

UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

**Analytical results and sample locality map of stream-sediment and  
heavy-mineral-concentrate samples from the Oregon Buttes  
Wilderness Study Area (WY-040-324), Sweetwater County, Wyoming**

By

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## **STUDIES RELATED TO WILDERNESS**

### **Bureau of Land Management Wilderness Study Areas**

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine their mineral resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a geochemical survey of the Oregon Buttes Wilderness Study Area (WSA), Sweetwater County, Wyoming.

## **INTRODUCTION**

In August 1988, the U.S. Geological Survey conducted a reconnaissance geochemical survey of Oregon Buttes Wilderness Study Area (WY-040-324) in Sweetwater County, Wyoming (fig. 1). The Oregon Buttes Wilderness Study Area, hereafter referred to as the "study area," is approximately 52 miles northeast of Rock Springs, Wyoming, and 40 miles south of Lander. It is accessed by graded roads from Wyoming State Highway 28 at South Pass and comprises 5700 acres (8.9 square miles).

Elevations range from 8,612 feet at Oregon Buttes to 7,314 feet at the southeast corner of the study area. The study area lies on the continental divide, south of the Wind River Range. The climate is arid and streams are intermittent. Exposed Tertiary-age sedimentary rocks (from oldest to youngest) are the Cathedral Bluffs Tongue of the Wasatch Formation, the Laney Member of the Green River Formation, the Bridger Formation, and the Arikaree Formation (Gibbons and others, 1990).

## **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 a limited number of 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.

