UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rock samples from the Abert Rim (OR-1-101) Wilderness Study Area, Lake County, Oregon

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 geochemical survey of the Abert Rim (OR-1-101) Wilderness Study Area, Lake County, Oregon.

INTRODUCTION

In August 1986, the U.S. Geological Survey conducted reconnaissance geochemical survey of the Abert Rim (OR-1-101) Wilderness Study Area, Lake County, Oregon (fig. 1).

The Abert Rim study area comprises about 36.4 mi^2 (94.6 km^2) in central part of Lake County, Oregon, and lies between about 20-40 mi (32-64 km) north of Lakeview, Oregon. Access to the study area is provided on the west by U.S. Highway 395, which runs along the western boundary of the study area, and on the east by unimproved dirt roads. Access to these unimproved dirt roads on the north is from an improved gravel road which joins U.S. Highway 395 about 20 mi (32 km) north of the study area and from the south access may be obtained via Fremont National Forest.

The study area is a volcanic plateau and cliff composed predominantly of Middle Tertiary basalt and andesite flows, with a few lenses of interbedded tuffs and tuffaceous sedimentary rocks capped by younger Tertiary basalt. The geology of the study area was mapped by Walker (1963, 1977).

The study area takes its name from Abert Rim which runs north-south the length of the area, and nearly bisects the area. East of the rim the plateau slopes gently eastward; west of the rim is a spectacular fault escarpment which varies in height but is in places over 2,000 ft (310 m) high. The topographic relief in the study area is about 2,800 ft (2,146 m) with a maximum elevation of about 7,040 ft (2,146 m). 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 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.

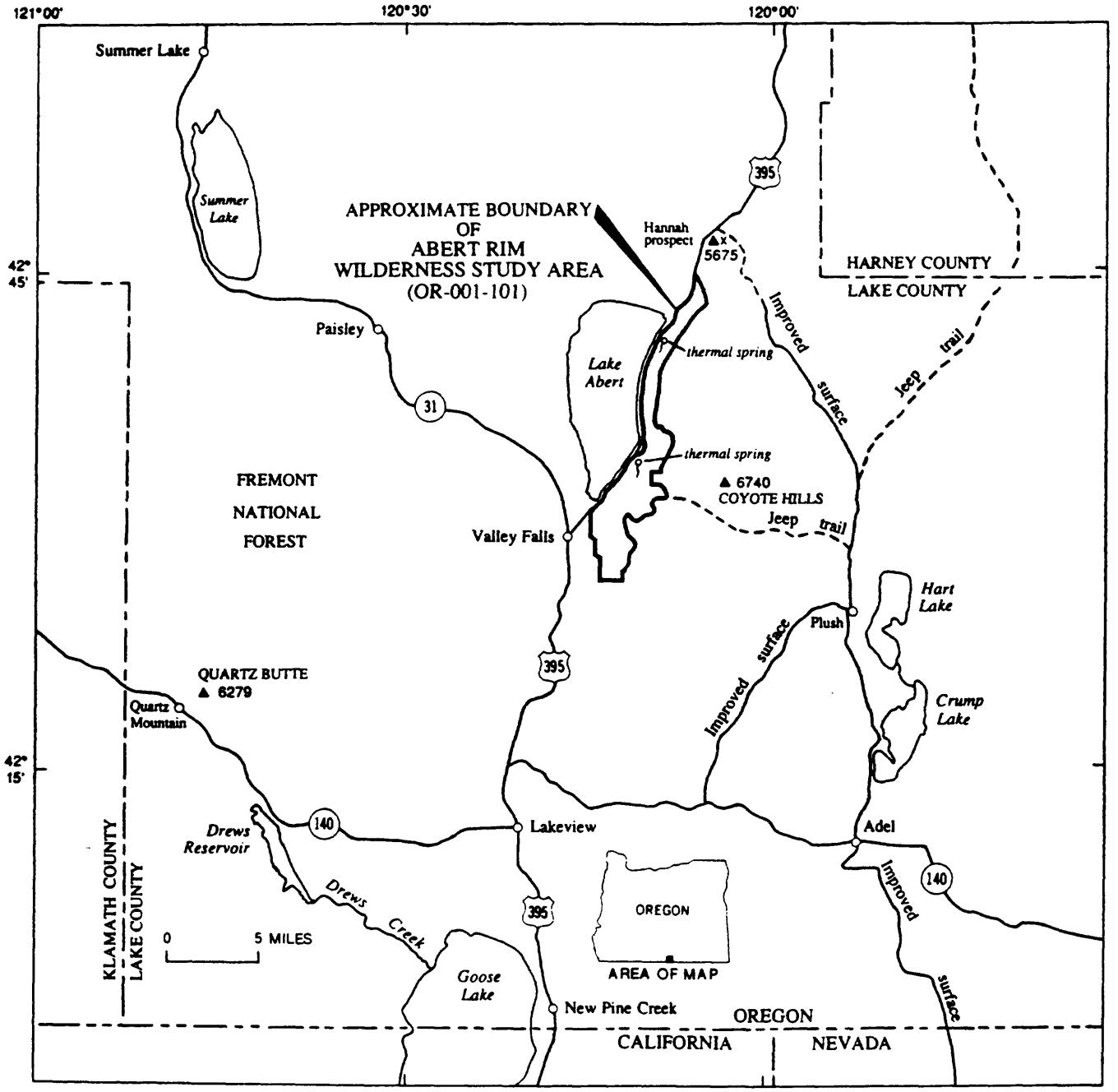

Figure 1. Index map showing location of the Abert Rim Wilderness Study Area, Lake County, Oregon.

