UNITED STATES DEPARTMENT OF THE INTERIOR
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Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rock samples from the Camp Creek and Cottonwood Creek Wilderness Study Area, Malheur County, Oregon

By

Janet L. Jones*, M.S. Erickson*, David L. Fey*,

Kay Kennedy*, and Carol Gent*

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*U.S. Geological Survey, DFC, Box 25046, MS 973, Denver, CO 80225

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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 Camp Creek and Cottonwood Creek Wilderness Study Areas (OR-003-031 and OR-003-032) Mahleur County, Oregon.

INTRODUCTION

In July 1986, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Camp Creek and Cottonwood Creek Wilderness Study Areas, Oregon (fig 1).

The Camp Creek Wilderness Study Area comprises about 20,310 acres (31.7 mi^2) and the Cottonwood Creek Wilderness Study Area about 7,700 acres (12.0 mi^2) in north-central Malheur County, Oregon. The study areas are located about 19 miles south-west of Harper, Oregon (fig.1). Access to the areas is provided by an unpaved road on the eastern side of the areas which leads from Harper Jct. to Crowley, Oregon. From this road, four-wheel drive roads branch off into and around the areas. Access within the areas is limited to the rough jeep trail which separates the two areas. There are a few other jeep trails within the areas but these are relatively rough and in some cases impassable.

The topographic relief in the study area is about 2,300 ft with a maximum elevation of about 5,700 ft at the top of Monument Peak and a minimum elevation of about 3,400 ft at the junction of the Wildcat and Cottonwood Creeks on the NE boundary. Vegetation in the areas consists of a few cottonwoods, aspens and willows in small groves along the creeks, and sagebrush along the ridges.

The study areas are located in an area entirely covered by volcanic rocks of Miocene and Pliocene age. The oldest of these consists of dark gray to black basalt flows of mid-Miocene age exposed in the bottom of Camp and Cottonwood Creeks. This is overlain by a thick sequence of slightly younger rhyolite and dacite flows and flow breccias. These are then overlain north of Camp Creek by extensive gray basalt flows of early Pliocene age and in the south of both areas by silicic ash flow tuff and pumice also of Pliocene age (Kittleman, 1967).

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.

