<30	15	10	15	50	<5	<20	7	15	<10
ML066R1	1.5	<10	<30	15	15	30	<30	<5	<20	10	15	<10
ML066R2	<1.0	<10	<30	<5	<10	10	<30	<5	<20	<5	<10	<10
ML066R3	<1.0	<10	<30	<5	<10	7	<30	<5	<20	<5	<10	<10
ML076R	1.5	<10	<30	15	10	15	70	<5	<20	7	15	<10
ML078R	1.5	<10	<30	<5	<10	7	<30	20	<20	<5	15	70
ML081R	1.5	<10	<30	10	<10	15	50	<5	<20	7	15	<10
ML083R1	1.5	<10	<30	7	15	20	<30	<5	<20	7	15	<10
ML083R2	<1.0	<10	<30	<5	15	15	<30	<5	<20	5	<10	<10

TABLE 4.--Continued

Sample	Sc-ppm s	Sn-ppm s	Sr-ppm s	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	AS ICP	BI ICP	CD ICP	SB ICP	ZN ICP
ML063R3	15	<10	700	200	<50	15	<200	150	164	<2	.2	3	25
ML064R1	20	<10	1,000	150	<50	20	<200	150	<5	<2	.4	<2	30
ML064R2	15	<10	1,000	150	<50	15	<200	150	5	<2	<.1	<2	24
ML066R1	20	<10	700	150	<50	30	<200	150	<5	<2	<.1	<2	18
ML066R2	<5	<10	1,500	15	<50	<10	<200	30	7	<2	.4	2	6
ML066R3	<5	<10	<100	<10	<50	<10	<200	<10	32	<2	<.1	<2	2
ML076R	15	<10	700	150	<50	20	<200	150	<5	<2	<.1	<2	25
ML078P	7	10	1,500	150	<50	<10	<200	<10	9,310	<2	.5	417	10
ML081R	15	<10	1,000	150	<50	15	<200	100	33	<2	<.1	37	23
ML083R1	15	<10	700	150	<50	20	<200	300	<5	<2	<.1	18	26
ML083R2	7	<10	3,000	15	<50	10	<200	30	9	<2	.3	9	15

TABLE 5.--Description of rocks from Mount Limbo Wilderness Study Area, Pershing County, Nevada

Sample number	Description
LK8404	granodiorite
LK8408	andesite/basalt dike
LK8411	pegmatite dike
LK8415	quartz vein
LK8416	granodiorite
LK8419	granodiorite
LK8425	granodiorite
LK8427	granodiorite
LK8432	granodiorite
LK8441	pegmatite dike
LK8442	mafic dike
LK8443	tufa
ML001R	granodiorite
ML002R1	granodiorite
ML002R2	calcite veinlet
ML003R	quartzite
ML004R1	granodiorite
ML004R2	granodiorite
ML005R1	granodiorite
ML005R2	tufa
ML006R	granodiorite
ML007R1	granodiorite
ML007R2	tufa
ML016R	granodiorite
ML017R1	granodiorite
ML017R2	granodiorite
ML018R	gangue material
ML019R	siliceous rock
ML020R	granodiorite
ML021R	granodiorite
ML031R1	granodiorite
ML031R2	gneiss
ML032R1	granodiorite
ML032R2	granodiorite
ML033R	granodiorite
ML034R1	granodiorite
ML034R2	tufa
ML035R	black shale
ML061R1	granodiorite
ML061R2	tufa
ML061R3	quartz
ML062R1	granodiorite
ML062R2	granodiorite
ML063R1	amphibolite dike
ML063R2	granodiorite
ML063R3	gangue material
ML064R1	granodiorite
ML064R2	granodiorite
ML066R1	granodiorite
ML066R2	tufa
ML066R3	pegmatite
ML076R	granodiorite
ML078R	mine dump
ML081R	granodiorite
ML083R1	granodiorite
ML083R2	tufa