Sample Collection

Stream-sediment samples were collected at 23 sites and heavy-mineral-concentrate samples were collected at all but one (AR002H) of those same sites (figures 2 and 3). Rock samples were collected at four of those same sites and at 23 additional sites. The site where one rock sample (86AR13) was collected is about 3 mi (4.8 km) north of the study area and the site is not shown on the localities maps (figures 2 and 3). Sampling density was about one sample site per 1.6 mi^2 for the stream sediments and heavy-mineral concentrates. The area of the drainage basins sampled ranged from .25 mi^2 to 4 mi^2.

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 (fig. 2). Each sample was composited from several localities within an area that may extend as much as 20 ft from the site 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 were removed.

Rock samples

Rock samples were collected from various types of occurrences in the vicinity of the plotted site location.

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.

After the samples were air dried, 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 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 0.2 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.

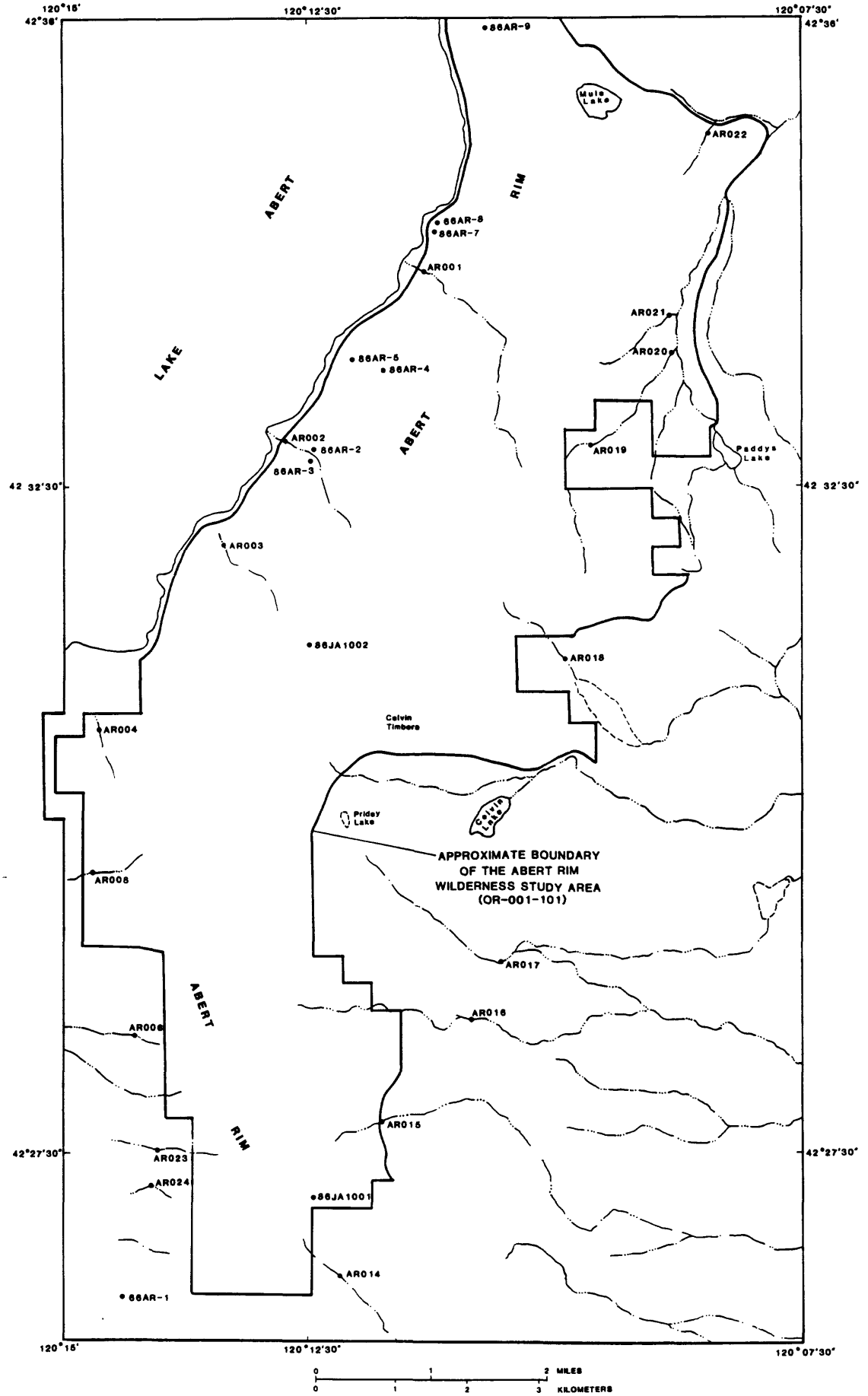

Figure 2. Localities of heavy-mineral-concentrate, stream-sediment, and rock samples from the south half of the Abert Rim Wilderness Study Area, Lake County, Oregon.

