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Analytical results and sample locality map of rock samples from the Lime Canyon Wilderness Study Area (NV-050-231), Clark 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 resource potential. 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 rock samples from the Lime Canyon Wilderness Study Area (WSA), Clark County, Nevada. Results of stream-sediment and panned-concentrate samples were released by McHugh and others (1989).

INTRODUCTION

In April 1987, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Lime Canyon Wilderness Study Area (NV-050-231) in Clark County, Nevada. The Lime Canyon WSA is 2 mi east of the Overton Arm of Lake Mead and 45 mi east of Las Vegas, Nevada (fig. 1).

The Lime Canyon WSA covers approximately 34,680 acres (54 square miles) in the desert highlands northeast of Lake Mead. The terrain of the study area is rugged; it rises from about 1,800 ft along the west side to sharp ridges above 3,000 ft in the northern part and above 4,000 ft in the southern part. The ridges are cut by a few steep rocky canyons and are separated by broad valleys. The deepest and most spectacular canyon is Lime Canyon, which is 1,200 ft deep at its east end (Evans and others, 1990). Vegetation in the WSA is predominantly desert shrubs, creosote, cacti, yucca, and Joshua trees.

Longwell and others (1965) described the geology of Clark County. More recently, geology of the Las Vegas 1° x 2° quadrangle (Bohannon, 1978) and the state of Nevada (Stewart and Carlson, 1978) were compiled; both compilations include the study area. A major fault south of the WSA is the northeast striking Gold Butte fault. Bohannon (1979) presents evidence that the Gold Butte fault is a left-lateral strike-slip fault with an offset of about 6 mi.

Precambrian metamorphic rocks underlie relatively small parts of the WSA, but are more extensively exposed south of the study area. The major north-south-trending ridges are composed mostly of Paleozoic carbonate rocks. Paleozoic or Mesozoic sandstones and shale also underlie extensive parts of the WSA. Tertiary volcanic rocks are present and Quaternary gravels, interbedded with Tertiary volcanic rocks, blanket the outwash plains.

Mineral deposits of Clark County were described by Longwell and others (1965). The southern part of the Lime Canyon WSA is within the Gold Butte mining district. Mineral deposits and mining activity within and near the WSA are described by Winters (1988); occurences within 2 mi include minor concentrations of gold, silver, copper, lead, and zinc in bedrock and dumps, minor placer gold, patented gypsum claims, and numerous uranium exploration trenches.

