U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rock samples from the Upper Leslie Gulch (OR-003-074) and Slocum Creek (OR-003-075) Wilderness Study Areas, Malheur County, Oregon.

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STUDIES RELATED TO WILDERNESS

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 Upper Leslie Gulch (OR-003-074) and Slocum Creek (OR-003-075) Wilderness Study Areas, Malheur County, Oregon.

INTRODUCTION

In May 1987, the U.S. Geological Survey conducted reconnaissance geochemical surveys of the Upper Leslie Gulch (OR-003-074) and Slocum Creek (OR-003-075) Wilderness Study Areas, Malheur County, Oregon.

The contiguous Upper Leslie Gulch and Slocum Creek Wilderness Study Areas comprise about 4.6 mi^2 (12 km^2) and 11.9 mi^2 (30.9 km^2) in the east-central part of Malheur County, Oregon, and lie about 54 mi (87 km) southwest of Boise, Idaho, and about 25 mi (40 km) north of the town of Jordan Valley, Oregon (fig.1).

Access to the study area is provided on the north by the dirt and, in places, gravel road which follows Runaway Creek and Leslie Gulch and forms northern boundaries of both study areas. This road connects to the improved gravel road which parallels Succor Creek and joins U.S. Highway 95 about 21 mi (34 km) north of the town of Jordan Valley. Jeep trails provide access to the vicinity of the study areas from other directions.

Geology of the study areas has been described by Vander Meulen and others (1989) and is included in geologic maps of Bannock ridge and Rooster Comb quadrangles (Vander Meulen and others,1986a, 1986b). The study areas are located within the Mahogany Mountain caldera and are underlain by a thick sequence of middle Miocene age intracaldera ash-flow and air-fall tuffs. The southeastern part of the caldera collapse structure north of Mahogany Mountain is included in the study areas. The central and eastern parts of the study areas were uplifted, domed, and faulted by post-caldera resurgent activity.

Elevations in the study areas range from about 2,800 ft (853 m) near the junction of Slocum Creek and Leslie Gulch at the northwest end of the Slocum Creek Study Area, up to 5,535 ft (1,687 m) on Grassy Ridge at the eastern border of the Leslie Gulch Study Area, giving a topographic relief of about 2,735 ft (834 m). The study areas are characterized by north and northwest-trending ridges and intervening deeply eroded canyons. The climate is semiarid.

METHODS OF STUDY

Sample Media

Analyses of the stream-sediment samples represent the chemistry of the rock material eroded from the drainage basin upstream from each sample site. Such information is useful in identifying those basins which contain concentrations of elements that may be related to mineral deposits. Heavy-mineral-concentrate samples provide information about the chemistry of certain minerals in rock material

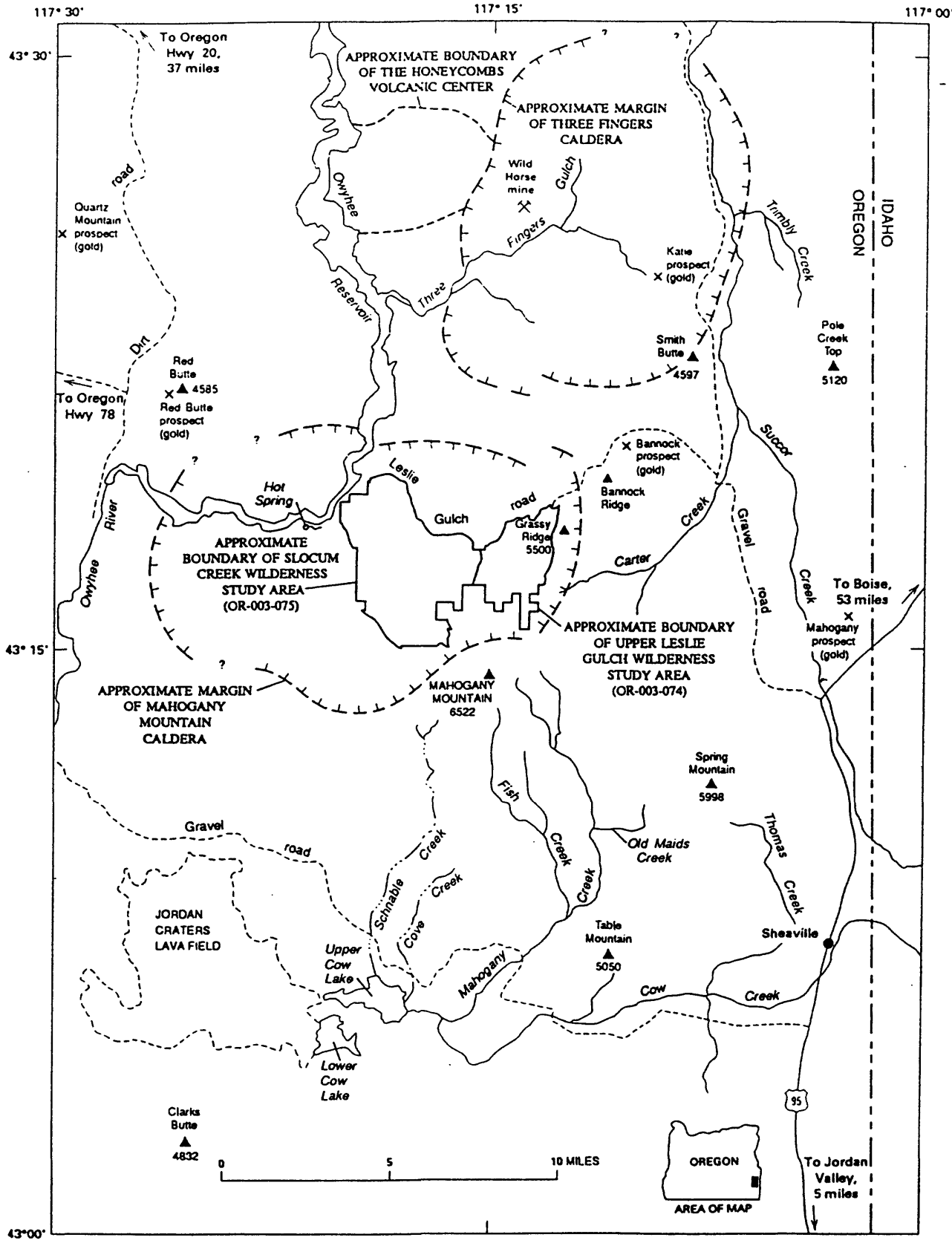

Figure 1. Index map showing location of Upper Leslie Gulch and Slocum Creek Wilderness Study Areas, Malheur County, Oregon. Caldera margins and nearby prospects also shown; inferred location of caldera margins shown by queries.