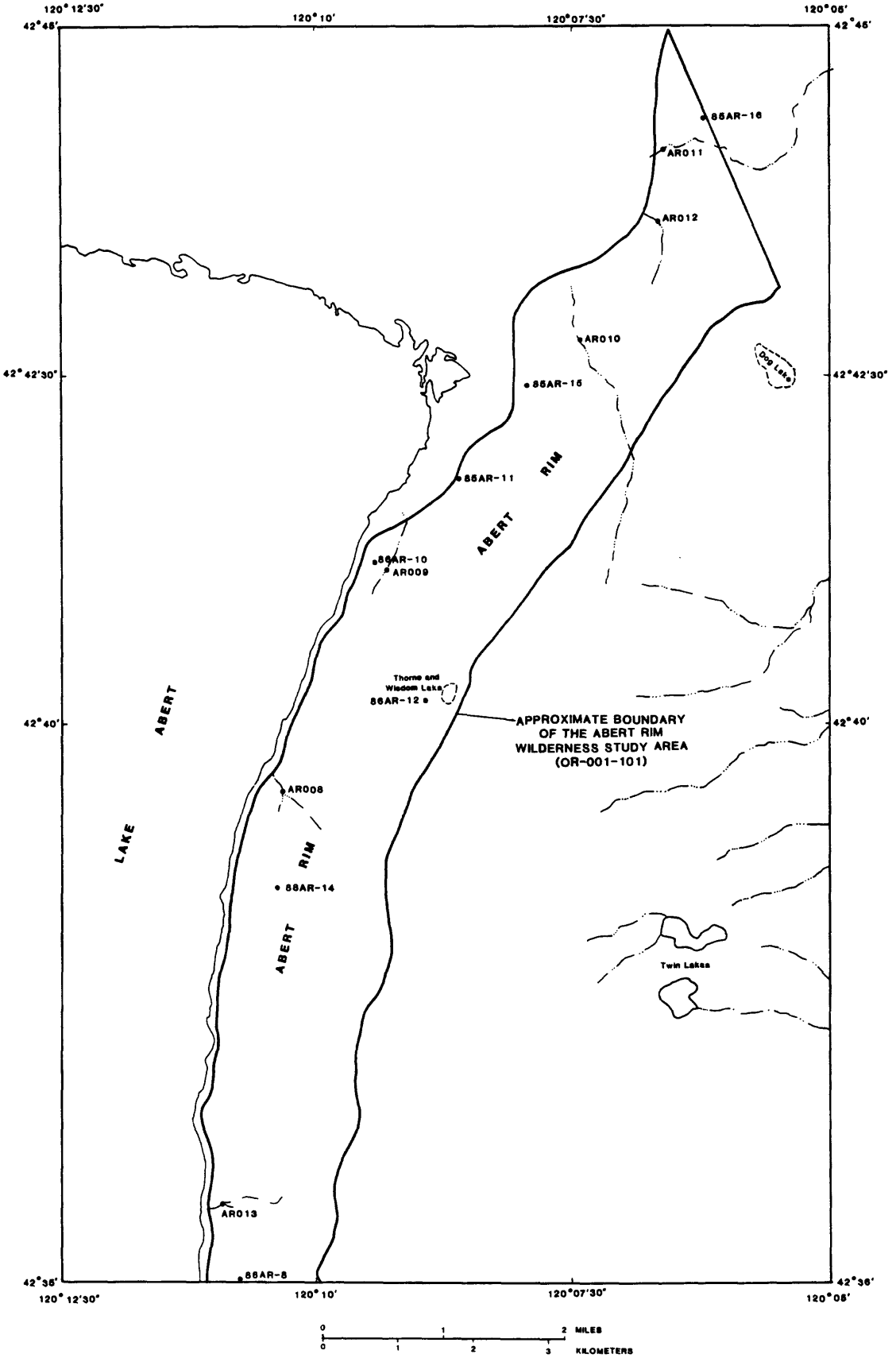

Figure 3. Localities of heavy-mineral concentrate, stream-sediment, and rock samples from the north half of the Abert Rim Wilderness Study Area, Lake County, Oregon

Sample Analysis

Spectrographic method

The stream-sediment, heavy-mineral-concentrate, and rock samples were analyzed for 31 elements using semiquantitative, direct-current arc emission spectrographic methods (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 Abert Rim Wilderness Study Area are listed in tables 3, 4, and 5.

Chemical methods

Rock and stream-sediment samples were analyzed for gold (Au) and mercury (Hg) using atomic absorbtion spectroscopy (AA) and for arsenic (As), antimony (Sb), bismuth (Bi), cadmium (Cd), and zinc (Zn) using inductively coupled plasma atomic-emission spectroscopy (ICP). See table 2 for a more detailed summary of these chemical methods.