METHODS OF STUDY

Sample Media

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

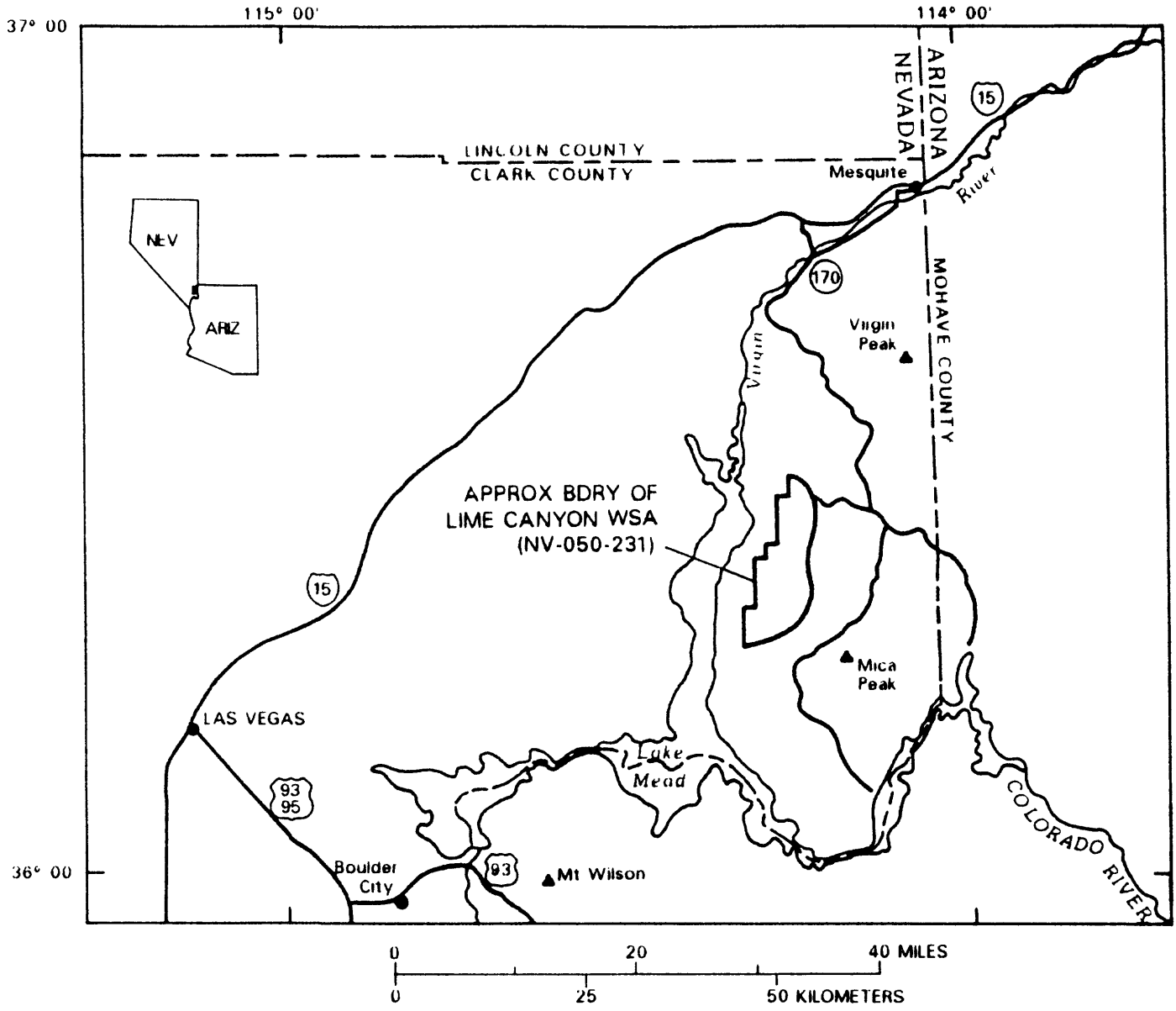

Figure 1. Location of the Lime Canyon Wilderness Study Area, Clark County, Nevada.

Sample Collection and Preparation

Samples were collected from forty sites (plate 1). These rocks were collected from outcrops and prospects. Descriptions of the rock samples are in table 4. The samples were crushed and then pulverized to approximately minus-100 mesh (minus-0.15 mm) with ceramic plates. All samples were collected by James G. Evans.

Sample Analysis

Spectrographic Method

Rock samples were analyzed for 35 elements using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). The elements analyzed and their 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, phosphorus, sodium, and titanium) are given in weight percent; all others are given in parts per million (micrograms/gram). Analytical data for the rock samples are listed in table 3.

All spectrographic analyses were performed by John H. Bullock Jr.

Chemical Methods

The rock samples from the study area were also analyzed for gold (Au) by flame atomic absorption emission spectroscopy (FAA), for mercury (Hg) by cold vapor atomic absorption emission spectroscopy (CVAA), and for uranium (U) by ultraviolet fluorimetry (UF). Uranium analyses were performed by Theodore A. Roemer, mercury analyses were performed by Eric P. Welsch, and gold analyses were performed by Phil L. Hageman. Limits of determination and references are listed in table 2.

Analytical results using these methods are listed in table 3.

DATA STORAGE SYSTEM

Upon completion of the analytical work, the analytical results were entered into a U.S. Geological Survey computer data base called PLUTO. 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

Table 3 lists the results of analyses for rock samples from the Lime Canyon Wilderness Study Area. The data are arranged so that column 1 contains field numbers. These numbers correspond to the numbers shown on the site location map (plate 1). The letters beneath the element symbols in the column headings indicate the method of analysis. The letter "s" below the element symbol indicates emission spectrographic analyses, "faa" indicates flame atomic absorption analyses, "cvaa" indicates cold vapor atomic absorption analyses, and "uf" indicates ultraviolet fluorimetric 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. For emission spectrographic analyses, a "less than" symbol (<) entered in the tables in front of the lower limit of determination indicates that the element was observed but was below the lowest reporting value. If an element was observed but was above the highest reporting value, a "greater than" symbol (>) was entered in front of the upper limit of determination. Because of the formatting used in the computer program that produced table 3, some of the elements listed in these tables (Ca, Fe, Mg, Ti, Be, and U) may 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.