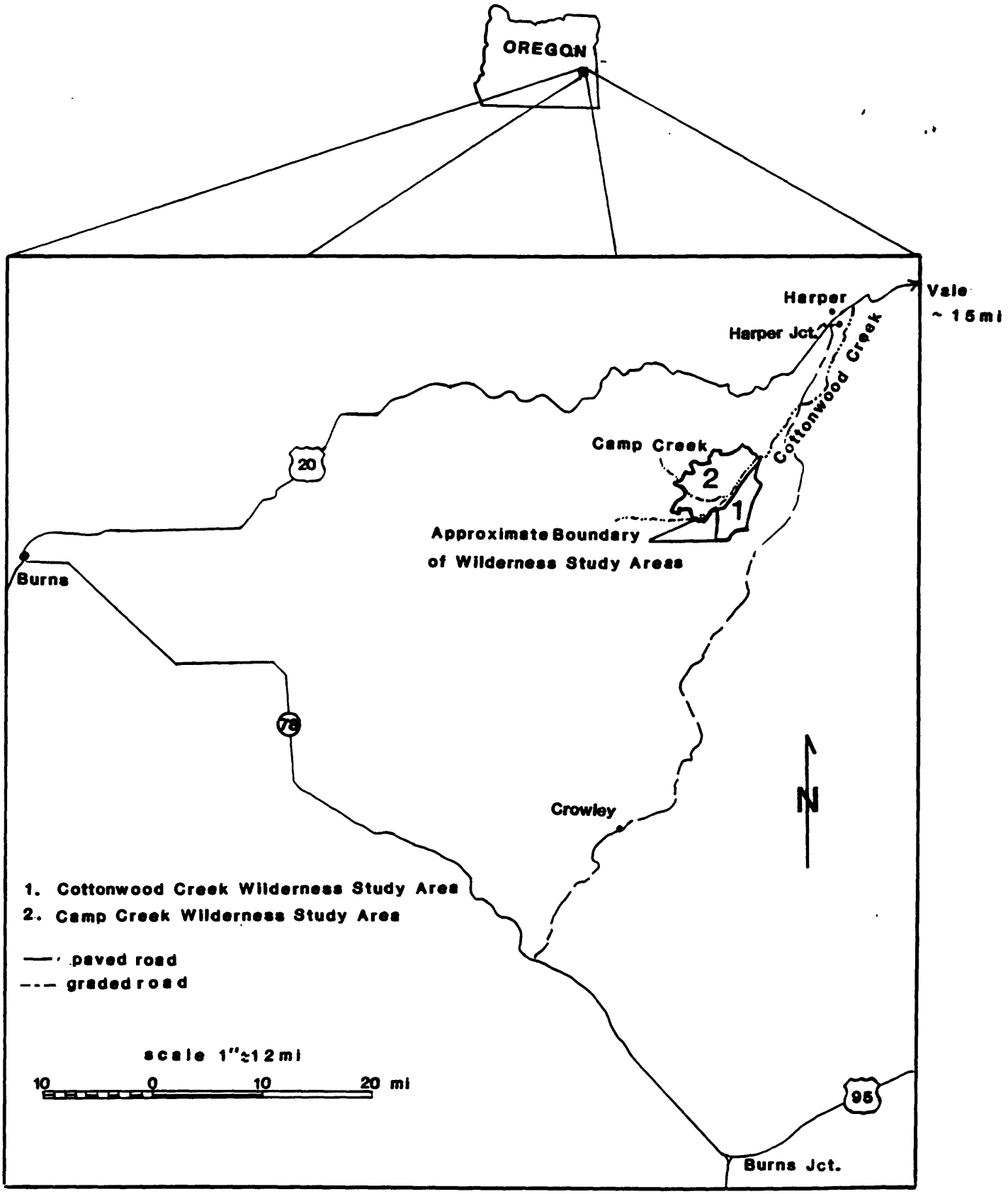

Figure 1. Location map of the Camp Creek and Cottonwood Creek Wilderness Study Areas, Malheur County, Oregon.

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

Heavy-mineral-concentrate and stream-sediment samples were collected at 20 sites in the Camp Creek Wilderness Study Area and at 11 sites in the Cottonwood Creek Wilderness Study Area. Rock samples were collected at 10 of the sites in Camp Creek area and at 7 in the Cottonwood Creek area. Sampling density was about one sample site per 1.6 square mile for stream sediments and heavy-mineral concentrates in the Camp Creek area and about one sample site per sq mi in the Cottonwood Creek area. Sample density for rock samples in the Camp Creek area was about one sample site per 3.17 square mile and in the Cottonwood Creek area about one sample site per 2.3 square mi.

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 map (plate 1).

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. Samples were collected from unaltered and\or altered and\or mineralized rocks.

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 air drying, 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.

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 Camp Creek and Cottonwood Creek are listed in tables 3-8.

Chemical methods

Samples from this study area were also analyzed by atomic absorption (AA) and by inductively coupled plasma-atomic emission spectroscopy (ICP). Rock and stream-sediment samples were analyzed for gold (Au) and mercury (Hg) using atomic absorption spectroscopy and rocks were analyzed for arsenic (As), antimony (Sb), zinc (Zn), bismuth (Bi), and cadmium (Cd) using inductively coupled plasma-atomic emission spectroscopy. For a more detailed summary of the chemical methods used on samples from the Camp Creek and Cottonwood Creek Wilderness Study Areas see table 2.

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 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 3-8 list the results of analyses for the samples of stream sediment, heavy-mineral concentrate, and rock, respectively. For the six tables, the data are arranged so that column 1 contains the USGS-assigned sample numbers. Samples from the Camp Creek will have the prefix CC and

samples from Cottonwood Creek will have the prefix CW. These numbers correspond to the numbers shown on the site location map (plate 1), however, the suffixes "H" and "R" have been deleted from the map to conserve space. Columns in which the element headings show the letter "s" below the element symbol are emission spectrographic analyses, and "icp" indicates inductively coupled plasma-atomic emission spectroscopy, 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. 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 3-8 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.

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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 values shown are the lower limits of determination assigned by the Grimes and Marranzino method. 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.]

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

TABLE 3. ANALYTICAL RESULTS OF STREAM-SEDIMENT SAMPLES COLLECTED FROM THE CAMP CREEK WILDERNESS STUDY AREA, 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	B-ppm s
86CC001	43 39 34	117 48 12	7	1.0	2.0	>1.0	1,500	N	N	N	20
86CC002	43 41 25	117 45 40	5	1.5	2.0	1.0	1,000	N	N	N	30
86CC003	43 40 58	117 45 5	5	1.0	1.5	1.0	1,000	N	N	N	30
86CC004	43 40 33	117 44 44	7	1.0	2.0	>1.0	1,000	N	N	N	20
86CC005	43 40 13	117 45 16	5	1.0	2.0	1.0	1,000	N	N	N	50
86CC006	43 39 51	117 45 48	5	1.0	2.0	1.0	1,500	N	N	N	20
86CC007	43 39 33	117 46 6	7	1.0	2.0	>1.0	1,500	N	N	N	30
86CC008	43 39 4	117 46 37	7	.7	2.0	>1.0	1,500	N	N	N	30
86CC009	43 38 59	117 46 45	10	1.0	1.5	1.0	5,000	N	N	N	20
86CC010	43 38 42	117 47 5	7	1.0	1.5	1.0	3,000	N	N	N	20
86CC011	43 38 13	117 47 28	10	2.0	2.0	1.0	5,000	N	N	N	30
86CC012	43 36 58	117 49 15	10	1.0	2.0	1.0	1,500	N	N	N	30
86CC013	43 36 46	117 49 41	5	1.0	1.5	1.0	1,000	N	N	N	20
86CC014	43 36 17	117 50 18	7	1.0	1.5	1.0	2,000	N	N	N	20
86CC015	43 36 13	117 50 54	7	1.0	1.5	1.0	2,000	N	N	N	20
86CC016	43 36 8	117 52 3	5	1.0	2.0	.7	1,000	N	N	N	50
86CC017	43 37 45	117 48 10	10	2.0	3.0	>1.0	1,500	N	N	N	20
86CC018	43 37 14	117 50 15	10	1.5	3.0	>1.0	5,000	N	N	N	10
86CC019	43 37 7	117 51 21	10	1.5	2.0	>1.0	2,000	N	N	N	20
86CC020	43 37 15	117 51 16	15	2.0	2.0	>1.0	2,000	N	N	N	50

