UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of stream-sediment and heavy-mineral-concentrate samples from the Blitzen River (OR-002-086E) Wilderness Study Area, Harney 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 Blitzen River (OR-002-086E) Wilderness Study Area, Harney County, Oregon.

INTRODUCTION

In August 1986, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Blitzen River (OR-002-86E) Wilderness Study Area, Harney County, Oregon (fig. 1).

The Blitzen River Wilderness Study Area comprises about 33.6 mi^2 (87.5 km^2) in the southern part of Harney County, Oregon, and lies about 54 mi (87 km) south of Burns, Oregon, and about 2 mi (3.2 km) southeast of Frenchglen. Access to the Blitzen River Wilderness Study Area is provided on the north by the Steens Mountain Loop road, an improved gravel road which forms the northern boundary of the study area; access to other sides of the study area is by various jeep trails.

The Blitzen River Wilderness Study Area is located on the northwest part of a 30 x 90 mi (48 x 145 km) north-trending Basin and Range fault block; Steens Mountain and the Pueblo Mountains are in the eastern part of the fault block. The Miocene Steens Basalt predominantly underlies the study area. The base of the Steens Basalt is not exposed in the study area; however, the basalt is at least 2,500 ft (762 m) thick along the Steens Mountain escarpment 9 mi (14 km) east of the study area. The study area is within the area of the geologic map of the Adel quadrangle at a scale of 1:250,000 (Walker and Repenning, 1965).

The topographic relief of the Blitzen River study area is about 2,370 ft (722 m) and the maximum elevation is about 6,600 ft (2,012 m). The ground surface of the study area slopes gently westward. The valley walls of the Donner und Blitzen River are generally steep and range up to about 500 ft (152 m) in height. 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.