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.

Sample Collection

In the Upper Leslie Gulch WSA, stream-sediment samples were collected at 11 sites, panned-concentrate samples at 11 sites and one rock sample was collected (fig. 2).

In the Slocum Creek WSA, stream-sediment samples were collected at 19 sites, panned-concentrate samples at 18 sites, and rock samples collected at 14 sites (fig. 3).

Stream-sediment samples

The stream-sediment 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 a composite derived from several localities within an area that may extend as much as 50 ft from the center of the symbol plotted on the map.

Heavy-mineral-concentrate samples

Heavy-mineral-concentrate samples were collected from the same active alluvium as the stream-sediment samples. 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 was removed.

Rock samples

Rock samples were collected from various types of occurrences in the vicinity of the plotted site location. Descriptions of rock samples are in table 9.

Sample Preparation

The stream-sediment samples were air dried, then sieved using 80-mesh (0.17-mm) stainless steel sieves. The portion of the sediment passing through the sieve was saved for analysis. Samples that had been panned in the field were air dried and sieved to minus-35 mesh; bromoform (specific gravity 2.85) was used to remove the remaining quartz and feldspar. 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 (removed at a setting of 0.25 ampere), primarily magnetite, was not analyzed. The second fraction (removed at a setting of 1.75 ampere), largely ferromagnesian silicates and iron oxides, was saved for archival storage. The third fraction (the nonmagnetic 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

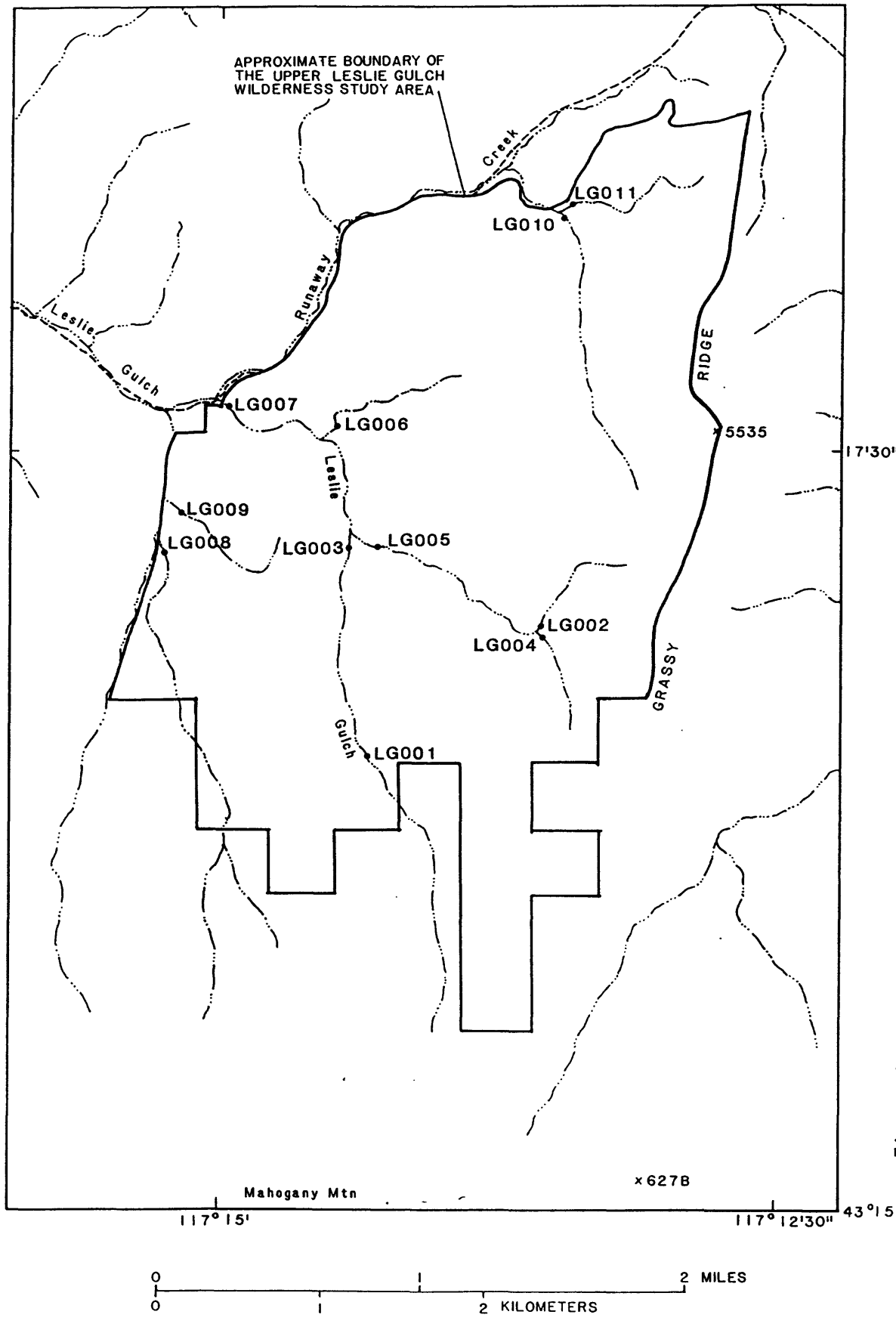

Figure 2--Localities of stream-sediment, heavy-mineral-concentrate, and rock samples from the Upper Leslie Gulch WSA, Malheur County, Oregon.

