UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of rock samples from the Jordan Craters Wilderness Study Area (OR-003-128), Malheur County, Oregon

By

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CONTENTS

ILLUSTRATIONS

TABLES

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 Jordan Craters Wilderness Study Area (OR-003-128), Malheur County, Oregon.

INTRODUCTION

In the summer of 1986, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Jordan Craters Wilderness Study Area, Malheur County, Oregon.

The Jordan Craters Wilderness Study Area (WSA) comprises about 36.3 mi^2 (94.0 km^2) in south central Malheur County, Oregon (fig.1). The area is about 20 miles northwest of Jordan Valley. The periphery of the area is accessible from dirt roads which surround the area. These dirt roads lead from U.S. Highway 95 both east and north of Jordan Valley. Dirt roads on the south and west perimeters are very rough.

The highest elevation is 4826 feet (1471 meters) on top of the north-trending ridge in the northwest part of the area. The lowest elevation is about 4300 feet (1311 meters) on West Cow Creek at the southeast tip of the area. The area has no trees. Most of the area is malpais with no drainages and little vegetation of any kind. The older rocks to the north, west and south support sparse desert shrubs, mostly sagebrush. Small ephemeral streams are present in the areas of the older rocks. Cow Lakes join the area on the east, and there are several small ponds in the malpais near the eastern border.

The oldest rock exposed in the area consists of Miocene rhyolite and dacite flows and flow breccia in the northerly trending ridge in the western part of the area. The lower west flanks along the stream valley on the western border are covered by lower Pliocene volcanic sedimentary rocks composed of tuffaceous sandstone, siltstone, claystone, pumice, diatomite and tuff of lacustrine or fluvatile origin. Border areas to the north and south of the malpais are covered by thin olivine basalt flows and flow breccia of Pliocene or Pleistocene age. The malpais which covers most of the area is Pleistocene or Holocene in age consisting largely of thin flows of scorraceous basalt with a few scattered cinder cones of cinders, bombs, and lapilli (Otto & Hutchison, 1977).

METHODS OF STUDY

Sample Media

Rocks were selected as the sample media in this study because this WSA is almost totally covered with lava flows and there are no streams draining the study area. 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.