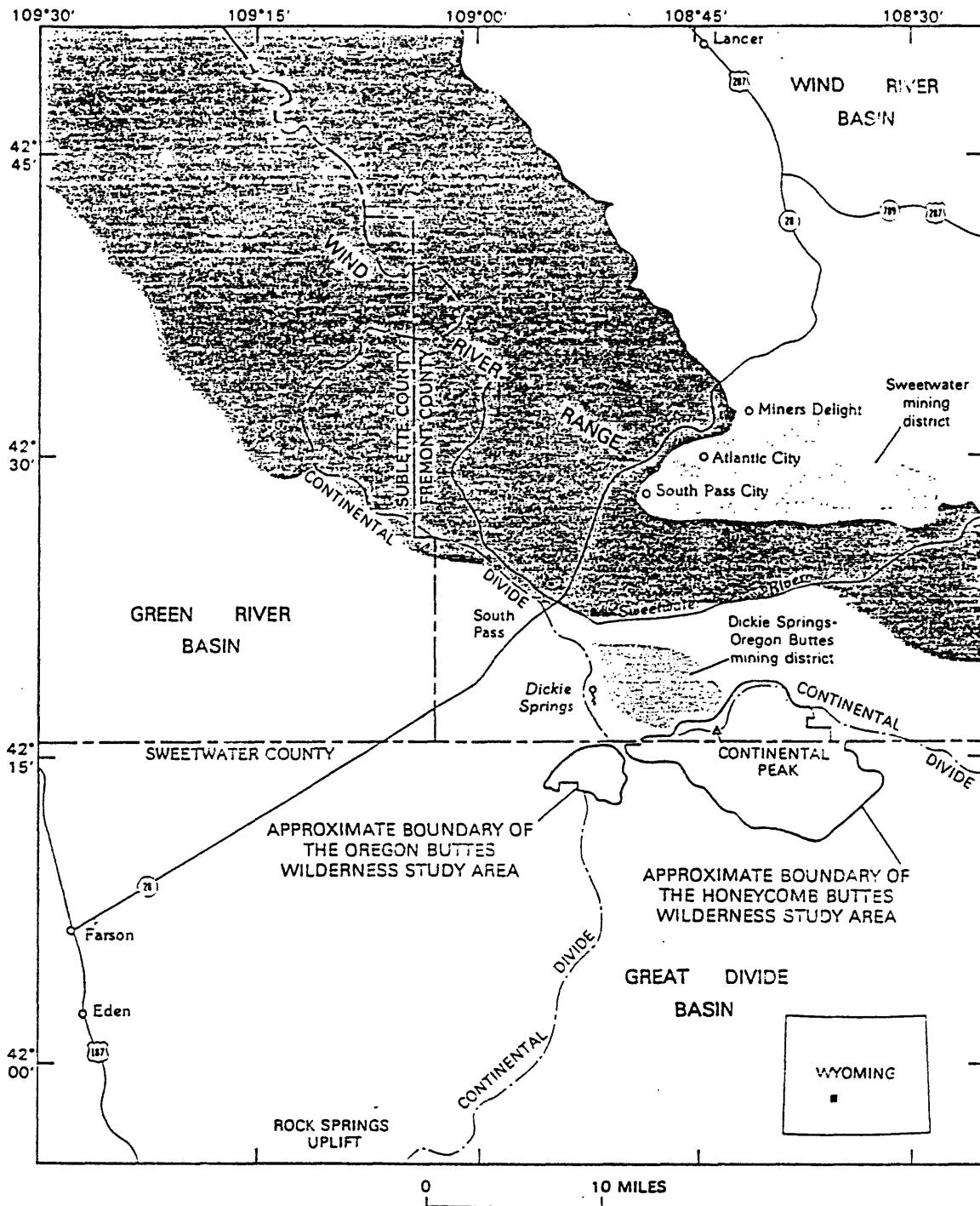


Figure 1.--Location of the Oregon Buttes Wilderness Study Area, Sweetwater County, Wyoming.

## **Sample Collection**

Samples were collected at a total of 15 sites (fig. 2). At all sites, both a stream-sediment sample and a heavy-mineral-concentrate sample were collected. Sampling density was about one sample site per 0.6 square miles. The area of the drainage basins sampled ranged from 0.1 to 0.5 square miles.

### **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) stream 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 50 feet 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 pulverized to -100 mesh and saved for analysis.

Samples that had been panned in the field were air dried and sieved to -35 mesh (0.50 mm); 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 by placing the sample in contact with the face of the magnet (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 Fa 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 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 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.)