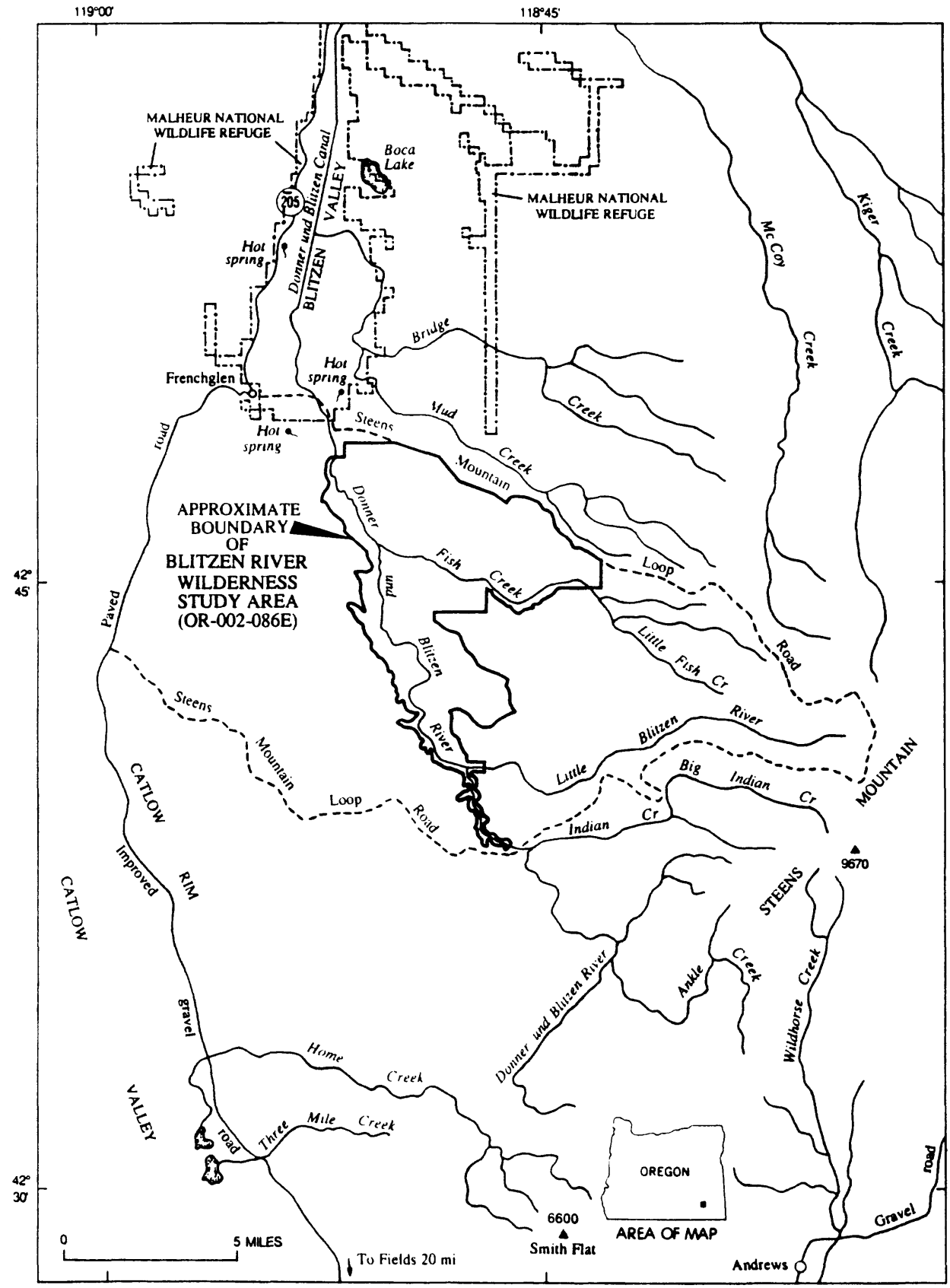

Figure 1. Index map showing location of the Blitzen River Wilderness Study Area, Harney County, Oregon.

Sample Collection

Heavy-mineral-concentrate and stream-sediment samples were collected at 30 sites (fig. 2). Sampling density was about one sample site per 1.33 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 (scale = 1:24,000). 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.

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.

Sample Analysis

Spectrographic method

The stream-sediment and heavy-mineral-concentrate 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.