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TABLE 1.--Limits of determination for the spectrographic analysis of rocks, based on a 10-mg sample

Elements	Lower determination limit	Upper determination limit
	Weight percent	
Calcium (Ca)	0.05	20
Iron (Fe)	.05	20
Magnesium (Mg)	.02	10
Sodium (Na)	.2	5
Phosphorus (P)	.2	10
Titanium (Ti)	.002	1
	Parts per million	
Silver (Ag)	0.5	5,000
Arsenic (As)	200	10,000
Gold (Au)	10	500
Boron (B)	10	2,000
Barium (Ba)	20	5,000
Beryllium (Be)	1	1,000
Bismuth (Bi)	10	1,000
Cadmium (Cd)	20	500
Cobalt (Co)	10	2,000
Chromium (Cr)	10	5,000
Copper (Cu)	5	20,000
Gallium (Ga)	5	500
Germanium (Ge)	10	100
Lanthanum (La)	50	1,000
Manganese (Mn)	10	5,000
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
Thorium (Th)	100	2,000
Vanadium (V)	10	10,000
Tungsten (W)	20	10,000
Yttrium (Y)	10	2,000
Zinc (Zn)	200	10,000
Zirconium (Zr)	10	1,000

TABLE 2.--Chemical Methods
(FAA, flame atomic absorption; CVAA, cold vapor atomic absorption; UF, ultraviolet fluorimetry)

Element determined	Sample type	Method	LLD (ppm)	References
Gold (Au)	Rock	FAA	0.05	Thompson and others, 1968; O'Leary and Meier, 1986.
Mercury (Hg)	Rock	CVAA	0.02	Koirtyohann and Khalil, 1976.
Uranium (U)	Rock	UF	0.1	Centanni and others, 1956; O'Leary and Meier, 1986.

TABLE 3--RESULTS OF ANALYSES OF ROCK SAMPLES FROM THE LIME CANYON WILDERNESS STUDY AREA, CLARK COUNTY, NEVADA.
[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown.]