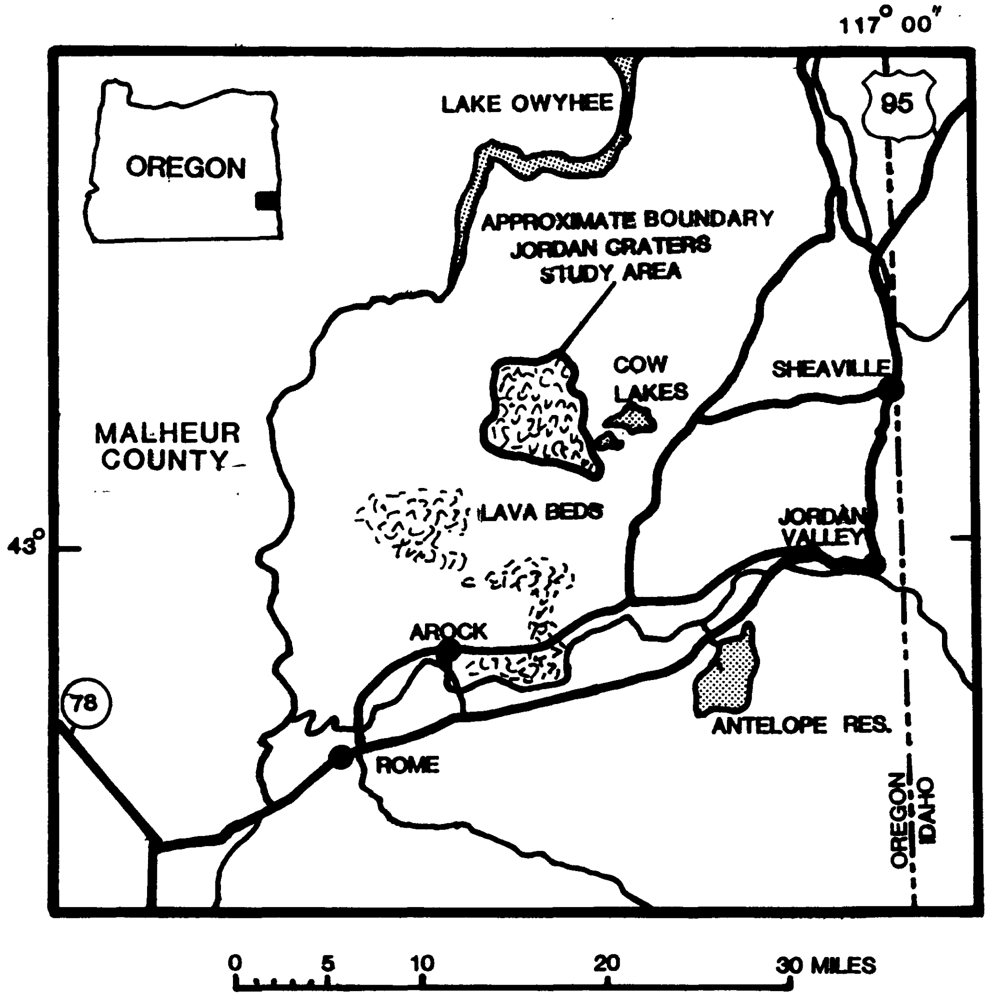

Figure 1. Location map of the Jordan Craters Wilderness Study Area (OR-003-128) Malheur County, Oregon.

Sample Collection

Rock samples

Rock samples were collected at 24 sites (plate 1). Sampling density was about one sample site per 1.5 mi^2. Rock sample sites in this Wilderness Study Area were chosen for various geochemical reasons and there was no attempt to collect samples on a predetermined density or pattern. All samples were collected in the vicinity of the plotted site location. Description of rock samples are in table 4.

Sample Preparation

Rock samples were crushed and then pulverized to (-100 mesh) with ceramic plates.

Sample Analysis

Spectrographic method

The rock samples were analyzed for 31 elements using semiquantitative, direct arc emission spectrographic method (Grimes and Marranzino, 1968). The elements analyzed and their lower limits of determination as 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 Jordan Craters WSA are listed in table 3.

Chemical methods

Rock samples from this study area were also analyzed for gold (Au), mercury (Hg), and thallium (Tl) using atomic absorption spectroscopy (AA) and for arsenic (As), antimony (Sb), zinc (Zn), bismuth (Bi), and cadmium (Cd) using inductively coupled plasma-atomic emission spectroscopy (ICP). The elements analyzed, the analytical methods, and the lower detection limits are listed in table 2. Analytical results for rock samples are listed in table 3.

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

Table 3 list the results of analyses for the rock samples. For this table, the data are arranged so that column 1 contains the USGS-assigned sample numbers. These numbers correspond to the numbers shown on the site location map (plate 1). Columns with the letter "s" below the element symbol indicates 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 table 3 in place of an analytical value. Because of the formatting used in the computer program that produced table 3, some of the elements listed in this table (Fe, Mg, Ca, Ti, Ag, and Be) carry one or more nonsignificant digits to the right of the significant digits. The analysts did not determine these elements to the accuracy suggested by the extra zeros.

ACKNOWLEDGMENTS

A number of our colleagues also participated in preparation and/or analyses of these samples. We would like to extend our appreciation to them-- Randy Baker, Carol Gent, Kay Kennedy, David Fey, Brenda Libby, Olga Erlich, and Eric Welsch.

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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
	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 and ICP = inductively coupled plasma spectroscopy]

Element or constituent determined	Method type	Determination limit (micrograms/ gram or ppm)	Reference
Gold (Au)	AA	.05	Thompson and others, 1968.
Mercury (Hg)	AA	.02	Koirtyohann and Khalil, 1978.
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	
Thallium (Tl)	AA	0.005	Simon and others, 1977.