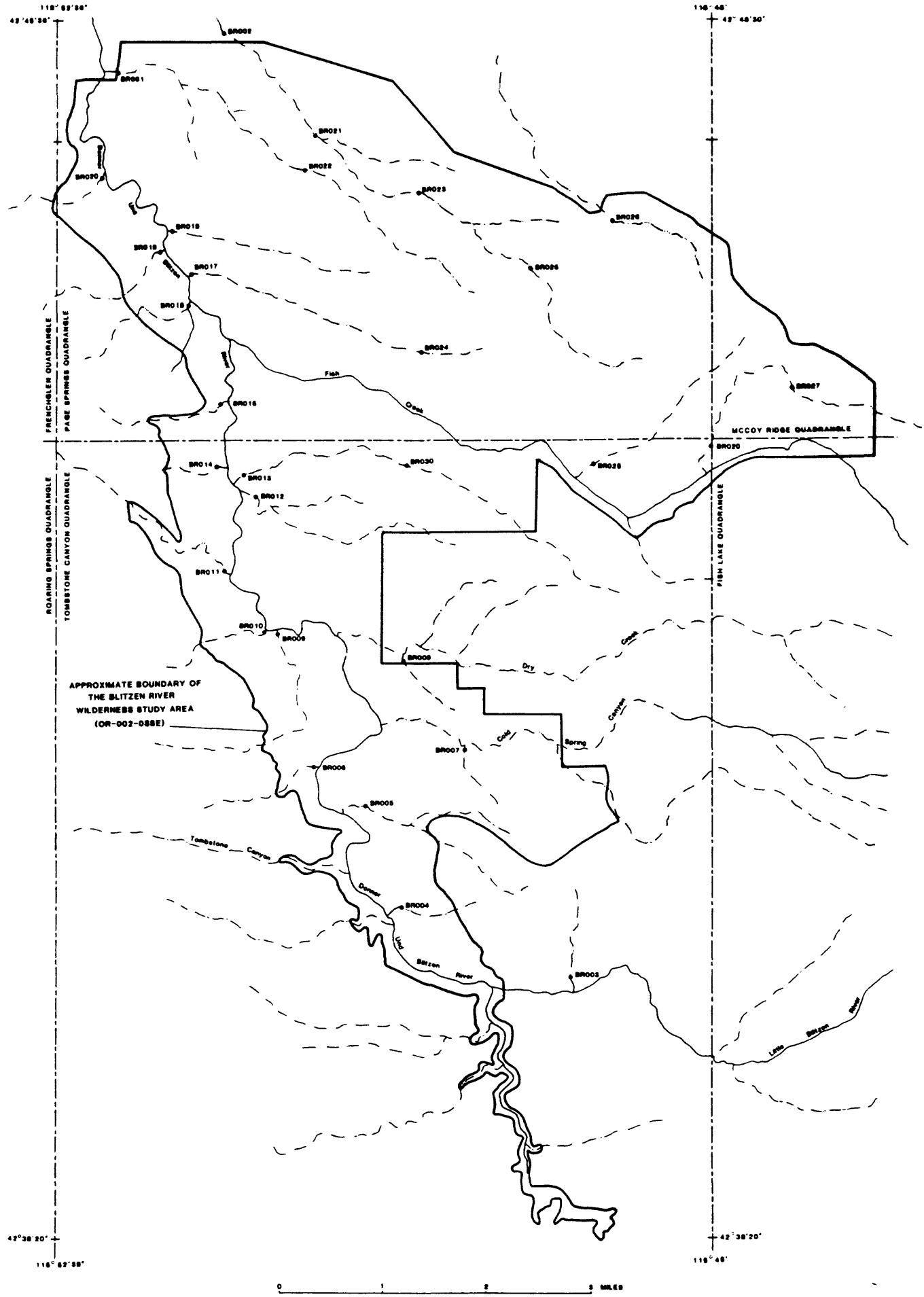

Figure 2. Localities of heavy-mineral-concentrate (C), and stream sediment (S) samples from the Blitzen River Wilderness Study Area.

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 Blitzen River Wilderness Study Area are listed in tables 3 and 4.

Chemical methods

Other analytical methods used on samples from the Blitzen River Wilderness Study Area are summarized in table 2.

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 and 4 list the results of analyses for the samples of stream sediment and heavy-mineral concentrate, 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 (fig. 2). Columns in which the element headings show the letter "s" below the element symbol indicates emission spectrographic analyses and "aa" indicates atomic absorption 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 an 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 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 and 4 in place of an analytical value. 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.

ACKNOWLEDGMENTS

A number of our colleagues also participated, we thank Kay Kennedy and Eric Welsch for their assistance in the preparation and analysis of these samples.

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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 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]

Element or constituent determined	Method	Determination limit (micrograms/ gram or ppm)	Reference
Gold (Au)	AA	0.05	Thompson and others, 1968.
Mercury (Hg)	AA	0.02	Koirtyohann and Khalil, 1976.
Arsenic (As)	AA	10	O'Leary and Viets, 1986.
Antimony (Sb)	AA	2	
Zinc (Zn)	AA	5	
Bismuth (Bi)	AA	1	
Cadmium (Cd)	AA	0.1	