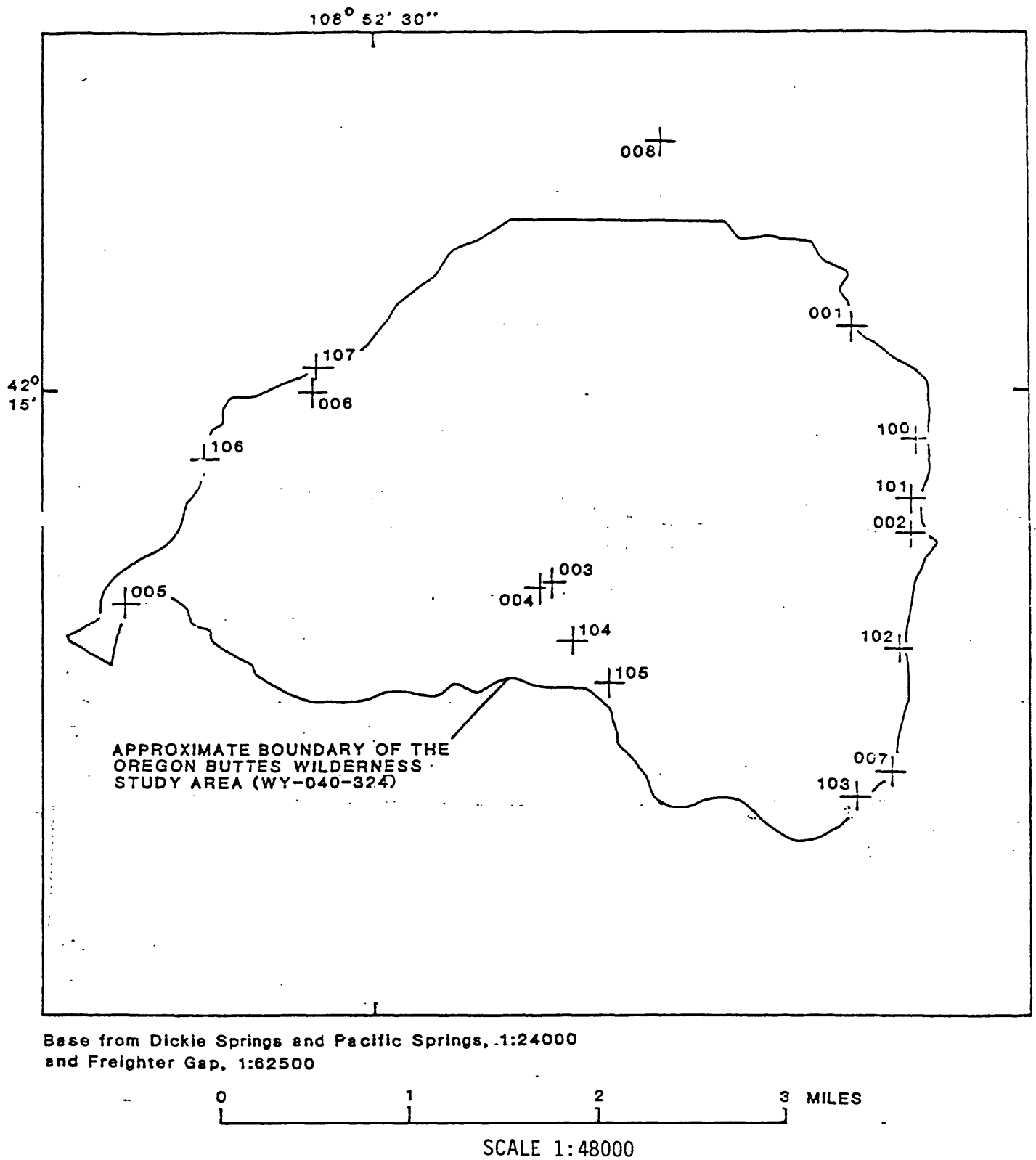


Figure 2.—Localities of stream-sediment and heavy-mineral-concentrate samples from the Oregon Buttes Wilderness Study Area, Sweetwater County, Wyoming.

## **Sample Analysis**

### **Spectrographic Method**

Stream-sediment samples were analyzed for 35 elements using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). Heavy-mineral-concentrate samples were analyzed for the same elements plus platinum and palladium by the same method. 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 intervals 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, sodium, phosphorus, and titanium) are given in weight percent; all others are given in parts per million (micrograms/gram).

### **Other Methods**

The stream-sediment samples from the WSA were also analyzed by inductively coupled plasma emission spectroscopy (ICP), and flame atomic absorption spectroscopy (AA). Arsenic (As), bismuth (Bi), cadmium (Cd), antimony (Sb), and zinc (Zn) were analyzed by ICP, and gold (Au) was analyzed by AA. Limits of determination and references are listed in table 2.

## **ROCK ANALYSIS 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 (Van Trump and Miesch, 1977).

## **DESCRIPTION OF DATA TABLES**

Tables 3 and 4 list the results of analyses for the stream-sediment and heavy-mineral-concentrate 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 fig. 2. Columns in which the element headings show the letter "s" following the element symbol indicates emission spectrographic analyses, "icp" indicates inductively couple plasma analyses, and "aa" flame 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 (LLD) shown for that element in table 1. For emission spectrographic analyses, a "less than" symbol (<) entered in the tables in front of the LLD indicates that an element was observed but was below the lowest reporting value. For ICP analyses, a "less than" symbol (<) entered in the tables in front of the LLD 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. Because of the formatting used in the computer program that produced the data tables, some of the elements listed in these tables (Fe, Ca, Mg, Na, and Ti) may carry one or more nonsignificant digits to the right of the significant digits. The analysts did not determine these elements to the accuracy suggested by the extra zeros.

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TABLE 1.--Limits of determination for the spectrographic analysis of 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 listed, except as noted]

Elements	Lower determination limit	Upper determination limit
Weight percent		
Calcium (Ca)	0.05	20
Iron (Fe)	.05	20
Magnesium (Mg)	.02	10
Sodium (Na)	.2	5
Phosphorus (P)	.2	10
Titanium (Ti)	.002	1
Parts per million		
Silver (Ag)	0.5	5,000
Arsenic (As)	200	10,000
Gold (Au)	10	500
Boron (B)	10	2,000
Barium (Ba)	20	5,000
Beryllium (Be)	1	1,000
Bismuth (Bi)	10	1,000
Cadmium (Cd)	20	500
Cobalt (Co)	10	2,000
Chromium (Cr)	10	5,000
Copper (Cu)	5	20,000
Gallium (Ga)	5	500
Germanium (Ge)	10	100
Lanthanum (La)	50	1,000
Manganese (Mn)	10	5,000
Molybdenum (Mo)	5	2,000
Niobium (Nb)	20	2,000
Nickel (Ni)	5	5,000
Lead (Pb)	10	20,000
Antimony (Sb)	100	10,000
Scandium (Sc)	5	100
Tin (Sn)	10	1,000
Strontium (Sr)	100	5,000
Thorium (Th)	100	2,000
Vanadium (V)	10	10,000
Tungsten (W)	20	10,000
Yttrium (Y)	10	2,000
Zinc (Zn)	200	10,000
Zirconium (Zr)	10	1,000
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.--Other methods used  
(AA, flame atomic absorption spectroscopy; ICP, inductively coupled plasma emission spectroscopy)