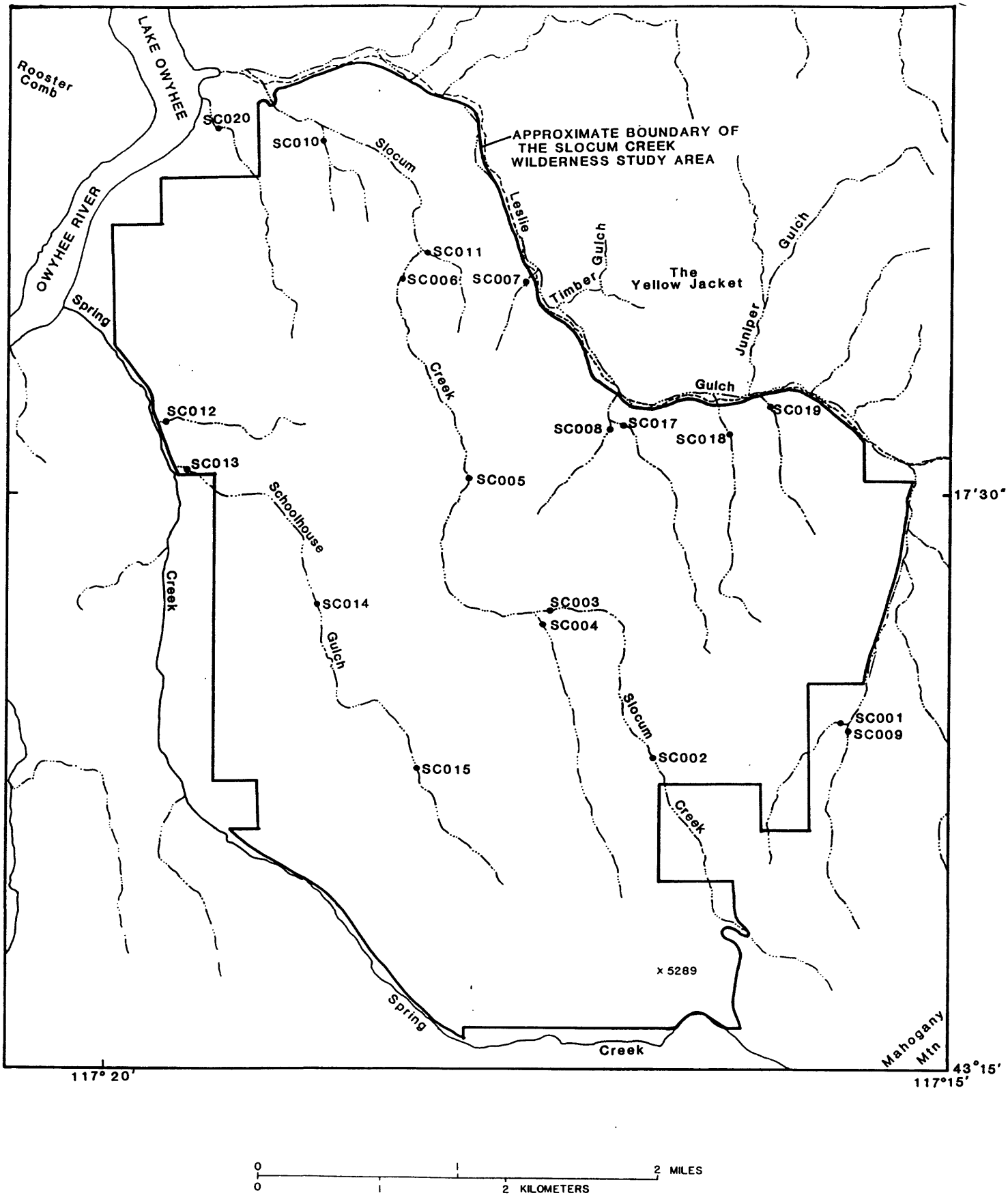

Figure 3--Localities of stream-sediment, heavy-mineral-concentrate, and rock samples from the Slocum Creek WSA, Malheur County, Oregon.

mineralogic analysis. (These magnetic separates are the same separates that would be produced using a Frantz Isodynamic Separator set at a slope of 15 degrees and a tilt of 10 degrees with a current of 0.2 ampere to remove the magnetite and ilmenite, and a current of 0.6 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 stream-sediment and rock samples were analyzed for 35 elements and the heavy-mineral-concentrate samples were analyzed for 37 elements using 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 Upper Leslie Gulch WSA are listed in tables 3, 4,and 5. Analytical data for Slocum Creek WSA are located in tables 6, 7, and 8.

Other methods

Samples from these study areas were also analyzed by other analytical methods. Rocks and stream sediments were analyzed by inductively coupled plasma emission spectroscopy (ICP), ultraviolet fluorimetry (UF), and atomic absorption spectroscopy (AA). Arsenic (As), bismuth (Bi), cadmium (Cd), antimony (Sb), and zinc (Zn) were analyzed by ICP, gold (Au) was analyzed by flame FAA, mercury (Hg) was analyzed by cold-vapor CVAA, and uranium (U) was analyzed by UF. Limits of determination and references are listed in table 2. Analytical results using these methods are listed in tables 3, 5, 6, and 8.

DATA STORAGE SYSTEM

Upon completion of all analytical work, the analytical results were entered into either the Branch of Geochemistry computer data base called PLUTO or the data base called RASS (Rock Analysis Storage System). These data bases contain 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 3-8 list the results of analyses for the stream-sediment, heavy-mineral-concentrate and rock samples respectively. For these 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 map (figs. 2 and 3). Columns in which the letter "s" appears next to the element symbol are emission spectrographic analyses; "faa" indicates flame atomic absorption analyses; "cvaa" indicates cold vapor atomic absorption analyses; "icp" indicates inductively coupled plasma-atomic emission spectroscopy; and "uf" indicates ultraviolet fluorimetry. 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 an element was observed but was below the lowest reporting value. For AA and ICP analyses, a "less than" symbol (<) entered in the tables in front of the lower limit of determination indicates that an element 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 the tables in front of the upper limit of determination. If an element was not looked for in a sample, two dashes (—) are entered in tables 3 in place of an analytical value. Because of the formatting used in the computer program that produced tables 3-8, 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.

ACKNOWLEDGMENTS

A number of our colleagues participated as field assistants, and in preparation or analyses of these samples. We would like to extend our appreciation to these colleagues —Paul Briggs, Tracy Delaney, Al Love, Ted Roemer, and Eric Welsh.

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TABLE 1—Limits of determination for the spectrographic analysis of rocks, based on a 10-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, except as noted.]

Elements	Lower determination limit	Upper determination limit
	Percent	
Calcium (Ca)	.05	20
Iron (Fe)	0.05	20
Magnesium (Mg)	.02	10
Sodium (Na)	0.2	5
Phosphorus (P)	0.2	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
Palladium (Pd)*	5	1,000
Platinum (Pt)*	20	1,000

*Determined in heavy-mineral-concentrate samples only. Limits are for heavy-mineral-concentrate samples.