Sample	Latitude	Longitude	Ca-pct. s	Fe-pct. s	Mg-pct. s	Na-pct. s	P -pct. s	Ti-pct. s	Ag-ppm s	As-ppm s	Au-ppm s	B-ppm s
LC1D	36 26 41	114 14 6	.05	2.00	.05	.2	N	.070	.5	200	N	10
LC2B	36 26 47	114 14 13	2.00	.15	.20	<.2	N	.020	N	N	N	<10
LC6B	36 26 7	114 15 32	3.00	.20	5.00	<.2	N	.010	N	N	N	<10
LC7C	36 26 7	114 15 43	.10	5.00	.15	.5	N	.030	N	N	N	100
LC9	36 24 16	114 14 22	2.00	.20	.15	N	.5	<.002	N	N	N	N
LC13D	36 16 44	114 12 13	.15	1.00	.20	1.0	.2	.030	N	N	N	N
LC17	36 16 4	114 16 46	2.00	.20	7.00	N	N	.005	N	N	N	20
LC18	36 16 5	114 16 48	2.00	1.00	.70	N	N	.002	N	N	N	<10
LC19	36 15 59	114 16 29	5.00	.50	1.00	N	N	.050	<.5	N	N	10
LC23C	36 16 2	114 16 14	1.50	.20	.20	.7	.3	.100	N	N	N	50
LC24	36 16 23	114 17 1	3.00	.50	.30	N	N	.010	.5	N	N	15
LC25	36 16 26	114 17 0	.05	1.50	.07	1.5	.2	.050	N	N	N	<10
LC28	36 16 35	114 17 12	.20	1.50	.20	1.5	.2	.002	N	N	N	10
LC30B	36 16 36	114 17 8	.10	2.00	.03	1.5	.2	.002	N	N	N	<10
LC32	36 16 44	114 17 4	.10	2.00	<.02	1.5	.5	.002	N	N	N	10
LC34	36 16 47	114 16 50	.30	2.00	.02	1.5	<.2	.003	N	N	N	10
LC36	36 16 41	114 16 43	3.00	2.00	.30	1.0	.3	.100	N	N	N	30
LC37	36 16 35	114 16 59	.20	1.50	<.02	1.5	.2	.005	N	N	N	<10
LC38	36 16 50	114 12 15	.20	2.00	.20	1.5	.2	.100	N	N	N	<10
LC39B	36 18 25	114 13 55	.70	1.50	.10	1.5	.3	.070	N	N	N	20
LC41	36 18 38	114 14 8	.30	.30	.30	N	N	.050	N	N	N	20
LC44	36 19 29	114 14 26	.15	5.00	.50	1.5	N	.100	<.5	N	N	10
LC45B	36 18 50	114 14 50	.20	2.00	.10	1.0	N	.070	N	N	N	200
LC47	36 17 18	114 16 50	.10	.20	<.02	N	N	<.002	N	N	N	N
LC48C	36 17 8	114 16 43	.20	3.00	.10	1.5	N	.010	N	N	N	<10
LC49	36 17 8	114 16 43	.07	1.50	.05	.7	<.2	.030	N	N	N	N
LC51B	36 16 54	114 16 35	1.00	2.00	.50	1.0	.2	.070	N	N	N	20
LC52	36 16 52	114 16 31	1.50	2.00	.20	1.5	N	.070	N	N	N	10
LC53B	36 16 52	114 16 25	3.00	1.50	.20	.7	N	.020	N	N	N	<10
LC54	36 16 44	114 16 19	2.00	2.00	.30	.7	N	.030	N	N	N	<10
LC55B	36 16 41	114 16 9	2.00	1.50	.15	.7	N	.020	N	N	N	10
LC56B	36 16 38	114 16 9	1.00	3.00	.10	.5	N	.030	N	N	N	20
LC57B	36 16 35	114 16 5	1.50	5.00	.10	.7	N	.010	N	N	N	30
LC58B	36 16 38	114 16 3	1.50	3.00	.10	1.5	<.2	.020	N	N	N	20
LC59	36 16 41	114 16 0	2.00	3.00	.20	.5	N	.050	N	N	N	20
LC60	36 16 50	114 16 0	2.00	2.00	1.50	.3	N	.050	1.5	N	N	50
LC61	36 17 10	114 15 52	2.00	2.00	.20	.5	N	.030	N	N	N	30
LC62	36 17 8	114 16 1	1.00	7.00	.15	.3	N	.005	N	N	N	15
LC63	36 17 5	114 16 9	2.00	1.50	.20	1.0	N	.007	N	N	N	<10
LC68	36 25 43	114 16 22	.15	10.00	.20	N	N	.020	N	N	N	50

TABLE 3--RESULTS OF ANALYSES OF ROCK SAMPLES FROM THE LIME CANYON WILDERNESS STUDY AREA, CLARK COUNTY, NEVADA.--Continued