TABLE 3. ANALYTICAL RESULTS OF STREAM-SEDIMENT SAMPLES COLLECTED FROM THE CAMP CREEK WILDERNESS STUDY AREA, OREGON--Continued

Sample	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	Ni-ppm s	Pb-ppm s
86CC001	700	2.0	N	N	30	50	50	50	5	20	30	15
86CC002	500	1.0	N	N	50	100	50	30	N	<20	50	15
86CC003	700	<1.0	N	N	30	30	50	30	5	<20	50	30
86CC004	1,000	1.5	N	N	20	50	50	50	5	20	20	30
86CC005	1,000	1.5	N	N	20	70	30	50	N	20	20	20
86CC006	1,000	1.5	N	N	30	50	50	50	5	20	20	30
86CC007	700	1.5	N	N	30	50	50	50	N	20	20	30
86CC008	1,000	1.5	N	N	30	50	50	50	N	20	20	30
86CC009	1,000	2.0	N	N	15	30	50	70	5	30	7	30
86CC010	1,000	2.0	N	N	20	20	30	50	<5	30	10	30
86CC011	1,000	2.0	N	N	15	50	30	70	5	20	15	50
86CC012	700	1.0	N	N	30	70	30	50	N	N	20	20
86CC013	700	1.0	N	N	20	15	70	50	5	20	7	30
86CC014	700	1.5	N	N	20	20	15	50	N	<20	7	20
86CC015	1,000	2.0	N	N	20	20	20	70	5	<20	7	20
86CC016	700	1.0	N	N	20	30	30	70	<5	N	10	30
86CC017	1,000	1.0	N	N	30	50	50	50	5	20	15	30
86CC018	1,000	1.0	N	N	30	20	30	70	<5	20	10	30
86CC019	1,500	2.0	N	N	20	50	50	100	7	20	20	50
86CC020	1,500	2.0	N	N	30	70	70	70	5	20	20	30

TABLE 3. ANALYTICAL RESULTS OF STREAM-SEDIMENT SAMPLES COLLECTED FROM THE CAMP CREEK WILDERNESS STUDY AREA, OREGON--Continued

Sample	Sb-ppm	Sc-ppm	Sn-ppm	Sr-ppm	V-ppm	W-ppm	Y-ppm	Zn-ppm	Zr-ppm	Th-ppm	Au-ppm	Hg-ppm
	a	s	s	s	s	s	s	s	s	s	aa	aa
86CC001	N	20	N	300	100	N	70	<200	200	N	<.1	.03
86CC002	N	20	N	200	100	N	50	<200	200	N	<.1	.02
86CC003	N	15	N	200	100	N	50	<200	200	N	<.1	<.02
86CC004	N	15	N	500	100	N	50	<200	200	N	<.1	<.02
86CC005	N	15	N	500	100	N	50	<200	200	N	<.1	.03
86CC006	N	20	N	200	100	N	70	<200	200	N	<.1	<.02
86CC007	N	20	N	300	100	N	70	<200	200	N	<.1	.02
86CC008	N	20	N	200	150	N	70	<200	200	N	<.1	.03
86CC009	N	15	N	200	70	N	150	<200	200	N	<.1	.02
86CC010	N	15	N	200	70	N	70	<200	200	N	<.1	<.02
86CC011	N	20	N	500	70	N	100	200	200	N	--	.04
86CC012	N	20	N	500	150	N	50	<200	200	N	<.1	<.02
86CC013	N	20	N	300	70	N	50	<200	200	N	<.1	<.02
86CC014	N	20	N	300	70	N	50	<200	200	N	<.1	.03
86CC015	N	15	N	500	100	N	70	<200	200	N	<.1	.02
86CC016	N	15	N	500	100	N	50	<200	200	N	<.1	<.02
86CC017	N	20	N	500	150	N	50	<200	200	N	<.1	.02
86CC018	N	20	N	500	150	N	50	<200	200	N	<.1	.03
86CC019	N	20	N	500	150	N	70	<200	200	N	<.1	.02
86CC020	N	30	N	500	200	N	70	200	200	N	<.1	<.02