TABLE 2—Chemical methods used

[FAA, flame atomic absorption; CVAA, cold vapor atomic absorption; ICP, inductively coupled plasma spectroscopy; UF, ultraviolet fluorimetry]

Element or constituent determined	Method type	Determination limit (micrograms/ gram or ppm)	Reference
Gold (Au)	FAA	.05	Thompson and others, 1968.
Mercury (Hg)	CVAA	.02	Koirtyohann and Khalil, 1976
Arsenic (As)	ICP	5	Crock and others, 1987.
Antimony (Sb)	ICP	2	
Zinc (Zn)	ICP	2	
Bismuth (Bi)	ICP	2	
Cadmium (Cd)	ICP	0.1	
Uranium (U)	UF	.10	Centanni and others, 1956; O'Leary and Meier, 1986.

TABLE 3—ANALYTICAL RESULTS OF STREAM-SEDIMENT SAMPLES FROM THE UPPER LESLIE GULCH WILDERNESS STUDY AREA, MALHEUR COUNTY, OREGON.

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

Sample	Latitude	Longitude	Ca %-s	Fe %-s	Mg %-s	Na %-s	P %-s	Ti %-s	Ag ppm-s
LG001S	43 16 29	117 14 21	.3	2	.5	>5	<.2	.2	N
LG002S	43 16 55	117 13 35	.2	2	.2	5	<.2	.3	N
LG003S	43 17 8	117 14 27	1	1.5	.5	>5	<.2	.5	N
LG004S	43 16 53	11713 34	.2	2	.15	>5	<.2	.3	N
LG005S	43 17 10	117 14 18	.7	2	.2	>5	<.2	.7	N
LG006S	43 17 34	117 14 29	1	1.5	.3	>5	<.2	.5	N
LG007S	43 17 39	117 14 58	.5	2	.3	>5	<.2	1	N
LG008S	43 17 10	117 15 15	.15	1.5	.2	2	<.2	.3	N
LG009S	43 17 18	117 15 10	.5	1	.5	5	<.2	.5	N
LG0010S	43 18 15	117 13 28	1.5	1	.3	>5	<.2	.7	N
LG0011S	43 18 19	117 13 26	.3	1	.15	3	<.2	.3	N

Sample	As ppm-s	Au ppm-s	B ppm-s	Ba ppm-s	Be ppm-s	Bi ppm-s	Cd ppm-s	Co ppm-s	Cr ppm-s
LG001S	N	N	<10	2,000	3	N	N	N	10
LG002S	N	N	10	2,000	5	N	N	N	<10
LG003S	N	N	<10	3,000	3	N	N	N	20
LG004S	N	N	10	2,000	5	N	N	N	10
LG005S	N	N	<10	5,000	3	N	N	N	15
LG006S	N	N	<10	2,000	3	N	N	N	20
LG007S	N	N	<10	3,000	5	N	N	N	30
LG008S	N	N	10	1,500	3	N	N	N	10
LG009S	N	N	15	1,500	5	N	N	N	10
LG010S	N	N	<10	3,000	5	N	N	N	<10
LG011S	N	N	<10	1,500	3	N	N	N	<10

Sample	Cu ppm-s	Ga ppm-s	Ge ppm-s	La ppm-s	Mnppm-s	Mo ppm-s	Nb ppm-s	Ni ppm-s	Pb ppm-s
LG001S	7	70	N	100	2,000	<5	<20	30	50
LG002S	<5	70	N	70	1,000	5	20	30	30
LG003S	5	70	N	150	2,000	N	20	30	50
LG004S	7	70	N	100	1,000	5	30	30	50
LG005S	5	70	N	150	1,500	5	30	<5	70
LG006S	7	50	N	70	1,500	N	20	<5	50
LG007S	7	70	N	100	1,500	<5	30	5	50
LG008S	5	50	N	<50	1,000	N	20	<5	50
LG009S	5	50	N	70	2,000	N	20	<5	70
LG010S	5	70	N	100	2,000	5	30	<5	70
LG011S	5	30	N	50	1,500	N	<20	N	20

TABLE 3—LESLIE GULCH SEDIMENTS—Continued

Sample	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
LG001S	N	5	N	100	N	20	N	100	N
LG002S	N	<5	N	<100	N	10	N	100	N
LG003S	N	5	N	<100	N	30	N	150	N
LG004S	N	5	N	100	N	10	N	100	N
LG005S	N	10	N	100	N	15	N	150	N
LG006S	N	<5	N	150	N	20	N	100	N
LG007S	N	7	N	100	N	30	N	150	N
LG008S	N	N	N	<100	N	15	N	50	N
LG009S	N	<5	N	<100	N	20	N	100	N
LG010S	N	5	N	150	N	15	N	150	N
LG011S	N	<5	N	100	N	15	N	70	N

Sample	Zr ppm-s	Au ppm faa	Hg ppm cvaa	As ppm icp	Bi ppm icp	Cd ppm icp	Sb ppm icp	Zn ppm icp	U ppm µf
LG001S	1,000	<.05	<.02	<5	<2	.3	<2	120	.75
LG002S	1,000	<.05	<.02	16	<2	.5	<2	150	.45
LG003S	>1,000	<.05	<.02	<5	<2	.5	<2	130	.9
LG004S	1,000	<.05	<.02	23	<2	.7	<2	180	.75
LG005S	>1,000	<.05	<.02	16	<2	.7	<2	150	.4
LG006S	>1,000	<.05	.02	5	<2	.6	<2	120	.75
LG007S	>1,000	<.05	.02	14	<2	.6	<2	150	.55
LG008S	1,000	<.05	<.02	5	<2	.5	<2	110	.55
LG009S	700	<.05	<.02	7	<2	.6	<2	150	1.9
LG010S	>1,000	<.05	<.02	6	<2	.4	<2	120	.8
LG011S	1,000	<.05	.02	7	<2	.6	<2	130	.6

TABLE 4—ANALYTICAL RESULTS OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE UPPER LESLIE GULCH WILDERNESS STUDY AREA, MALHEUR COUNTY, OREGON.