Table 3. Results of analyses of stream-sediment samples from the Blitzen River Wilderness Study Area, Harney 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
BZ001CS	42 48 5	118 51 49	5	1.0	3	>1	1,000	N	N	N	20	500
BZ002HS	42 48 26	118 52 1	10	1.0	2	>1	2,000	N	N	N	50	500
BZ003CS	42 40 28	118 46 37	7	1.0	2	>1	1,500	N	N	N	15	500
BZ004CS	42 41 5	118 48 32	5	1.0	2	>1	1,500	N	N	N	30	500
BZ005CS	42 41 54	118 48 54	5	1.0	2	>1	1,000	N	N	N	30	500
BZ006CS	42 42 16	118 49 36	7	1.0	2	>1	1,500	N	N	N	30	500
BZ007CS	42 42 24	118 47 50	5	1.0	2	>1	1,000	N	N	N	30	500
BZ008CS	42 43 9	118 48 32	7	1.5	2	>1	2,000	N	N	N	30	500
BZ009CS	42 43 23	118 49 58	7	1.5	2	>1	1,500	N	N	N	30	500
BZ010CS	42 43 23	118 50 8	7	1.0	2	>1	1,000	N	N	N	50	500
BZ013CS	42 44 43	118 50 22	5	1.0	2	1	1,500	N	N	N	20	500
BZ014CS	42 44 46	118 50 41	7	1.5	2	>1	1,500	N	N	N	50	500
BZ015CS	42 45 18	118 50 30	5	1.0	2	>1	1,000	N	N	N	30	500
BZ016CS	42 46 8	118 50 59	10	2.0	3	>1	5,000	N	N	N	15	500
BZ017CS	42 46 24	118 50 58	7	2.0	3	>1	3,000	N	N	N	20	500
BZ018CS	42 46 36	118 51 20	7	1.5	2	>1	2,000	N	N	N	30	500
BZ019CS	42 46 45	118 51 11	2	1.0	2	>1	700	N	N	N	50	300
BZ020CS	42 47 13	118 52 1	3	1.0	2	>1	700	N	N	N	30	300
BZ021CS	42 47 33	118 48 2	7	1.5	2	>1	2,000	N	N	N	20	500
BZ022CS	42 47 16	118 49 38	7	1.0	2	>1	1,500	N	N	N	30	500
BZ023CS	42 47 4	118 48 22	5	1.0	2	>1	1,500	N	N	N	20	500
BZ024CS	42 45 45	118 48 19	5	1.0	2	>1	2,000	N	N	N	20	500
BZ025CS	42 46 27	118 47 5	7	1.5	2	>1	1,500	N	N	N	20	500
BZ026CS	42 46 50	118 46 8	7	1.0	2	>1	1,500	N	N	N	50	500
BZ027CS	42 45 27	118 44 6	7	1.0	2	>1	700	N	N	N	30	500
BZ028CS	42 44 47	118 46 24	7	1.0	2	>1	1,000	N	N	N	20	300
BZ029CS	42 44 51	118 45 7	7	1.0	2	>1	1,500	N	N	N	30	300
BZ030CS	42 44 47	118 48 29	7	1.5	2	>1	2,000	N	N	N	30	300

Table 3. Results of analyses of stream-sediment samples from the Blitzen River Wilderness Study Area, Harney 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
BZ001CS	<1.0	N	N	30	100	50	200	N	<20	20	15	N	20	N
BZ002HS	1.0	N	N	50	200	70	30	N	<20	70	20	N	30	N
BZ003CS	1.0	N	N	50	100	100	30	N	N	50	10	N	20	N
BZ004CS	1.0	N	N	30	70	100	50	N	<20	50	20	N	20	N
BZ005CS	1.0	N	N	30	100	100	100	N	<20	30	15	N	20	N
BZ006CS	<1.0	N	N	30	100	100	50	N	N	30	20	N	20	N
BZ007CS	1.0	N	N	20	70	100	50	N	N	50	10	N	20	N
BZ008CS	1.0	N	N	30	100	150	70	N	<20	70	15	N	20	N
BZ009CS	1.0	N	N	30	150	150	100	N	<20	70	20	N	20	N
BZ010CS	1.0	N	N	30	150	100	50	N	<20	50	20	N	20	N
BZ013CS	1.0	N	N	20	100	70	N	N	N	15	15	N	15	N
BZ014CS	1.0	N	N	30	100	100	N	N	N	20	20	N	20	N
BZ015CS	1.0	N	N	20	100	100	30	N	N	20	20	N	20	N
BZ016CS	<1.0	N	N	50	150	100	30	N	<20	50	20	N	20	N
BZ017CS	<1.0	N	N	30	200	70	70	N	N	20	10	N	20	N
BZ018CS	1.0	N	N	50	70	150	30	N	<20	70	20	N	20	N
BZ019CS	1.0	N	N	20	70	50	30	N	N	20	15	N	15	N
BZ020CS	1.0	N	N	20	70	50	50	N	N	20	15	N	15	N
BZ021CS	1.0	N	N	50	200	70	30	N	N	20	15	N	20	N
BZ022CS	1.0	N	N	30	100	70	50	N	<20	20	20	N	20	N
BZ023CS	1.0	N	N	30	300	100	30	N	N	50	15	N	20	N
BZ024CS	1.0	N	N	50	200	50	30	N	<20	30	15	N	20	N
BZ025CS	1.0	N	N	50	500	70	30	N	<20	70	20	N	20	N
BZ026CS	1.0	N	N	30	500	100	30	N	<20	50	30	N	20	N
BZ027CS	1.5	N	N	20	150	70	70	N	<20	50	20	N	20	N
BZ028CS	1.0	N	N	30	150	70	50	N	<20	50	15	N	20	N
BZ029CS	1.0	N	N	30	70	200	N	N	N	50	15	N	20	N
BZ030CS	1.0	N	N	50	100	150	N	N	N	30	20	N	20	N