Table 3. Results of analyses of rock samples from the Jordan Craters Wilderness Study Area, Malheur 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	Be-ppm s
JC001R	43 4 25	117 21 6	5.0	7.00	5.00	>1.000	700	N	N	N	<10	300	<1.0
JC002R	43 4 11	117 22 31	7.0	5.00	2.00	>1.000	700	N	N	N	<10	200	N
JC003R	43 1 57	117 26 34	10.0	7.00	3.00	>1.000	1,000	N	N	N	<10	300	N
JC004R1	43 5 10	117 27 21	1.5	.20	.50	.200	1,000	N	N	N	30	700	1.5
JC004R2	43 5 10	117 27 21	3.0	.15	.50	.200	500	N	N	N	15	2,000	1.5
JC004R3	43 5 10	117 27 21	10.0	2.00	3.00	>1.000	1,000	N	N	N	<10	1,000	1.0
JC005R	43 5 3	117 29 10	7.0	7.00	3.00	>1.000	1,000	N	N	N	N	200	<1.0
JC006R	43 6 12	117 20 40	7.0	7.00	5.00	>1.000	1,000	N	N	N	N	200	N
JC007R	43 9 26	117 23 16	7.0	7.00	5.00	>1.000	1,000	N	N	N	<10	300	N
JC008R	43 9 41	117 25 20	7.0	7.00	5.00	>1.000	1,000	N	N	N	N	300	<1.0
JC009R	43 8 50	117 27 32	10.0	7.00	5.00	>1.000	1,000	N	N	N	N	150	N
JC010R	43 8 43	117 27 49	2.0	.10	.07	.150	300	N	N	N	10	1,000	2.0
JC011R1	43 8 39	117 27 53	2.0	.07	.10	.100	300	N	N	N	20	700	3.0
JC011R2	43 8 39	117 27 53	1.5	.50	.70	.100	200	N	N	N	20	700	3.0
JC011R3	43 8 39	117 27 53	2.0	.05	.50	.100	500	N	N	N	15	1,000	2.0
JC012R	43 6 38	117 28 37	10.0	7.00	2.00	>1.000	1,000	N	N	N	N	300	N
JC013R	43 6 34	117 27 19	1.0	.10	.15	.070	150	N	N	N	15	50	3.0
JC014R1	43 6 29	117 27 43	2.0	.20	.30	.100	500	N	N	N	100	100	3.0
JC014R2	43 6 29	117 27 43	1.5	.05	<.05	.070	300	N	N	N	30	150	3.0
JC015R	43 5 57	117 27 1	1.5	.07	.15	.100	200	N	N	N	15	50	3.0
JC016R	43 6 17	117 27 41	1.5	.07	.07	.100	200	N	N	N	15	50	3.0
JC017R	43 6 21	117 27 42	2.0	.30	.10	.150	300	N	N	N	20	150	3.0
JC018R1	43 6 34	117 28 9	.3	.02	N	.005	50	N	N	N	30	N	30.0
JC018R2	43 6 34	117 28 9	1.5	.20	.20	.100	300	N	N	N	15	700	2.0

Sample	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s	Pb-ppm s	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s
JC001R	N	N	30	100	70	N	N	20	150	N	N	30	N	700
JC002R	N	N	50	100	70	N	N	20	150	N	N	20	N	200
JC003R	N	N	50	150	50	N	N	20	200	N	N	30	N	300
JC004R1	N	N	<5	N	5	<20	N	N	5	<10	N	7	N	100
JC004R2	N	N	N	<10	5	100	N	50	<5	30	N	5	N	100
JC004R3	N	N	50	20	7	<20	N	N	7	15	N	30	N	300
JC005R	N	N	50	150	70	N	N	<20	150	N	N	30	N	500
JC006R	N	N	30	200	30	N	N	<20	150	N	N	20	N	500
JC007R	N	N	50	150	70	N	N	20	100	N	N	20	N	300
JC008R	N	N	50	200	70	N	N	30	150	N	N	20	N	500
JC009R	N	N	50	150	70	N	N	20	100	N	N	20	N	200
JC010R	N	N	N	N	5	100	<5	50	<5	50	N	N	<10	N
JC011R1	N	N	N	N	<5	70	5	30	<5	30	N	N	<10	N
JC011R2	N	N	N	N	N	150	N	20	<5	15	N	N	<10	<100
JC011R3	N	N	N	N	<5	150	10	30	N	50	N	N	<10	N
JC012R	N	N	50	150	70	N	N	20	150	N	N	30	N	500
JC013R	N	N	N	N	<5	70	N	<20	<5	10	N	N	N	<100
JC014R1	N	N	<5	<10	7	70	N	30	5	20	N	<5	<10	<100
JC014R2	N	N	N	N	<5	70	N	20	5	20	N	N	10	N
JC015R	N	N	N	N	<5	70	N	20	<5	30	N	N	<10	N
JC016R	N	N	N	N	<5	70	N	20	<5	15	N	N	N	N
JC017R	N	N	N	N	5	100	N	30	5	50	N	N	<10	N
JC018R1	N	N	N	N	N	<20	N	N	<5	<10	N	N	N	N
JC018R2	N	N	N	N	5	70	N	20	<5	20	N	<5	N	<100