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

Sample	Latitude	Longitude	Ca %-s	Fe %-s	Mg %-s	Na %-s	P %-s	Ti %-s	Ag ppm-s	As ppm-s
LG002C	43 16 55	117 13 35	.5	.3	.05	N	.5	.2	N	N
LG003C	43 17 8	117 14 27	1	.3	.05	N	1.5	.5	N	N
LG004C	43 16 53	117 13 34	.5	.7	.05	N	<.5	.5	N	N
LG005C	43 17 10	117 14 18	.7	.2	.05	N	.5	.07	N	N
LG006C	43 17 34	117 14 29	.5	.3	.05	N	.5	.5	N	N
LG007C	43 17 39	117 14 58	.7	.2	.05	N	.5	.3	N	N
LG008C	43 17 10	117 15 15	1	.2	.05	N	1	.2	N	N
LG009C	43 17 18	117 15 10	1.5	.2	.05	N	1.5	.15	N	N
LG010C	43 18 15	117 13 28	.7	.5	<.05	N	.5	1.5	N	N
LG011C	43 18 19	117 13 26	.7	.3	<.05	N	<.5	2	N	N

Sample	Au ppm-s	B ppm-s	Ba ppm-s	Be ppm-s	Bi ppm-s	Cd ppm-s	Co ppm-s	Cr ppm-s	Cu ppm-s
LG002C	N	20	500	5	N	N	N	<20	<10
LG003C	N	20	700	7	N	N	N	<20	<10
LG004C	N	20	700	7	N	N	N	<20	<10
LG005C	N	<20	1,000	7	N	N	N	<20	<10
LG006C	N	20	1,000	7	N	N	N	<20	<10
LG007C	N	20	1,000	5	N	N	N	<20	<10
LG008C	N	20	700	10	N	N	N	<20	<10
LG009C	N	20	500	10	N	N	N	<20	<10
LG010C	N	20	300	7	N	N	N	<20	<10
LG011C	N	20	1,000	7	N	N	N	<20	<10

TABLE 4—LESLIE GULCH CONCENTRATES—Continued

Sample	Ga pm-s	Ge ppm-s	La ppm-s	Mn ppm-s	Mo ppm-s	Nb ppm-s	Ni ppm-s	Pbppm-s	Pd ppm-s	Pt ppm-s
LG002C	<10	N	<100	200	N	N	<10	<20	N	N
LG003C	<10	N	<100	200	N	N	<10	<20	N	N
LG004C	<10	N	100	300	N	N	<10	<20	N	N
LG005C	<10	N	<100	200	N	N	<10	<20	N	N
LG006C	<10	N	<100	200	N	N	<10	<20	N	N
LG007C	<10	N	<100	200	N	N	<10	<20	N	N
LG008C	<10	N	<100	200	N	N	<10	<20	N	N
LG009C	<10	N	150	150	N	N	<10	<20	N	N
LG010C	<10	N	<100	200	N	N	<10	<20	N	N
LG011C	<10	N	100	200	N	N	<10	<20	N	N

Sample	Sb pm-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
LG002C	N	<10	N	N	N	20	<50	5,000	N	>2,000
LG003C	N	<10	N	N	N	20	<50	5,000	N	>2,000
LG004C	N	<10	N	N	N	<20	<50	5,000	N	>2,000
LG005C	N	<10	N	N	N	<20	<50	>5,000	N	>2,000
LG006C	N	<10	N	N	N	20	<50	5,000	N	>2,000
LG007C	N	<10	N	N	N	<20	<50	>5,000	N	>2,000
LG008C	N	<10	N	N	N	<20	<50	>5,000	N	>2,000
LG009C	N	<10	N	N	N	20	<50	>5,000	N	>2,000
LG010C	N	30	N	N	N	<20	<50	>5,000	N	>2,000
LG011C	N	20	N	N	N	<20	<50	>5,000	N	>2,000

TABLE 5—ANALYTICAL RESULTS OF ROCK SAMPLE FROM THE UPPER LESLIE GULCH WILDERNESS STUDY AREA, MALHEUR COUNTY, OREGON.

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

Sample	Latitude	Longitude	Ca %-s	Fe %-s	Mg %-s	Na %-s	P %-s	Ti %-s	Ag ppm-s
LG009R	43 17 18	117 15 15	.1	1	.3	5	<.2	.15	N

Sample	As ppm-s	Au ppm-s	B ppm-s	Ba ppm-s	Be ppm-s	Bi ppm-s	Cd ppm-s	Co ppm-s	Cr ppm-s
LG009R	N	N	15	300	5	N	N	N	N

Sample	Cu ppm-s	Ga ppm-s	Ge ppm-s	La ppm-s	Mn ppm-s	Mo ppm-s	Nb ppm-s	Ni ppm-s	Pb ppm-s
LG009R	20	70	N	100	300	N	20	N	70

Sample	Sb ppm-s	Scppm-s	Sn ppm-s	Sr ppm-s	Th ppm-s	V ppm-s	W ppm-s	Y ppm-s	Zn ppm-s
LG009R	N	N	N	<100	N	<10	N	150	N

Sample	Zr ppm-s	Au ppm-s faa	Hg ppm-s cvaa	As ppm-s icp	Bi ppm-s icp	Cd ppm-s icp	Sb ppm-s icp	Zn ppm-s icp	U ppm-s uf
LG009R	700	<.05	.02	<5	<2	.4	<2	150	1.5

TABLE 6—ANALYTICAL RESULTS OF STREAM-SEDIMENT SAMPLES FROM THE SLOCUM CREEK WILDERNESS STUDY AREA, MALHEUR COUNTY, OREGON.

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

Sample	Latitude	Longitude	Ca %-s	Fe %-s	Mg %-s	Na %-s	P %-s	Ti %-s	Ag ppm-s
SC001S	43 16 30	117 15 40	.3	2	.5	>5	<.2	.3	N
SC002S	43 16 22	117 16 47	.2	2	.15	5	<.2	.3	N
SC003S	43 17 0	117 17 23	.7	1.5	.5	3	<.2	.5	N
SC004S	43 16 56	117 17 25	3	1.5	1.5	2	<.2	.5	N
SC005S	43 17 34	117 17 53	1.5	2	.5	>5	<.2	.5	N
SC006S	43 18 26	117 18 16	2	3	.7	5	<.2	.7	N
SC007S	43 18 25	117 17 31	1.5	2	.7	>5	<.2	.5	N
SC008S	43 17 47	117 17 2	2	2	.5	>5	<.2	.5	N
SC009S	43 16 28	117 15 37	2	2	.5	>5	<.2	>1	N
SC010S	43 19 3	117 18 44	5	2	2	>5	<.2	.7	N
SC011S	43 18 33	117 18 7	2	5	.5	5	<.2	.5	N
SC012S	43 17 48	117 19 41	2	5	1.5	1.5	<.2	.7	N
SC013S	43 17 36	117 19 31	2	2	.7	>5	<.2	.5	N
SC014S	43 17 1	117 18 46	2	2	.5	>5	<.2	.5	N
SC015S	43 16 18	117 18 10	3	5	2	1	<.2	.7	N
SC017S	43 17 47	117 16 56	2	2	.7	>5	<.2	1	N
SC018S	43 17 45	117 16 19	2	5	2	>5	<.2	1	N
SC019S	43 17 53	117 16 4	1.5	2	.5	>5	<.2	.5	N
SC020S	43 19 6	117 19 22	5	3	2	5	<.2	1	N