Table 3. Results of analyses of stream-sediment samples from the Blitzen River Wilderness Study Area, Harney 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 aa	Bi-ppm aa	Cd-ppm aa	Sb-ppm aa	Zn-ppm aa
BZ001CS	500	200	N	30	N	100	N	N	.26	N	N	.2	N	70
BZ002HS	500	200	N	50	N	100	N	N	.08	N	N	.3	N	110
BZ003CS	500	200	N	30	N	150	N	N	.04	N	N	.3	N	105
BZ004CS	500	150	N	30	N	150	N	N	.04	N	N	.2	N	60
BZ005CS	500	150	N	30	N	150	N	N	.04	N	N	.2	N	65
BZ006CS	500	200	N	30	N	150	N	--	.18	N	N	.3	N	95
BZ007CS	300	100	N	30	N	150	N	N	.04	N	N	.2	N	65
BZ008CS	500	200	N	30	N	150	N	N	.04	N	N	.3	N	75
BZ009CS	500	150	N	30	N	150	N	N	.10	N	N	.2	N	85
BZ010CS	500	150	N	30	N	150	N	N	N	N	N	.2	N	50
BZ013CS	500	150	N	20	N	100	N	N	N	N	N	.3	N	90
BZ014CS	500	200	N	30	N	150	N	N	.02	N	N	.3	N	105
BZ015CS	500	200	N	30	N	150	N	N	.04	N	N	.3	N	85
BZ016CS	500	200	N	30	N	150	N	N	.04	N	N	.3	N	80
BZ017CS	500	200	N	30	N	150	N	N	N	N	N	.3	N	100
BZ018CS	500	200	N	30	<200	150	N	N	.02	N	N	.3	N	80
BZ019CS	500	150	N	20	<200	100	N	N	N	N	N	.4	N	75
BZ020CS	500	100	N	20	<200	100	N	N	N	N	N	.2	N	65
BZ021CS	500	200	N	30	<200	70	N	--	.08	N	N	.3	N	120
BZ022CS	500	200	N	30	<200	100	N	N	.02	N	N	.3	N	70
BZ023CS	300	200	N	30	<200	100	N	--	.02	N	N	.3	N	110
BZ024CS	500	200	N	30	<200	200	N	N	.02	N	N	.3	N	75
BZ025CS	500	200	N	30	<200	150	N	N	.02	N	N	.2	N	105
BZ026CS	500	150	N	30	<200	200	N	N	.02	N	N	.2	N	140
BZ027CS	500	150	N	50	<200	200	N	N	.04	N	N	.2	N	85
BZ028CS	500	200	N	30	<200	150	N	N	.02	N	N	.2	N	95
BZ029CS	300	200	N	30	200	150	N	N	.02	N	N	.2	N	125
BZ030CS	300	200	N	30	200	150	N	N	.02	N	N	.3	N	125