Analytical results for stream-sediment, heavy-mineral-concentrate, and rock samples are listed in tables 3, 4, and 5, respectively.

DATA 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 3-5 list the results of analyses for the stream-sediment, heavy-mineral-concentrate, and rock samples, respectively. For the three 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 (fig. 2). Columns in which the element headings show the letter "s" below the element symbol are emission spectrographic analyses; "aa" indicates atomic absorption analyses; and "icp" indicates inductively coupled plasma-atomic emission spectroscopy. 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 place of an analytical value. Because of the formatting used in the computer program that produced tables 3-5, 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. In Table 5, the following samples were run by AA for As, Bi, Cd, Sb, and Zn: AR006HR, AR021HR, AR023HR1, and AR023HR2.

ACKNOWLEDGMENTS

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TABLE 1.--Limits of determination for the spectrographic analysis of rocks and stream sediments, 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 given for rocks and stream sediments.]

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	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)	5	2,000
Chromium (Cr)	10	5,000
Copper (Cu)	5	20,000
Lanthanum (La)	20	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	2,000

TABLE 2.--Chemical methods used

[AA = atomic absorption; ICP = inductively coupled plasma spectroscopy]

Element or constituent determined	Sample type	Method	Determination limit (micrograms/ gram or ppm)	Reference
Gold (Au)	rock, sediment	AA	0.1	Modification of Thompson and others, 1968.
Mercury (Hg)	rock, sediment	AA	0.02	Koirtyohann and Khalil, 1976.
Arsenic (As)	rock, sediment	ICP	5	Crock and others, 1987.
Antimony (Sb)	rock, sediment	ICP	2	
Zinc (Zn)	rock, sediment	ICP	2	
Bismuth (Bi)	rock, sediment	ICP	2	
Cadmium (Cd)	rock, sediment	ICP	0.1	
Arsenic (As)	rock	AA	10	O'Leary and Viets, 1986
Antimony (Sb)	rock	AA	2	
Zinc (Zn)	rock	AA	5	
Bismuth (Bi)	rock	AA	1	
Cadmium (Cd)	rock	AA	0.1	

Table 3. Results of analyses of stream-sediment samples from the Abert Rim Wilderness Study Area, Lake County, Oregon

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
AR001H	42 34 6	120 11 18	5	1.5	2.0	>1	1,000	N	N	N	30	500
AR002H	42 32 50	120 12 45	5	1.5	2.0	>1	1,000	N	N	N	50	500
AR003H	42 32 5	120 13 20	5	1.5	2.0	>1	1,000	N	N	N	20	300
AR004H	42 30 40	120 14 37	5	2.0	2.0	>1	700	N	N	N	15	200
AR005H	42 29 36	120 14 41	7	2.0	2.0	>1	1,500	N	N	N	30	300
AR006H	42 28 22	120 14 15	10	2.0	2.0	>1	1,000	N	N	N	30	300
AR008C	42 39 31	120 10 20	7	3.0	5.0	>1	1,000	N	N	N	30	300
AR009C	42 41 5	120 9 18	5	2.0	2.0	>1	1,000	N	N	N	50	500
AR010C	42 42 45	120 7 25	5	2.0	2.0	>1	1,000	N	N	N	50	300
AR011C	42 44 17	120 6 37	10	5.0	3.0	>1	1,000	N	N	N	70	300
AR012C	42 43 36	120 6 40	7	3.0	5.0	>1	1,000	N	N	N	50	500
AR013C	42 36 33	120 10 56	7	3.0	5.0	>1	1,000	N	N	N	50	300
AR014C	42 26 34	120 12 10	10	2.0	2.0	>1	2,000	N	N	N	20	300
AR015C	42 27 43	120 11 45	10	2.0	2.0	>1	2,000	N	N	N	20	300
AR016C	42 28 30	120 10 50	10	2.0	2.0	>1	1,500	N	N	N	20	300
AR017H	42 28 56	120 10 31	10	2.0	2.0	>1	3,000	N	N	N	20	500
AR018H	42 31 13	120 9 52	10	2.0	2.0	>1	1,500	N	N	N	30	500
AR019C	42 32 48	120 8 37	10	2.0	2.0	>1	2,000	N	N	N	50	500
AR020C	42 33 30	120 8 48	15	2.0	2.0	>1	2,000	N	N	N	50	500
AR021H	42 33 46	120 8 50	15	1.5	1.5	>1	2,000	N	N	N	30	300
AR022H	42 35 8	120 8 27	10	1.5	1.5	>1	1,500	N	N	N	50	500
AR023H	42 27 31	120 14 3	10	5.0	5.0	>1	2,000	N	N	N	30	500
AR024H	42 27 15	120 14 6	10	5.0	5.0	>1	1,500	N	N	N	30	500