Element determined	Sample type	Method (PPM)	LLD	References
Arsenic (As)	Stream-sed	ICP	5	Crock and others, 1987. 2
Bismuth (Bi)		do.	do.	
Cadmium (Cd)	do.	do.	0.1	
Antimony (Sb)	do.		do.	
Zinc (Zn)	do.	do.	2	
Gold (Au)	do.	AA	0.05	Thompson and others, 1968; O'Leary and Meier, 1986.

TABLE 3--RESULTS OF ANALYSES OF STREAM-SEDIMENT SAMPLES FROM THE OREGON BUTTES WILDERNESS STUDY AREA, SWEETWATER COUNTY, WYOMING.

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

Sample	Latitude	Longitude	Ca-pct. s	Fe-pct. s	Mg-pct. s	Na-pct. s	P-pct. s	Ti-pct. s	Ag-ppm s	As-ppm s	Au-ppm s	B-ppm s	Ba-ppm s
OB001 S	42 15 17	108 49 29	2.0	2	1.5	2.0	N	.3	N	N	N	<10	1,500
OB002 S	42 14 20	108 49 6	2.0	2	1.0	2.0	N	.5	N	N	N	15	3,000
OB003 S	42 14 5	108 51 26	5.0	5	2.0	2.0	N	.5	N	N	N	10	2,000
OB004 S	42 14 4	108 51 29	3.0	3	1.5	2.0	N	.5	N	N	N	<10	1,000
OB005 S	42 14 0	108 54 2	2.0	3	1.5	3.0	N	.3	N	N	N	<10	700
OB006 S	42 14 59	108 52 54	3.0	2	1.5	3.0	N	.3	N	N	N	15	1,000
OB008 S	42 16 10	108 50 41	2.0	3	1.5	5.0	N	.3	N	N	N	15	1,000
OB100 S	42 14 44	108 49 3	2.0	3	1.5	2.0	N	.5	N	N	N	15	1,000
OB101 S	42 14 28	108 49 5	3.0	2	1.0	2.0	N	.5	N	N	N	20	1,500
OB102 S	42 13 50	108 49 16	3.0	3	2.0	2.0	N	.5	N	N	N	15	5,000
OB103 S	42 11 54	108 49 33	2.0	10	1.5	2.0	N	1.0	N	N	N	15	5,000
OB104 S	42 13 21	108 51 16	2.0	2	2.0	2.0	N	.3	N	N	N	10	1,000
OB105 S	42 13 37	108 51 2	3.0	3	2.0	2.0	N	.5	N	N	N	10	1,500
OB106 S	42 14 41	108 53 32	1.5	2	2.0	1.5	N	.3	N	N	N	15	1,000
OB107 S	42 15 6	108 52 53	5.0	3	3.0	2.0	N	.2	N	N	N	20	1,000

TABLE 3--RESULTS OF ANALYSES OF STREAM-SEDIMENT SAMPLES FROM THE OREGON BUTTES WILDERNESS STUDY AREA, SWEETWATER COUNTY, WYOMING.--Continued