Table 4. Results of heavy-mineral-concentrate samples from the Blitzen River Wilderness Study Area, Harney 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
BR001CC3	42 48 5	118 51 49	.5	.15	10	.30	150	N	N	N
BR002HC3	42 48 26	118 52 1	.7	.50	7	.50	500	N	N	N
BR003CC3	42 40 28	118 46 37	.7	.50	7	.50	300	N	N	N
BR004CC3	42 41 5	118 48 32	.5	.15	5	.20	150	N	N	N
BR005CC3	42 41 54	118 48 54	.5	.20	7	.70	200	N	N	N
BR006CC3	42 42 16	118 49 36	.5	.20	5	.30	200	N	N	N
BR007CC3	42 42 24	118 47 50	.5	.30	10	.50	200	N	N	N
BR008CC3	42 43 9	118 48 32	.5	.20	10	.30	200	N	N	N
BR009CC3	42 43 23	118 49 58	.5	.20	5	.50	200	N	N	N
BR010CC3	42 43 23	118 50 8	.5	.30	5	.70	200	N	N	N
BR011CC3	42 43 54	118 50 34	.5	.20	10	.20	200	N	N	N
BR012CC3	42 44 32	118 50 13	.5	.20	7	.20	200	N	N	N
BR013CC3	42 44 43	118 50 22	.5	.30	10	.20	150	N	N	N
BR014CC3	42 44 46	118 50 41	.7	.20	10	.20	150	N	N	N
BR015CC3	42 45 18	118 50 38	.7	.30	7	.20	200	N	N	N
BR016CC3	42 46 8	118 50 59	.7	.20	7	.20	200	N	N	N
BR017CC3	42 46 24	118 50 58	.7	.30	7	.20	200	N	N	N
BR018CC3	42 46 36	118 51 20	.7	.15	7	.20	200	N	N	N
BR019CC3	42 46 45	118 51 11	.7	.30	10	.30	200	N	N	N
BR020CC3	42 47 13	118 52 1	.7	.30	7	.70	200	N	N	N
BR021CC3	42 47 33	118 49 2	.7	.50	7	.50	200	N	N	N
BR022CC3	42 47 16	118 49 38	.7	.20	7	.20	150	N	N	N
BR023CC3	42 47 4	118 48 22	.5	.15	7	.30	200	N	N	N
BR024CC3	42 45 45	118 48 19	.5	.20	7	.20	200	N	N	N
BR025CC3	42 46 27	118 47 5	.7	.15	5	.15	150	N	N	N
BR026CC3	42 46 50	118 46 8	.7	.10	5	.15	150	N	N	N
BR027CC3	42 45 27	118 44 6	.5	.15	5	.20	150	N	N	N
BR028CC3	42 44 47	118 46 24	.5	.10	5	.15	150	N	N	N
BR029CC3	42 44 51	118 45 7	.7	.30	7	.30	150	N	N	N
BR030CC3	42 44 47	118 48 29	.7	.15	10	.15	150	N	N	N

Table 4. Results of heavy-mineral-concentrate samples from the Blitzen River Wilderness Study Area, Harney 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
BR001CC3	20	700	<2	N	N	N	20	N	100	N	N
BR002HC3	20	500	<2	N	N	N	50	N	150	N	N
BR003CC3	20	1,000	<2	N	N	N	20	N	70	N	N
BR004CC3	20	700	<2	N	N	N	20	N	50	N	N
BR005CC3	20	700	2	N	N	N	30	N	150	N	N
BR006CC3	20	500	<2	N	N	N	<20	N	<50	N	N
BR007CC3	20	500	<2	N	N	N	<20	N	100	N	N
BR008CC3	20	1,000	<2	N	N	N	<20	N	50	N	N
BR009CC3	50	700	<2	N	N	N	20	N	50	N	N
BR010CC3	20	500	<2	N	N	N	30	N	70	N	N
BR011CC3	20	500	<2	N	N	N	<20	N	<50	N	N
BR012CC3	20	500	<2	N	N	N	<20	N	<50	N	N
BR013CC3	20	1,000	<2	N	N	N	20	N	<50	N	N
BR014CC3	20	1,000	<2	N	N	N	<20	N	N	N	N
BR015CC3	20	700	<2	N	N	N	<20	N	70	N	N
BR016CC3	30	700	<2	N	N	N	<20	N	<50	N	N
BR017CC3	20	500	<2	N	N	N	20	N	<50	N	N
BR018CC3	30	700	<2	N	N	N	<20	N	<50	N	N
BR019CC3	30	1,000	3	N	N	N	20	N	70	N	N
BR020CC3	30	500	<2	N	N	N	50	N	100	N	N
BR021CC3	30	500	<2	N	N	N	20	N	70	N	N
BR022CC3	30	700	<2	N	N	N	20	N	<50	N	N
BR023CC3	20	500	<2	N	N	N	20	N	50	N	N
BR024CC3	20	700	<2	N	N	N	<20	N	50	N	N
BR025CC3	20	700	<2	N	N	N	<20	N	<50	N	N
BR026CC3	20	700	<2	N	N	N	<20	N	<50	N	N
BR027CC3	20	700	<2	N	N	N	<20	N	<50	N	N
BR028CC3	20	700	<2	N	N	N	<20	N	<50	N	N
BR029CC3	20	700	<2	N	N	N	<20	N	<50	N	N
BR030CC3	20	500	<2	N	N	N	<20	N	<50	N	N