Table 3. Results of analyses of stream-sediment samples from the Abert Rim Wilderness Study Area, Lake County, Oregon--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	Sc-ppm s	Sn-ppm s
AR001H	1.5	N	N	30	100	50	N	N	N	50	20	N	20	N
AR002H	1.5	N	N	30	150	100	N	N	N	70	20	N	30	N
AR003H	1.0	N	N	50	200	150	N	N	N	70	20	N	20	N
AR004H	1.0	N	N	30	200	100	N	N	N	70	15	N	20	N
AR005H	1.0	N	N	50	300	100	N	N	<20	70	15	N	30	N
AR006H	<1.0	N	N	70	150	100	N	N	20	30	10	N	30	N
AR008C	1.0	N	N	30	300	70	N	N	N	100	15	N	30	N
AR009C	1.0	N	N	30	200	70	N	N	N	70	15	N	20	N
AR010C	1.0	N	N	30	200	50	N	N	N	70	15	N	20	N
AR011C	1.0	N	N	50	200	200	N	N	<20	100	10	N	30	N
AR012C	1.0	N	N	30	100	100	N	N	N	70	20	N	20	N
AR013C	1.0	N	N	30	200	50	N	N	N	50	20	N	20	N
AR014C	1.0	N	N	50	200	100	N	N	<20	50	20	N	30	N
AR015C	1.0	N	N	50	300	150	N	N	<20	70	15	N	30	N
AR016C	1.0	N	N	50	200	70	N	N	N	100	15	N	30	N
AR017H	1.0	N	N	70	200	70	N	N	<20	70	20	N	30	N
AR018H	1.0	N	N	30	150	50	N	N	<20	70	20	N	30	N
AR019C	1.0	N	N	50	100	70	N	N	<20	100	15	N	20	N
AR020C	1.0	N	N	50	200	100	N	N	<20	100	15	N	20	N
AR021H	1.0	N	N	30	100	70	N	N	<20	50	30	N	20	N
AR022H	1.5	N	N	30	100	50	70	N	20	30	20	N	20	N
AR023H	1.0	N	N	50	200	150	N	N	N	100	10	N	20	N
AR024H	1.0	N	N	50	200	100	N	N	<20	50	10	N	20	N

Table 3. Results of analyses of stream-sediment samples from the Abert Rim Wilderness Study Area, Lake County, Oregon--Continued

Sample	Sr-ppm s	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s	Au-ppm aa	Hg-ppm aa	As-ppm icp	Bi-ppm icp	Cd-ppm icp	Sb-ppm icp	Zn-ppm icp
AR001H	500	150	N	30	<200	150	N	<.1	.03	<5	<2	.2	<2	49
AR002H	500	150	N	30	<200	100	N	<.1	.03	<5	<2	.7	<2	75
AR003H	300	200	N	20	<200	100	N	<.1	.02	5	<2	.5	<2	61
AR004H	200	200	N	20	<200	100	N	<.1	<.02	<5	<2	.9	<2	86
AR005H	500	200	N	30	<200	150	N	<.1	.04	6	<2	.6	<2	62
AR006H	1,000	300	N	30	300	100	N	<.1	<.02	37	<2	1.1	<2	110
AR008C	700	200	N	30	<200	100	N	<.1	<.02	<5	<2	.6	<2	57
AR009C	500	150	N	30	<200	150	N	<.1	<.02	<5	<2	.6	<2	57
AR010C	500	150	N	30	<200	100	N	<.1	<.02	<5	<2	.7	<2	54
AR011C	500	300	N	50	<200	150	N	<.1	<.02	<5	<2	1.0	<2	65
AR012C	500	200	N	50	<200	150	N	<.1	<.02	<5	2	.5	<2	48
AR013C	700	150	N	20	<200	100	N	<.1	<.02	<5	<2	.5	<2	40
AR014C	500	200	N	30	200	100	N	<.1	<.02	<5	3	.6	<2	73
AR015C	500	200	N	30	200	100	N	<.1	<.02	<5	4	.7	<2	71
AR016C	500	200	N	30	<200	100	N	<.1	.03	7	2	.7	<2	64
AR017H	700	200	N	30	<200	100	N	<.1	.02	<5	2	.6	<2	59
AR018H	1,000	150	N	30	200	150	N	<.1	<.02	<5	<2	.5	<2	59
AR019C	700	150	N	30	<200	100	N	<.1	.02	<5	<2	.8	<2	70
AR020C	500	200	N	30	200	100	N	<.1	.02	7	2	.9	<2	84
AR021H	500	200	N	30	200	100	N	<.1	.02	7	<2	1.3	<2	120
AR022H	300	150	N	50	<200	100	N	<.1	<.02	<5	3	.3	<2	46
AR023H	500	200	N	30	<200	100	N	<.1	<.02	<5	2	.6	<2	64
AR024H	700	200	N	20	<200	100	N	<.1	.02	9	<2	.6	<2	67

Table 4. Results of analyses of heavy-mineral-concentrate samples from the Abert Rim Wilderness Study Area, Lake County, Oregon