Sample	As ppm-s	Au ppm-s	B ppm-s	Ba ppm-s	Be ppm-s	Bi ppm-s	Cd ppm-s	Co ppm-s	Cr ppm-s
SC001S	N	N	10	1,500	3	N	N	N	<10
SC002S	N	N	<10	1,500	3	N	N	N	<10
SC003S	N	N	10	1,500	5	N	N	<10	70
SC004S	N	N	<10	1,500	3	N	N	<10	100
SC005S	N	N	<10	1,500	5	N	N	N	20
SC006S	N	N	10	1,500	3	N	N	<10	30
SC007S	N	N	<10	1,500	2	N	N	N	20
SC008S	N	N	10	1,500	3	N	N	N	20
SC009S	N	N	<10	3,000	1.5	N	N	N	15
SC010S	N	N	15	3,000	1	N	N	N	200
SC011S	N	N	<10	1,000	2	N	N	N	30
SC012S	N	N	15	2,000	2	N	N	20	50
SC013S	N	N	10	2,000	2	N	N	<10	70
SC014S	N	N	10	2,000	3	N	N	N	15
SC015S	N	N	10	300	1	N	N	20	200
SC017S	N	N	<10	1,500	2	N	N	<10	100
SC018S	N	N	<10	1,000	1.5	N	N	15	70
SC019S	N	N	<10	1,500	2	N	N	<10	20
SC020S	N	N	10	1,500	1	N	N	15	100

TABLE 6—SLOCUM CREEK SEDIMENTS—Continued

Sample	Cu ppm-s	Ga ppm-s	Ge ppm-s	La ppm-s	Mn ppm-s	Mo ppm-s	Nb ppm-s	Ni ppm-s	Pb ppm-s
SC001S	5	70	N	100	1,000	N	20	<5	50
SC002S	<5	50	N	70	500	N	20	<5	20
SC003S	15	50	N	70	1,500	N	20	5	50
SC004S	15	50	N	50	1,500	<5	<20	5	20
SC005S	10	70	N	150	1,500	5	30	<5	50
SC006S	20	50	N	100	1,000	N	30	7	50
SC007S	20	50	N	100	1,500	<5	20	<5	50
SC008S	15	70	N	200	1,500	<5	20	5	100
SC009S	7	50	N	70	2,000	N	30	<5	50
SC010S	30	70	N	50	2,000	<5	<20	10	100
SC011S	15	50	N	70	3,000	N	20	7	100
SC012S	30	50	N	50	1,500	N	<20	30	20
SC013S	15	50	N	100	1,500	N	20	5	20
SC014S	10	70	N	100	2,000	N	20	<5	50
SC015S	50	20	N	N	1,500	N	N	50	10
SC017S	20	70	N	70	1,500	N	30	15	70
SC018S	30	70	N	100	1,500	N	20	30	50
SC019S	10	70	N	50	1,500	N	<20	<5	50
SC020S	50	70	N	200	3,000	N	<20	20	50

Sample	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
SC001S	N	5	N	<100	N	10	N	100	N
SC002S	N	5	N	<100	N	10	N	100	N
SC003S	N	7	N	150	N	30	N	100	N
SC004S	N	10	N	200	N	100	N	70	<200
SC005S	N	5	N	100	N	20	N	100	N
SC006S	N	10	N	150	N	50	N	100	N
SC007S	N	7	N	150	N	50	N	100	N
SC008S	N	7	N	100	N	20	N	200	N
SC009S	N	10	N	100	N	20	N	150	N
SC010S	N	15	N	500	N	100	N	150	N
SC011S	N	7	N	150	N	50	N	100	N
SC012S	N	15	N	200	N	100	N	70	N
SC013S	N	10	N	100	N	70	N	100	N
SC014S	N	5	N	100	N	50	N	150	N
SC015S	N	20	N	200	N	200	N	20	<200
SC017S	N	7	N	150	N	100	N	100	N
SC018S	N	10	N	150	N	100	N	100	N
SC019S	N	5	N	150	N	30	N	100	N
SC020S	N	15	N	200	N	100	N	50	N

TABLE 6—SLOCUM CREEK SEDIMENTS—Continued

Sample	Zr ppm-s	Au ppm faa	Hg ppm cvaa	As/p ppm icp	Bi/p ppm icp	Cd/p ppm icp	Sb/p ppm icp	Zn/p ppm icp	U ppm uf
SC001S	1,000	<.05	<.02	6	<2	.6	<2	140	.75
SC002S	1,000	<.05	<.02	<5	<2	.3	<2	100	1.2
SC003S	>1,000	<.05	<.02	<5	<2	.4	<2	120	2.5
SC004S	200	<.05	.02	<5	<2	.5	<2	99	3.3
SC005S	1,000	<.05	<.02	7	<2	.6	<2	150	1.4
SC006S	1,000	<.05	<.02	7	<2	.6	<2	140	1.4
SC007S	500	<.05	.04	11	<2	.6	<2	140	1.5
SC008S	1,000	<.05	<.02	<5	<2	.6	<2	150	.75
SC009S	1,000	<.05	<.02	6	<2	.6	<2	130	.5
SC010S	700	<.05	<.02	6	<2	.6	<2	89	1.1
SC011S	1,000	<.05	<.02	9	<2	.5	<2	110	1.7
SC012S	700	<.05	.02	<5	<2	.6	<2	110	1.2
SC013S	1,000	<.05	<.02	10	<2	.6	<2	140	1.3
SC014S	1,000	<.05	<.02	12	<2	.6	<2	160	1.4
SC015S	150	<.05	<.02	<5	<2	.7	<2	78	1.8
SC017S	>1,000	<.05	.04	11	<2	.6	<2	140	1.5
SC018S	700	<.05	<.02	<5	<2	.7	<2	120	2
SC019S	700	<.05	<.02	<5	<2	.5	<2	98	1.5
SC020S	300	<.05	.02	5	<2	.8	<2	110	.7

TABLE 7—ANALYTICAL RESULTS OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE SLOCUM CREEK WILDERNESS STUDY AREA, MALHEUR COUNTY, OREGON.