Table 4. Results of heavy-mineral-concentrate samples from the Blitzen River Wilderness Study Area, Harney 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
BR001CC3	10	N	N	<10	70	2,000	50	<100	500	N	>2,000	N
BR002HC3	20	200	N	50	N	2,000	100	<100	1,000	N	>2,000	<200
BR003CC3	15	N	N	<10	N	2,000	70	<100	300	N	>2,000	N
BR004CC3	<10	N	N	<10	N	2,000	50	<100	300	N	>2,000	N
BR005CC3	15	N	N	<10	N	3,000	100	<100	700	N	>2,000	N
BR006CC3	<10	N	N	<10	N	1,500	70	<100	300	N	>2,000	N
BR007CC3	15	N	N	<10	N	2,000	70	<100	500	N	>2,000	N
BR008CC3	20	N	N	<10	N	2,000	70	<100	500	N	>2,000	N
BR009CC3	20	N	N	<10	N	2,000	70	<100	200	N	>2,000	N
BR010CC3	20	N	N	<10	N	2,000	70	<100	300	N	>2,000	N
BR011CC3	20	N	N	<10	N	1,500	50	<100	150	N	>2,000	N
BR012CC3	10	N	N	<10	N	1,500	70	<100	100	N	>2,000	N
BR013CC3	10	N	N	<10	N	2,000	70	<100	100	N	>2,000	N
BR014CC3	10	N	N	<10	N	2,000	70	<100	100	N	>2,000	N
BR015CC3	10	N	N	<10	20	2,000	70	<100	150	N	>2,000	N
BR016CC3	10	<20	N	<10	N	2,000	30	<100	500	N	>2,000	N
BR017CC3	10	N	N	<10	N	2,000	70	<100	200	N	>2,000	N
BR018CC3	15	N	N	<10	N	2,000	50	<100	300	N	>2,000	N
BR019CC3	20	N	N	<10	<20	2,000	50	<100	500	N	>2,000	N
BR020CC3	20	N	N	<10	50	2,000	50	<100	700	N	>2,000	N
BR021CC3	15	N	N	<10	N	2,000	70	<100	500	N	>2,000	N
BR022CC3	10	N	N	<10	N	2,000	30	<100	200	N	>2,000	N
BR023CC3	15	N	N	<10	N	3,000	50	<100	700	N	>2,000	N
BR024CC3	20	N	N	<10	N	2,000	50	<100	500	N	>2,000	N
BR025CC3	10	N	N	<10	N	2,000	50	<100	500	N	>2,000	N
BR026CC3	10	N	N	<10	20	3,000	30	<100	700	N	>2,000	N
BR027CC3	15	N	N	<10	N	3,000	50	<100	700	N	>2,000	N
BR028CC3	15	N	N	<10	N	1,500	50	<100	200	N	>2,000	N
BR029CC3	10	20	N	<10	N	2,000	70	<100	200	N	>2,000	N
BR030CC3	<10	N	N	<10	N	1,500	50	<100	150	N	>2,000	N