[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
AR001HC3	42 34 6	120 11 18	.2	.20	15	.50	200	5	N	N
AR002HC3	42 32 50	120 12 43	--	--	--	--	--	--	--	--
AR003HC3	43 32 5	120 13 20	1.0	.70	10	.20	200	N	N	N
AR004HC3	42 30 40	120 14 37	1.5	1.00	10	.30	300	N	N	N
AR005HC3	42 29 36	120 14 41	2.0	2.00	7	.30	300	N	N	N
AR006HC3	42 28 22	120 14 15	1.0	.50	10	.15	200	N	N	N
AR008CC3	42 39 31	120 10 20	.7	.30	7	.10	150	N	N	N
AR009CC3	42 41 5	120 9 18	.7	.20	7	.15	150	N	N	N
AR010CC3	42 42 45	120 7 25	.5	.20	10	.15	200	N	N	N
AR011CC3	42 44 17	120 6 37	1.0	.70	15	.15	200	N	N	N
AR012CC3	42 43 36	120 6 40	.5	.30	7	.15	150	N	N	N
AR013CC3	42 36 33	120 10 56	.7	.50	15	.10	150	N	N	N
AR014CC3	42 26 34	120 12 10	.5	.50	10	1.00	200	N	N	N
AR015CC3	42 27 43	120 11 45	.7	.20	10	.15	200	N	N	N
AR016CC3	42 28 30	120 10 50	.5	.20	7	.15	150	N	N	N
AR017HC3	42 28 56	120 10 31	.5	.15	7	.30	150	N	N	N
AR018HC3	42 31 13	120 9 52	.5	.15	7	.20	100	N	N	N
AR019CC3	42 32 48	120 8 37	.7	.50	20	2.00	200	N	N	N
AR020CC3	42 33 30	120 8 48	.3	.10	10	.15	150	N	N	N
AR021HC3	42 33 46	120 8 50	.5	.10	7	.10	150	N	N	N
AR022HC3	42 35 8	120 8 27	.5	.10	3	.15	150	N	N	N
AR023HC3	42 27 31	120 14 3	.7	.50	15	.15	150	N	N	N
AR024HC3	42 27 15	120 14 6	.7	1.00	15	.20	200	N	N	N

Table 4. Results of analyses of heavy-mineral-concentrate samples from the Abert Rim Wilderness Study Area, Lake County, Oregon--Continued

Sample	B-ppm s	Ba-ppm s	Be-ppm s	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s
AR001HC3	20	500	<2	20	N	<10	20	200	50	N	N
AR002HC3	--	--	--	--	--	--	--	--	--	--	--
AR003HC3	20	300	<2	N	N	<10	150	10	N	N	N
AR004HC3	20	300	<2	N	N	<10	200	15	N	N	N
AR005HC3	50	200	<7	N	N	<30	300	30	70	N	N
AR006HC3	20	500	<2	N	N	<10	20	300	N	N	N
AR008CC3	20	300	<2	N	N	<10	20	15	N	N	N
AR009CC3	20	300	<2	N	N	<10	20	10	N	N	N
AR010CC3	50	500	<2	N	N	<10	20	15	N	N	N
AR011CC3	50	500	<2	N	N	<10	20	20	50	N	N
AR012CC3	50	500	<2	N	N	<10	20	15	N	N	N
AR013CC3	70	500	<2	N	N	<10	50	15	N	N	N
AR014CC3	50	500	<2	N	N	<10	50	50	70	N	N
AR015CC3	50	500	<2	N	N	<10	20	15	50	N	N
AR016CC3	50	500	<2	N	N	<10	20	<10	50	N	N
AR017HC3	50	500	<2	N	N	<10	20	10	N	N	N
AR018HC3	50	500	<2	N	N	<10	20	<10	N	N	N
AR019CC3	50	500	5	N	N	<10	30	10	70	N	N
AR020CC3	50	500	<2	N	N	<10	20	10	N	N	N
AR021HC3	50	700	<2	N	N	<10	20	15	N	N	N
AR022HC3	50	500	<2	N	N	<10	20	<10	N	N	N
AR023HC3	50	200	<2	N	N	<10	50	15	N	N	N
AR024HC3	50	300	<2	N	N	<10	50	15	50	N	N

Table 4. Results of analyses of heavy-mineral-concentrate samples from the Abert Rim Wilderness Study Area, Lake County, Oregon--Continued