Table 3. Results of analyses of rock samples from the Jordan Craters Wilderness Study Area, Malheur County, Oregon--Continued

Sample	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s	Au-ppm aa	Hg-ppm aa	Tl-ppm aa	As-ppm icp	Bi-ppm icp	Cd-ppm icp	Sb-ppm icp	Zn-ppm icp
JC001R	150	N	20	N	100	N	N	.84	.03	<5	<2	.7	5	53
JC002R	150	N	20	N	100	N	N	N	.03	<5	<2	.5	6	39
JC003R	200	N	20	N	100	N	N	.06	.03	<5	<2	.3	5	36
JC004R1	70	N	50	N	150	N	N	N	.12	<5	<2	<.1	<2	25
JC004R2	20	N	150	N	1,000	N	N	.06	.29	<5	<2	.1	<2	70
JC004R3	300	N	50	N	150	N	N	.02	.23	<5	<2	.3	<2	77
JC005R	200	N	20	N	100	N	N	N	.03	<5	3	.2	4	41
JC006R	200	N	20	N	100	N	N	N	.03	<5	<2	.6	5	34
JC007R	200	N	20	N	100	N	N	N	.03	<5	<2	.6	5	38
JC008R	200	N	20	N	100	N	N	.04	.04	<5	<2	.5	6	39
JC009R	200	N	20	N	100	N	N	N	.04	<5	<2	.6	5	37
JC010R	10	N	150	N	700	N	N	N	.77	<5	<2	.1	<2	120
JC011R1	15	N	100	N	700	N	N	N	.90	<5	<2	<.1	<2	68
JC011R2	<10	N	70	<200	700	N	N	N	.20	<5	<2	.1	<2	59
JC011R3	<10	N	150	N	700	N	N	N	.88	<5	<2	.2	<2	13
JC012R	200	N	20	N	100	N	N	N	.06	<5	3	.5	4	41
JC013R	15	N	70	200	700	N	N	N	.04	<5	<2	<.1	<2	110
JC014R1	100	N	100	200	1,000	N	N	N	.17	<5	<2	.2	<2	75
JC014R2	30	N	70	<200	500	N	N	N	.37	<5	<2	<.1	<2	68
JC015R	30	N	70	300	700	N	N	N	.07	<5	<2	<.1	<2	140
JC016R	50	N	100	200	700	N	N	.02	.14	<5	<2	<.1	<2	78
JC017R	30	N	100	200	700	N	N	N	.42	<5	<2	<.1	<2	78
JC018R1	20	N	30	N	70	N	N	.02	--	7	<2	<.1	<2	12
JC018R2	150	N	70	N	700	N	N	.02	--	<5	<2	.2	<2	78

TABLE 4.--Description of rock samples from the Jordan Craters Wilderness Study Area, Malheur County, Oregon.

86JC001R	Vesicular basalt flow
86JC002R	Vesicular basalt flow
86JC003R	Vesicular basalt flow
86JC004R1	Jasperoid
86JC004R2	Siliceous vein
86JC004R3	Andesite
86JC005R	Vesicular basalt flow
86JC006R	Olivine basalt
86JC007R	Olivine basalt
86JC008R	Olivine basalt
86JC009R	Vesicular olivine basalt
86JC010R	Welded tuff
86JC011R1	Jasperoid
86JC011R2	Jasperoid
86JC011R3	Vitric tuff
86JC012R	Olivine basalt
86JC013R	Ash flow tuff
86JC014R1	Rhyolite tuff
86JC014R2	Rhyolite tuff
86JC015R	Ash flow tuff
86JC016R	Rhyolite ash flow tuff
86JC017R	Rhyolite ash flow tuff
86JC018R1	Jasperoid
86JC018R2	Brecciated rhyolite