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

Sample	Latitude	Longitude	Ca %-s	Fe %-s	Mg %-s	Na %-s	P %-s	Ti %-s	Ag ppm-s
SC001C	43 16 30	117 15 40	2	.2	.05	.7	.7	.1	N
SC002C	43 16 22	117 16 47	.7	.2	.07	1.5	.5	.1	N
SC003C	43 17 0	117 17 23	.2	.5	.05	.7	<.5	.1	N
SC004C	43 16 56	117 17 25	3	.2	.15	1	.7	.2	N
SC005C	43 17 34	117 17 53	10	.2	.05	.5	1	.07	N
SC006C	43 18 26	117 18 16	2	.3	.1	1	.5	.15	N
SC007C	43 18 25	117 17 31	.3	.2	.05	2	<.5	.2	N
SC008C	43 17 47	117 17 2	30	.3	.05	.5	1.5	.7	N
SC009C	43 16 28	117 15 37	.3	.1	.05	.5	<.5	.05	N
SC010C	43 19 3	117 18 44	3	.15	.07	.7	1.5	.5	N
SC012C	43 17 48	117 19 41	3	.2	.2	1	1	.7	N
SC013C	43 17 36	117 19 31	3	.3	.15	2	<.5	.1	N
SC014C	43 17 1	117 18 46	.7	.15	<.05	.5	.7	.03	N
SC015C	43 16 18	117 18 10	5	.2	.2	5	<.5	.07	N
SC017C	43 17 47	117 16 56	20	.15	.15	.5	1	.15	N
SC018C	43 17 45	117 16 19	7	.3	.2	1	.5	.05	N
SC019C	43 17 53	117 16 4	2	.2	.05	.7	<.5	.2	N
SC020C	43 19 6	117 19 22	10	.15	.1	.7	7	1.5	N

Sample	As ppm-s	Au ppm-s	B ppm-s	Ba ppm-s	Be ppm-s	Bi ppm-s	Cd ppm-s	Co ppm-s	Cr ppm-s
SC001C	N	N	<20	300	7	N	N	N	20
SC002C	N	N	<20	2,000	5	N	N	N	20
SC003C	N	N	<20	1,000	3	N	N	N	<20
SC004C	N	N	<20	1,500	<2	N	N	N	30
SC005C	N	N	<20	300	7	N	N	N	<20
SC006C	N	N	<20	1,000	2	N	N	N	50
SC007C	N	N	<20	5,000	<2	N	N	N	<20
SC008C	N	N	<20	300	15	N	N	N	<20
SC009C	N	N	<20	200	5	N	N	N	<20
SC010C	N	N	<20	1,000	2	N	N	N	20
SC012C	N	N	<20	1,000	2	N	N	N	50
SC013C	N	N	<20	1,500	3	N	N	N	20
SC014C	N	N	<20	300	7	N	N	N	<20
SC015C	N	N	<20	500	<2	N	N	N	<20
SC017C	N	N	<20	300	10	N	N	N	<20
SC018C	N	N	<20	500	7	N	N	N	20
SC019C	N	N	<20	>10,000	3	N	N	N	<20
SC020C	N	N	1	>10,000	2	N	N	N	50

TABLE 7—SLOCUM CREEK CONCENTRATES—Continued

Sample	Cu ppm-s	Ga ppm-s	Ge ppm-s	La ppm-s	Mn ppm-s	Mo ppm-s	Nb ppm-s	Ni ppm-s	Pb ppm-s	Sb ppm-s
SC001C	N	10	N	<100	200	N	N	10	<20	N
SC002C	N	30	N	100	500	N	N	<10	20	N
SC003C	N	15	N	<100	300	N	N	<10	N	N
SC004C	N	30	N	<100	300	N	N	<10	N	N
SC005C	N	10	N	200	300	N	N	<10	200	N
SC006C	N	30	N	<100	200	N	N	<10	<20	N
SC007C	N	30	N	<100	200	N	N	<10	<20	N
SC008C	N	10	N	1,000	500	N	50	<10	20	N
SC009C	N	10	N	N	300	N	N	<10	20	N
SC010C	N	15	N	<100	200	N	N	<10	20	N
SC012C	N	20	N	<100	300	N	N	10	N	N
SC013C	N	50	N	<100	500	N	N	<10	20	N
SC014C	N	10	N	100	200	N	N	<10	N	N
SC015C	N	70	N	<100	50	N	N	<10	N	N
SC017C	N	15	N	150	200	N	N	<10	3,000	N
SC018C	N	15	N	100	300	N	N	<10	20	N
SC019C	N	10	N	<100	200	N	N	<10	<20	N
SC020C	N	15	N	100	500	N	N	<10	N	N

Sample	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
SC001C	<10	50	200	N	50	<50	5,000	N	>2,000
SC002C	<10	30	300	N	20	<50	>5,000	N	>2,000
SC003C	<10	30	<200	N	20	<50	3,000	N	>2,000
SC004C	<10	20	<200	N	30	<50	2,000	N	>2,000
SC005C	<10	N	<200	N	<20	<50	3,000	N	>2,000
SC006C	<10	N	200	N	20	<50	2,000	N	>2,000
SC007C	<10	N	200	N	<20	<50	3,000	N	>2,000
SC008C	<10	70	500	N	<20	N	3,000	N	>2,000
SC009C	<10	N	<200	N	<20	N	2,000	N	>2,000
SC010C	<10	>2,000	<200	N	70	N	3,000	N	>2,000
SC012C	<10	50	200	N	100	N	3,000	N	>2,000
SC013C	<10	N	<200	N	<20	N	1,000	N	>2,000
SC014C	<10	N	<200	N	<20	N	3,000	N	>2,000
SC015C	<10	N	700	N	<20	N	300	N	>2,000
SC017C	<10	N	200	N	<20	N	3,000	N	>2,000
SC018C	<10	N	<200	N	<20	N	2,000	N	>2,000
SC019C	<10	N	<200	N	20	N	3,000	N	>2,000
SC020C	50	N	1,000	N	30	N	1,500	N	>2,000

TABLE 8—ANALYTICAL RESULTS OF ROCK SAMPLES FROM THE SLOCUM CREEK WILDERNESS STUDY AREA, MALHEUR COUNTY, OREGON.