Sample	Ni-ppm s	Pb-ppm s	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
AR001HC3	15	>50,000	N	<10	500	2,000	50	<100	200	N	>2,000	N
AR002HC3	--	--	--	--	--	--	--	--	--	--	--	--
AR003HC3	20	300	N	<10	N	2,000	70	<100	70	N	>2,000	N
AR004HC3	20	100	N	<10	20	2,000	100	<100	200	N	>2,000	N
AR005HC3	50	<70	N	<30	N	2,000	200	<300	300	N	>7,000	N
AR006HC3	10	100	N	<10	N	5,000	30	<100	20	N	2,000	N
AR008CC3	20	N	N	<10	N	1,500	30	<100	50	N	>2,000	N
AR009CC3	30	N	N	<10	N	2,000	20	<100	100	N	>2,000	N
AR010CC3	20	N	N	<10	N	2,000	20	<100	100	N	>2,000	N
AR011CC3	20	N	N	<10	N	2,000	20	<100	100	N	>2,000	N
AR012CC3	15	N	N	<10	N	2,000	20	<100	70	N	>2,000	N
AR013CC3	20	100	N	<10	N	2,000	20	<100	50	N	2,000	N
AR014CC3	20	N	N	<10	N	2,000	50	<100	500	N	>2,000	N
AR015CC3	20	30	N	<10	N	2,000	50	<100	200	N	>2,000	N
AR016CC3	15	N	N	<10	N	2,000	30	<100	50	N	>2,000	N
AR017HC3	20	N	N	<10	N	2,000	50	<100	200	N	>2,000	N
AR018HC3	15	N	N	<10	N	2,000	30	<100	70	N	>2,000	N
AR019CC3	20	N	N	<10	N	3,000	100	<100	700	N	>2,000	N
AR020CC3	10	N	N	<10	N	2,000	<20	<100	70	N	>2,000	N
AR021HC3	10	N	N	<10	N	2,000	20	<100	100	N	>2,000	N
AR022HC3	10	N	N	<10	N	1,500	20	<100	70	N	>2,000	N
AR023HC3	10	N	N	<10	N	2,000	30	<100	20	N	>2,000	N
AR024HC3	15	N	N	<10	N	5,000	50	<100	500	N	>2,000	N

Table 5. Results of analyses of rock samples from the Abert Rim Wilderness Study Area, Lake County, Oregon

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
86AR1	42 26 25	120 14 24	5	1.0	5	.5	500	N	N	N	20	1,000
86JA1001	42 27 10	120 12 27	10	5.0	7	>1.0	2,000	N	N	N	15	300
86AR2	42 32 47	120 12 26	7	7.0	7	>1.0	1,500	N	N	N	15	200
86AR3	42 32 42	120 12 28	7	3.0	5	>1.0	1,500	N	N	N	10	200
86AR4	42 33 23	120 11 44	10	2.0	7	>1.0	1,000	N	N	N	30	300
86AR5	42 33 28	120 12 3	15	5.0	10	>1.0	2,000	N	N	N	15	300
86AR6	42 34 30	120 11 10	7	7.0	10	>1.0	1,500	N	N	N	15	200
86AR7	42 34 25	120 11 11	10	7.0	10	>1.0	1,500	N	N	N	20	150
86AR8	42 36 1	120 10 44	10	3.0	5	>1.0	1,000	N	N	N	70	500
86AR9	42 35 56	120 10 41	15	3.0	5	>1.0	1,500	N	N	N	15	500
86JA1002	42 31 19	120 12 31	5	10.0	7	>1.0	1,500	N	N	N	10	150
86AR10	42 41 10	120 9 25	10	7.0	10	>1.0	1,500	N	N	N	50	100
86AR11A	42 41 46	120 8 36	2	1.0	1	1.0	200	N	N	N	200	500
86AR11B	42 41 46	120 8 36	3	1.5	1	1.0	300	<.5	N	N	300	300
86AR11C	42 41 46	120 8 36	15	7.0	10	>1.0	1,000	N	N	N	20	100
86AR12	42 40 10	120 8 56	10	10.0	7	>1.0	2,000	N	N	N	15	200
86AR13	42 47 21	120 5 19	7	1.0	2	>1.0	500	N	N	N	50	1,000
86AR14A	42 38 50	120 10 23	7	7.0	7	>1.0	2,000	N	N	N	<10	200
86AR15A	42 42 26	120 7 56	5	2.0	2	>1.0	700	N	N	N	50	500
86AR15B	42 42 26	120 7 56	15	3.0	10	>1.0	2,000	N	N	N	15	500
86AR15C	42 42 26	120 7 56	5	3.0	5	1.0	700	.5	N	N	100	300
86AR15D	42 42 26	120 7 56	15	7.0	10	>1.0	2,000	N	N	N	10	200
86AR16	42 44 21	120 6 12	10	7.0	10	>1.0	1,500	N	N	N	10	100
AR006HR	42 28 22	120 14 15	5	1.5	5	1.0	500	N	N	N	15	1,000
AR021HR	42 33 46	120 8 50	5	1.0	3	>1.0	500	N	N	N	<10	500
AR023HR1	42 27 31	120 14 3	5	5.0	10	>1.0	500	N	N	N	<10	200
AR023HR2	42 27 31	120 14 3	7	3.0	5	>1.0	1,000	N	N	N	<10	300