Sample	Ba-ppm s	Be-ppm s	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	Ga-ppm s	Ge-ppm s	La-ppm s	Mn-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s
LC1D	300	2.0	N	N	10	N	100	<5	N	N	100	5	N	N
LC2B	100	N	N	N	N	N	N	N	N	N	15	N	N	N
LC6B	500	N	N	N	N	N	5	N	N	N	20	<5	N	<5
LC7C	200	N	N	N	15	N	50	10	N	N	50	15	N	5
LC9	200	N	N	N	N	N	<5	N	N	N	20	N	N	N
LC13D	300	N	N	N	N	N	N	5	N	N	100	N	N	N
LC17	100	N	N	N	N	N	50	N	N	N	70	<5	N	N
LC18	300	N	N	N	<10	N	50	N	N	N	500	5	N	5
LC19	100	N	N	N	N	N	50	5	N	N	300	5	N	N
LC23C	700	3.0	N	N	10	N	10	20	N	<50	1,000	<5	N	<5
LC24	200	<1.0	N	N	N	N	50	N	N	N	700	7	N	5
LC25	700	1.0	N	N	<10	N	20	20	N	N	150	N	N	5
LC28	200	3.0	N	N	<10	N	20	30	N	N	500	N	N	15
LC30B	300	5.0	N	N	<10	N	70	30	N	N	200	N	N	10
LC32	300	7.0	N	N	N	N	<5	15	N	N	700	N	N	7
LC34	300	10.0	N	N	N	N	10	30	N	N	2,000	N	N	N
LC36	500	3.0	N	N	15	N	15	30	N	70	3,000	<5	N	10
LC37	100	2.0	N	N	N	N	5	20	N	N	300	N	N	N
LC38	500	7.0	N	N	N	N	<5	15	N	50	150	<5	N	N
LC39B	500	1.0	N	N	<10	N	7	20	N	N	300	<5	N	N
LC41	150	N	N	N	N	N	N	<5	N	N	15	N	N	N
LC44	500	1.5	N	N	N	20	50	30	N	<50	100	7	N	<5
LC45B	500	2.0	N	N	N	30	20	15	N	N	10	<5	N	10
LC47	50	<1.0	N	N	N	N	N	N	N	N	500	N	N	N
LC48C	300	3.0	N	N	N	N	15	30	N	N	700	5	N	10
LC49	300	3.0	N	N	N	N	<5	20	N	50	30	N	N	N
LC51B	500	1.0	N	N	<10	N	20	30	N	N	1,500	N	N	20
LC52	300	2.0	N	N	10	N	10	20	N	<50	1,000	N	N	10
LC53B	500	2.0	N	N	N	N	5	10	N	<50	1,500	N	N	N
LC54	200	5.0	N	N	<10	N	<5	10	N	<50	1,500	N	N	N
LC55B	700	2.0	N	N	<10	N	10	15	N	<50	1,000	N	N	N
LC56B	300	3.0	N	N	10	N	15	15	N	100	1,500	N	N	15
LC57B	700	7.0	N	N	15	N	10	20	N	70	3,000	N	N	30
LC58B	700	2.0	N	N	N	N	10	30	N	N	2,000	N	N	10
LC59	500	5.0	N	N	10	N	20	20	N	50	3,000	N	N	20
LC60	300	3.0	N	N	15	N	20	20	N	<50	1,500	N	N	10
LC61	200	1.0	N	N	<10	10	15	15	N	<50	2,000	N	N	<5
LC62	500	7.0	N	N	<10	N	N	20	N	50	5,000	N	N	10
LC63	500	3.0	N	N	N	N	5	10	N	N	1,000	<5	N	N
LC68	300	1.0	N	N	20	<10	30	20	N	N	50	15	N	150

TABLE 3--RESULTS OF ANALYSES OF ROCK SAMPLES FROM THE LIME CANYON WILDERNESS STUDY AREA, CLARK COUNTY, NEVADA.--Continued

Sample	Pb-ppm s	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s	Th-ppm s	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Au-ppm faa	Hg-ppm cvaa	U-ppm uf
LC1D	100	N	N	N	<100	N	50	N	10	N	150	N	.08	1.90
LC2B	N	N	N	N	1,000	N	10	N	N	N	10	N	N	.30
LC6B	30	N	N	N	100	N	<10	N	N	N	10	N	.02	2.90
LC7C	50	N	N	N	100	N	<10	N	<10	<200	50	N	.02	7.80
LC9	<10	N	N	N	<100	N	<10	N	N	N	15	N	N	4.70
LC13D	<10	N	N	N	<100	N	10	N	<10	N	50	N	N	1.00
LC17	10	N	N	N	N	N	<10	N	N	N	N	N	.02	.60
LC18	30	N	N	N	<100	N	<10	N	10	N	<10	N	.06	1.70
LC19	100	N	N	N	100	N	10	N	10	N	20	N	N	1.10
LC23C	20	N	7	N	200	N	15	N	30	<200	70	N	.02	1.90
LC24	300	N	N	N	100	N	10	N	<10	N	N	N	.04	2.10
LC25	100	N	N	N	100	N	20	N	N	N	30	N	N	.65
LC28	150	N	N	N	<100	N	15	N	N	500	N	N	.02	2.00
LC30B	200	N	N	N	<100	N	15	N	N	500	N	N	N	2.20
LC32	30	N	N	N	100	N	10	N	10	700	N	N	N	1.50
LC34	30	N	N	N	<100	N	30	N	<10	300	N	N	N	2.70
LC36	300	N	15	N	100	N	50	N	20	500	50	N	.14	1.00
LC37	50	N	N	N	N	N	10	N	N	500	N	N	N	1.90
LC38	15	N	5	N	N	N	50	N	50	N	100	N	N	.70
LC39B	20	N	<5	N	N	N	30	N	15	N	20	N	N	1.50
LC41	N	N	N	N	N	N	<10	N	N	N	50	N	N	.70
LC44	200	N	<5	N	100	N	70	N	<10	<200	70	N	N	2.00
LC45B	15	N	N	<10	200	N	20	N	N	N	30	N	N	1.70
LC47	N	N	N	N	N	N	<10	N	<10	N	N	N	N	1.00
LC48C	50	N	N	N	<100	N	15	N	<10	500	N	N	N	1.30
LC49	20	N	N	N	<100	N	<10	N	20	N	100	N	N	.70
LC51B	50	N	7	N	<100	N	20	N	10	200	10	N	.04	.60
LC52	20	N	5	N	<100	N	20	N	<10	N	30	N	N	1.00
LC53B	30	N	5	N	200	N	10	N	30	N	<10	N	N	1.70
LC54	10	N	5	N	100	N	10	N	15	<200	30	N	.04	.75
LC55B	30	N	5	N	100	N	20	N	50	N	10	N	.04	.40
LC56B	30	N	<5	N	<100	N	15	N	N	300	50	N	.08	.80
LC57B	30	N	N	N	200	N	20	N	10	500	70	N	.10	1.70
LC58B	50	N	<5	N	150	N	15	N	<10	200	15	N	.12	.90
LC59	1,000	N	10	N	200	N	30	N	30	200	20	N	.18	4.90
LC60	1,000	N	5	N	100	N	20	N	15	1,500	30	N	.08	9.10
LC61	15	N	5	N	<100	N	20	N	15	N	20	N	.08	1.40
LC62	20	N	N	N	100	N	30	N	10	700	15	N	.02	1.30
LC63	30	N	N	N	200	N	10	N	N	N	<10	N	N	.60
LC68	15	N	<5	N	500	N	10	N	N	300	10	N	N	26.00