Sample	Be-ppm s	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	Ga-ppm s	Ge-ppm s	La-ppm s	Mn-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s	Pb-ppm s	Sb-ppm s
08001 S	N	N	N	<10	70	<5	50	N	100	200	N	N	15	10	N
08002 S	N	N	N	10	70	5	50	N	150	300	N	20	20	20	N
08003 S	<1	N	N	20	200	10	70	N	70	700	N	N	30	15	N
08004 S	N	N	N	10	100	<5	50	N	50	300	N	N	15	10	N
08005 S	N	N	N	15	150	<5	70	N	N	150	N	N	20	10	N
08006 S	1	N	N	<10	30	5	50	N	50	300	N	N	10	15	N
08008 S	N	N	N	10	70	5	70	N	<50	150	<5	N	20	10	N
08100 S	<1	N	N	15	70	7	50	N	<50	300	N	N	30	15	N
08101 S	<1	N	N	<10	50	<5	30	N	<50	200	N	N	15	10	N
08102 S	<1	N	N	15	150	5	50	N	100	500	N	N	20	15	N
08103 S	<1	N	N	20	500	10	70	N	200	1,000	N	<20	30	20	N
08104 S	N	N	N	10	70	5	30	N	70	500	N	N	20	10	N
08105 S	<1	N	N	15	70	5	50	N	70	500	N	N	20	10	N
08106 S	<1	N	N	10	50	10	20	N	50	300	N	N	20	10	N
08107 S	<1	N	N	10	30	20	30	N	50	300	5	N	20	15	N

TABLE 3--RESULTS OF ANALYSES OF STREAM-SEDIMENT SAMPLES FROM THE OREGON BUTTES WILDERNESS STUDY AREA, SWEETWATER COUNTY, WYOMING.--Continued

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	As-ppm icp	Bi-ppm icp	Cd-ppm icp	Sb-ppm icp	Zn-ppm icp	Au-ppm aa
08001 s	5	N	300	N	70	N	<10	N	500	<5	<2	.1	<2	20	N
08002 s	5	N	150	N	50	N	10	N	150	7	<2	.1	<2	32	N
08003 s	10	N	1,000	N	100	N	15	N	300	<5	<2	.2	<2	31	N
08004 s	5	N	200	N	70	N	<10	N	200	<5	<2	.2	<2	26	N
08005 s	5	N	100	N	70	N	N	N	70	<5	<2	.2	<2	24	N
08006 s	<5	N	500	N	50	N	<10	N	70	<5	<2	.3	<2	40	N
08008 s	<5	N	200	N	50	N	N	N	100	<5	<2	.2	<2	30	N
08100 s	5	N	200	N	100	N	<10	N	300	9	<2	.3	<2	44	N
08101 s	5	N	300	N	70	N	10	N	300	<5	<2	.1	<2	21	N
08102 s	7	N	300	N	100	N	15	N	700	<5	<2	.3	<2	31	N
08103 s	15	N	200	N	200	N	70	N	1,000	<5	<2	.9	<2	47	N
08104 s	5	N	300	N	70	N	10	N	200	<5	<2	.2	<2	29	N
08105 s	7	N	300	N	100	N	<10	N	150	<5	<2	.3	<2	31	N
08106 s	7	N	300	N	100	N	<10	N	200	<5	<2	.3	<2	45	N
08107 s	5	N	300	N	100	N	<10	N	70	<5	<2	.5	<2	59	N

TABLE 4--RESULTS OF ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE OREGON BUTTES WILDERNESS STUDY AREA,  
SWEETWATER COUNTY, WYOMING.

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

Sample	Latitude	Longitude	Ca-pct. s	Fe-pct. s	Mg-pct. s	Na-pct. s	P-pct. s	Ti-pct. s	Ag-ppm s	As-ppm s	Au-ppm s	B-ppm s
OB001 C	42 15 17	108 49 29	3.0	.3	.7	<.5	1.0	.7	N	N	N	30
OB002 C	42 14 20	108 49 6	1.0	.1	.2	N	.7	1.0	N	N	N	30
OB003 C	42 14 5	108 51 26	7.0	.3	1.5	N	2.0	1.5	N	N	N	20
OB004 C	42 14 4	108 51 29	7.0	.2	1.5	1.0	1.5	1.5	N	N	N	30
OB005 C	42 14 0	108 54 2	10.0	.5	3.0	N	3.0	2.0	N	N	N	30
OB006 C	42 14 59	108 52 54	10.0	.2	1.0	N	5.0	>2.0	N	N	N	30
OB008 C	42 16 10	108 50 41	10.0	.7	2.0	1.0	1.5	2.0	N	N	N	20
OB100 C	42 14 44	108 49 3	.7	.3	.3	N	N	1.5	N	N	N	<20
OB101 C	42 14 28	108 49 5	5.0	.2	.5	N	.5	2.0	<1	N	N	30
OB102 C	42 13 50	108 49 16	1.0	<.1	.2	N	N	.7	N	N	N	N
OB103 C	42 11 54	108 49 33	5.0	.1	.3	N	.7	2.0	N	N	N	<20
OB104 C	42 13 21	108 51 16	3.0	1.0	1.5	.5	.5	2.0	N	N	N	N
OB105 C	42 13 37	108 51 2	3.0	.5	2.0	N	.7	1.0	N	N	N	N
OB106 C	42 14 41	108 53 32	7.0	.7	3.0	1.0	1.5	2.0	N	N	N	30
OB107 C	42 15 6	108 52 53	3.0	1.5	1.0	N	.5	1.0	N	N	N	N