Table 5. Results of analyses of rock samples from the Abert Rim Wilderness Study Area, Lake County, Oregon--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	Sc-ppm s	Sn-ppm s
86AR1	1.0	N	N	20	10	30	50	N	N	20	30	N	15	N
86JA1001	1.0	N	N	50	200	100	N	N	N	100	N	N	20	N
86AR2	<1.0	N	N	50	300	100	N	N	N	150	N	N	20	N
86AR3	<1.0	N	N	30	100	200	N	N	N	70	N	N	20	N
86AR4	<1.0	N	N	50	15	200	N	N	<20	15	N	N	30	N
86AR5	<1.0	N	N	70	150	200	N	N	N	70	N	N	30	N
86AR6	N	N	N	70	100	100	N	N	N	200	N	N	30	N
86AR7	N	N	N	50	150	150	N	N	N	150	N	N	30	N
86AR8	1.0	N	N	50	15	70	50	N	20	20	<10	N	20	N
86AR9	1.0	N	N	50	<10	50	30	N	<20	5	N	N	30	N
86JA1002	N	N	N	50	200	100	N	N	N	150	N	N	30	N
86AR10	N	N	N	50	300	100	N	N	<20	200	N	N	30	N
86AR11A	2.0	N	N	7	30	30	50	N	N	50	30	N	7	N
86AR11B	1.0	N	N	10	50	200	30	N	N	30	30	N	10	N
86AR11C	N	N	N	70	300	150	N	N	N	150	N	N	30	N
86AR12	N	N	N	50	300	100	N	N	N	100	N	N	30	N
86AR13	2.0	N	N	7	15	30	100	<5	30	5	30	N	15	N
86AR14A	1.0	N	N	30	200	200	30	N	N	70	<10	N	30	N
86AR15A	1.5	N	N	15	20	70	N	N	N	15	20	N	15	N
86AR15B	1.0	N	N	50	50	200	N	N	N	50	15	N	20	N
86AR15C	1.0	N	N	15	20	150	30	N	N	30	50	N	15	N
86AR15D	<1.0	N	N	50	100	150	N	N	N	150	N	N	30	N
86AR16	N	N	N	50	200	150	N	N	N	150	N	N	30	N
AR006HR	<1.0	N	N	20	<10	20	50	N	N	10	10	N	10	N
AR021HR	<1.0	N	N	10	<10	15	50	N	<20	<5	<10	N	10	N
AR023HR1	N	N	N	30	100	150	N	N	N	70	<10	N	20	N
AR023HR2	<1.0	N	N	50	200	100	N	N	N	50	10	N	20	N

Table 5. Results of analyses of rock samples from the Abert Rim Wilderness Study Area, Lake County, Oregon--Continued

Sample	Sr-ppm s	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s	Au-ppm aa	Hg-ppm aa	As-ppm icp	Bi-ppm icp	Cd-ppm icp	Sb-ppm icp	Zn-ppm icp
86AR1	1,500	100	N	15	<200	100	N	N	.02	<5	<2	.2	<2	60
86JA1001	500	200	N	30	<200	70	N	N	.06	<5	<2	1.0	<2	51
86AR2	500	150	N	20	<200	70	N	N	.04	<5	<2	1.1	<2	57
86AR3	500	200	N	30	<200	100	N	N	.04	<5	<2	.6	<2	67
86AR4	300	200	N	30	<200	100	N	N	.06	13	<2	.9	<2	66
86AR5	300	300	N	20	<200	50	N	N	.02	<5	<2	.9	<2	46
86AR6	700	200	N	20	<200	50	N	N	.02	<5	<2	1.0	<2	34
86AR7	500	200	N	20	<200	50	N	N	.02	<5	<2	.9	<2	43
86AR8	700	150	N	20	<200	100	N	N	.02	<5	<2	.4	<2	33
86AR9	700	100	N	30	<200	100	N	N	.04	6	2	1.1	<2	88
86JA1002	500	200	N	20	<200	70	N	N	.04	<5	<2	1.2	<2	50
86AR10	500	200	N	20	<200	50	N	N	.02	<5	<2	.9	<2	43
86AR11A	300	50	N	30	<200	200	N	N	.02	<5	<2	<.1	<2	7
86AR11B	300	100	N	20	<200	200	N	N	.08	<5	<2	.2	<2	39
86AR11C	300	200	N	20	<200	30	N	N	.02	<5	<2	1.0	<2	42
86AR12	500	200	N	20	<200	50	N	N	.04	<5	<2	1.1	<2	53
86AR13	500	30	N	30	<200	500	N	N	.02	<5	<2	.3	<2	87
86AR14A	500	150	N	20	<200	100	N	N	.02	<5	<2	.8	<2	73
86AR15A	300	100	N	20	<200	200	N	N	.02	<5	<2	.1	<2	4
86AR15B	500	200	N	30	<200	100	N	N	.02	<5	<2	1.0	<2	64
86AR15C	200	70	N	20	<200	200	N	N	.01	<5	<2	.3	<2	19
86AR15D	500	300	N	20	<200	100	N	N	.10	<5	<2	.9	<2	59
86AR16	300	200	N	15	<200	30	N	N	.06	<5	<2	1.0	<2	47
AR006HR	1,000	100	N	20	N	100	N	N	<.02	N	N	N	N	40
AR021HR	500	50	N	30	N	200	N	N	.03	N	N	N	N	55
AR023HR1	500	200	N	20	N	100	N	N	.02	N	N	N	N	55
AR023HR2	700	200	N	20	N	100	N	N	<.02	N	N	N	N	40