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

Sample	Latitude	Longitude	Ca %-s	Fe %-s	Mg %-s	Na %-s	P %-s	Ti %-s	Ag ppm-s
SC001R	43 16 30	117 15 40	.7	.7	.1	5	N	.2	N
SC003R1	43 17 0	117 17 23	2	.7	.3	2	N	.3	N
SC003R2	43 17 0	117 17 23	.1	.5	.02	>5	N	.15	N
SC003R3	43 17 0	117 17 23	.07	.7	.07	>5	N	.2	N
SC005R	43 17 34	117 17 53	.1	.5	.05	.5	N	.2	N
SC006R	43 18 26	117 18 16	.2	.7	.05	1.5	N	.2	N
SC007R	43 18 25	117 17 31	1	.5	.03	2	<.2	.2	N
SC009R	43 16 28	117 15 37	.05	>20	.03	.5	N	.07	N
SC011R	43 18 33	117 18 7	.5	1.5	.03	5	N	.2	N
SC014R	43 17 1	117 18 46	.3	1	.1	.5	N	.2	N
SC015R1	43 16 18	117 18 10	.5	1	.07	5	N	.2	N
SC015R2	43 16 18	117 18 10	.15	.7	.1	.3	N	.15	N
SC018R1	43 17 45	117 16 19	.2	1	.05	>5	N	.3	N
SC018R2	43 17 45	117 16 19	.15	1	.03	5	N	.2	N

Sample	As ppm-s	Au ppm-s	B ppm-s	Ba ppm-s	Be ppm-s	Bi ppm-s	Cd ppm-s	Co ppm-s	Cr ppm-s
SC001R	N	N	20	1,000	3	N	N	N	<10
SC003R1	N	N	15	2,000	7	N	N	N	<10
SC003R2	N	N	20	500	3	N	N	N	<10
SC003R3	N	N	15	100	3	N	N	N	<10
SC005R	N	N	15	200	2	N	N	N	<10
SC006R	N	N	15	1,000	2	N	N	N	<10
SC007R	N	N	15	1,000	2	N	N	N	<10
SC009R	N	N	70	500	15	N	N	N	<10
SC011R	N	N	15	1,000	2	N	N	N	<10
SC014R	N	N	10	5,000	3	N	N	N	<10
SC015R1	N	N	15	1,000	2	N	N	N	<10
SC015R2	N	N	10	70	2	N	N	<10	10
SC018R1	N	N	10	700	5	N	N	N	<10
SC018R2	N	N	15	700	5	N	N	N	<10

TABLE 8—SLOCUM CREEK ROCKS—Continued

Sample	Cu ppm-s	Ga ppm-s	Ge ppm-s	La ppm-s	Mn ppm-s	Mo ppm-s	Nb ppm-s	Ni ppm-s	Pb ppm-s
SC001R	<5	30	N	100	500	5	20	<5	50
SC003R1	<5	50	N	70	300	<5	20	<5	20
SC003R2	<5	30	N	100	300	5	<20	<5	30
SC003R3	<5	30	N	70	500	<5	20	<5	30
SC005R	<5	30	N	100	300	<5	<20	<5	30
SC006R	<5	30	N	50	300	<5	N	<5	15
SC007R	<5	30	N	70	200	<5	<20	<5	20
SC009R	15	15	N	50	>5,000	5	N	<5	100
SC011R	5	20	N	70	700	N	20	<5	30
SC014R	<5	15	N	50	700	N	<20	<5	20
SC015R1	<5	20	N	70	100	<5	<20	<5	20
SC015R2	<5	20	N	50	300	N	<20	<5	20
SC018R1	<5	30	N	100	300	<5	30	<5	50
SC018R2	<5	30	N	100	500	5	20	<5	30

Sample	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
SC001R	N	<5	10	100	N	<10	N	100	N
SC003R1	N	<5	<10	200	N	1	N	50	N
SC003R2	N	N	N	<100	N	15	N	70	N
SC003R3	N	N	10	<100	N	15	N	100	N
SC005R	N	N	N	<100	N	2	N	70	N
SC006R	N	N	N	<100	N	<10	N	70	N
SC007R	N	N	N	<100	N	<10	N	70	N
SC009R	N	N	N	<100	N	2	N	50	300
SC011R	N	<5	N	<100	N	1	N	100	N
SC014R	N	N	N	<100	N	2	N	70	N
SC015R1	N	N	N	<100	N	1	N	70	N
SC015R2	N	<5	N	<100	N	15	N	70	N
SC018R1	N	5	10	<100	N	<10	N	150	N
SC018R2	N	<5	10	<100	N	<10	N	100	N

Sample	Zr ppm-s	Au ppm faa	Hg ppm cvaa	As/p ppm icp	Bi/p ppm icp	Cd/p ppm icp	Sb/p ppm icp	Zn/p ppm icp	U ppm uf
SC001R	1,000	<.05	<.02	<5	<2	.2	<2	65	.8
SC003R1	700	<.05	<.02	<5	<2	.2	<2	39	2.2
SC003R2	500	<.05	<.02	<5	<2	.1	<2	100	2.5
SC003R3	1,000	<.05	<.02	<5	<2	.1	<2	83	2.3
SC005R	500	<.05	<.02	<5	<2	.2	<2	50	.4
SC006R	500	<.05	.02	10	<2	.3	<2	48	.7
SC007R	700	<.05	.44	20	<2	.3	<2	30	2.1
SC009R	500	<.05	.06	32	<2	4.3	<2	370	1.7
SC011R	1,000	<.05	<.02	<5	<2	.6	<2	130	1.4
SC014R	700	<.05	<.02	10	<2	.4	<2	120	2.8
SC015R1	500	<.05	<.02	20	<2	.3	<2	74	1.8
SC015R2	500	<.05	.1	<5	<2	.1	<2	58	.35
SC018R1	>1,000	<.05	<.02	<5	<2	.4	<2	110	.65
SC018R2	1,000	<.05	<.02	<5	<2	.3	<2	130	1.2

TABLE 9—DESCRIPTION OF ROCK SAMPLES FROM THE SLOCUM CREEK WILDERNESS STUDY AREA, MALHEUR COUNTY, OREGON.

SAMPLE	DESCRIPTION
SC001 R	Welded tuff with abundant quartz veinlets
SC003 R1	Nonwelded tuff
SC003 R2	Densely welded tuff
SC003 R3	Welded tuff
SC005 R	Silicified tuff
SC006 R	Silicified tuff
SC007 R	Nonwelded tuff
SC009 R	Geothite
SC011 R	Welded tuff
SC014 R	Welded tuff
SC015 R1	Welded tuff
SC015 R2	Silicified tuff
SC018 R1	Welded tuff
SC018 R2	Welded tuff

Description of rock sample from Upper Leslie Gulch Wilderness Study Area, Malheur County, Oregon.

SAMPLE	DESCRIPTION
LG009 R	Silicified tuff