TABLE 4--RESULTS OF ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE OREGON BUTTES WILDERNESS STUDY AREA,  
SWEETWATER COUNTY, WYOMING.--Continued

Sample	Ba-ppm s	Be-ppm s	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	Ga-ppm s	Ge-ppm s	La-ppm s	Mn-ppm s	Mo-ppm s	Nb-ppm s
OB001 C	>10,000	N	N	N	N	N	N	N	N	<100	150	N	N
OB002 C	>10,000	N	N	N	N	N	N	N	N	1,500	50	N	N
OB003 C	>10,000	N	N	N	N	N	N	N	N	150	500	N	50
OB004 C	>10,000	<2	N	N	N	<20	N	10	N	150	300	N	<50
OB005 C	>10,000	<2	N	N	N	<20	N	<10	N	300	1,000	N	100
OB006 C	1,000	7	N	N	N	30	N	<10	N	300	500	N	<50
OB008 C	10,000	N	N	N	N	<20	N	10	N	200	700	N	70
OB100 C	>10,000	5	N	N	N	N	N	N	N	100	70	N	<50
OB101 C	>10,000	7	N	N	N	N	N	N	N	<100	150	N	50
OB102 C	>10,000	N	N	N	N	N	N	N	N	N	30	N	N
OB103 C	>10,000	N	N	N	N	N	N	N	N	150	150	N	N
OB104 C	>10,000	N	N	N	N	<20	N	<10	N	100	100	N	<50
OB105 C	>10,000	N	N	N	N	N	N	N	N	<100	300	N	<50
OB106 C	3,000	<2	N	N	N	<20	N	15	N	100	700	N	50
OB107 C	10,000	N	N	N	N	N	<10	N	N	<100	200	N	N

TABLE 4--RESULTS OF ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE OREGON BUTTES WILDERNESS STUDY AREA,  
SWEETWATER COUNTY, WYOMING.--Continued

Sample	Ni-ppm s	Pb-ppm s	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s	Th-ppm s	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Pd-ppm s	Pt-ppm s
08001 C	N	<20	N	N	70	2,000	N	30	N	70	N	>2,000	N	N
08002 C	N	70	N	N	<20	5,000	300	30	N	100	N	>2,000	N	N
08003 C	N	<20	N	N	N	2,000	N	70	N	100	N	>2,000	N	N
08004 C	N	<20	N	N	N	300	N	70	N	100	N	>2,000	N	N
08005 C	N	<20	N	N	<20	1,500	N	100	N	200	N	>2,000	N	N
08006 C	N	30	N	<10	20	N	N	150	N	500	N	>2,000	N	N
08008 C	N	<20	N	N	N	<200	N	100	N	150	N	>2,000	N	N
08100 C	N	20	N	N	N	700	N	50	N	100	N	>2,000	N	N
08101 C	N	<20	N	N	N	2,000	N	70	N	100	N	>2,000	N	N
08102 C	N	N	N	N	N	3,000	N	<20	N	20	N	>2,000	N	N
08103 C	N	30	N	N	200	7,000	N	50	N	200	N	>2,000	N	N
08104 C	N	<20	N	N	N	1,500	N	100	N	150	N	>2,000	N	N
08105 C	N	N	N	N	N	1,500	N	70	N	70	N	>2,000	N	N
08106 C	N	20	N	N	N	<200	N	100	N	150	N	>2,000	N	N
08107 C	N	N	N	N	N	<200	N	70	N	50	N	>2,000	N	N