Table 4.--Rock descriptions

Sample	Description
LC-1D	Iron oxide enriched sandstone
2B	Veins in shale-gypsum
6B	Fractured limestone cemented by red hematite
7C	Brown iron oxide veins in white siltstone
9	Limestone containing red and yellow altered zones and quartz veins
13D	Black veins in granite-possible mylonitic laminae D
17	Limestone stained red and yellow
18	Red and yellow recrystallized limestone, contains quartz veins and is partly silicified
19	Yellow altered limestone
23C	Biotite granite containing iron oxide veins in shear zones
24	Yellow altered limestone
25	Migmatite containing iron oxide veins (carbonate present)
28	Pegmatite containing yellow-brown iron-oxide veins (carbonate present)
30B	Brecciated granite cemented by iron oxide (carbonate present)
32	Brecciated pegmatite cemented by maroon and red iron oxide (carbonate present)

Table 4.--Rock descriptions continued

Sample	Description
34	Brecciated pegmatite cemented by maroon and black oxide (carbonate present)
36	Vein of quartz containing iron oxide (carbonate present)
37	Brecciated pegmatite cemented by maroon iron oxide (carbonate present)
38	Black veins in porphyritic granite (carbonate present)
39B	Brecciated granite stained by iron oxide (carbonate present)
41	Red fine-grained sandstone
44	Brecciated gneiss cemented by maroon iron oxide
LC-45B	Brown stained quartzite (carbonate present)
47	Quartz vein containing black veins
48C	Brecciated pegmatite cemented by iron oxide
49	Red quartzite
51B	Vein of maroon iron oxide (carbonate present)
52	Red, maroon, and yellow vein material (carbonate present)
53B	Brecciated granite cemented by red iron oxide (carbonate present)
54	Yellow-brown and maroon veins (carbonate present)

Table 4.--Rock descriptions continued

Sample	Description
55B	Brecciated biotite granodiorite cemented by red iron oxide (carbonate present)
56B	Brecciated granite cemented by maroon iron oxide (carbonate present)
57B	Brecciated granite cemented by iron oxide carbonate present)
58B	Brecciated granite cemented by iron oxide carbonate present)
59	Iron oxide veins in granite (carbonate present)
60	Red-brown and yellow veins (carbonate present)
61	Red-brown and yellow veins (carbonate present)
62	Maroon and yellow-brown veins (carbonate present)
63	Brecciated granite cemented by maroon iron oxide (carbonate present)
68	Black nodules in limestone