TABLE 4. ANALYTICAL RESULTS OF HEAVY-MINERAL-CONCENTRATE SAMPLES COLLECTED FROM THE CAMP CREEK WILDERNESS STUDY AREA, 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
86CC001H	43 39 34	117 48 12	30	2.0	5.0	>2	>10,000	N	N	N
86CC002H	43 41 25	117 45 48	20	10.0	5.0	>2	>10,000	N	N	N
86CC003H	43 40 58	117 45 5	30	3.0	5.0	>2	>10,000	N	N	N
86CC004H	43 40 33	117 44 44	30	2.0	5.0	>2	10,000	N	N	N
86CC005H	43 40 13	117 45 16	20	5.0	5.0	>2	>10,000	N	N	N
86CC006H	43 39 51	117 45 48	30	3.0	5.0	>2	>10,000	N	N	N
86CC007H	43 39 33	117 46 6	50	3.0	5.0	>2	>10,000	N	N	N
86CC008H	43 39 4	117 46 37	50	3.0	5.0	>2	>10,000	N	N	N
86CC009H	43 38 59	117 46 45	50	2.0	5.0	>2	>10,000	N	N	N
86CC010H	43 38 42	117 47 5	20	1.5	3.0	>2	>10,000	N	N	N
86CC011H	43 38 13	117 47 28	50	2.0	5.0	>2	>10,000	N	N	N
86CC012H	43 36 58	117 49 15	20	5.0	7.0	>2	7,000	N	N	N
86CC013H	43 36 46	117 49 41	30	5.0	5.0	>2	>10,000	N	N	N
86CC014H	43 36 17	117 50 18	50	2.0	1.5	>2	>10,000	N	N	N
86CC015H	43 36 13	117 50 54	>50	1.5	3.0	>2	>10,000	N	N	N
86CC016H	43 36 8	117 52 3	50	7.0	5.0	>2	>10,000	N	N	N
86CC017H	43 37 45	117 48 10	30	5.0	5.0	>2	>10,000	N	N	N
86CC018H	43 37 14	117 50 15	50	2.0	3.0	>2	>10,000	N	N	N
86CC019H	43 37 7	117 51 21	20	5.0	5.0	>2	>10,000	N	N	N
86CC020H	43 37 15	117 51 16	30	5.0	5.0	>2	>10,000	N	N	N

TABLE 4. ANALYTICAL RESULTS OF HEAVY-MINERAL-CONCENTRATE SAMPLES COLLECTED FROM THE CAMP CREEK WILDERNESS STUDY AREA, 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	Pb-ppm s
86CC001H	100	2,000	3	N	N	50	100	70	150	10	100
86CC002H	100	1,000	2	N	N	70	200	70	50	<10	100
86CC003H	150	2,000	<2	N	N	50	300	100	70	10	100
86CC004H	100	700	<2	N	N	30	200	70	50	<10	100
86CC005H	70	1,500	<2	N	N	50	200	100	100	<10	70
86CC006H	70	2,000	3	N	N	50	150	100	70	<10	50
86CC007H	100	3,000	2	N	N	50	200	150	150	<10	70
86CC008H	100	3,000	3	N	N	50	100	100	200	10	50
86CC009H	100	5,000	5	N	N	50	50	100	200	<10	70
86CC010H	50	1,500	3	N	N	30	30	50	100	15	100
86CC011H	150	2,000	5	N	N	20	20	70	200	10	100
86CC012H	<20	1,000	<2	N	N	50	700	150	N	<10	N
86CC013H	70	1,500	2	N	N	50	200	150	200	<10	100
86CC014H	150	2,000	7	N	N	30	30	70	100	10	50
86CC015H	100	3,000	5	N	N	30	20	100	500	<10	100
86CC016H	100	1,000	<2	N	N	70	300	150	100	<10	70
86CC017H	150	2,000	3	N	N	70	200	100	200	<10	70
86CC018H	200	2,000	5	N	N	50	30	70	300	<10	50
86CC019H	70	1,000	2	N	N	50	300	70	150	<10	70
86CC020H	100	1,500	2	N	N	50	300	150	200	<10	<50

TABLE 4. ANALYTICAL RESULTS OF HEAVY-MINERAL-CONCENTRATE SAMPLES COLLECTED FROM THE CAMP CREEK WILDERNESS STUDY AREA, 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
86CC001H	50	<20	N	100	N	<200	100	N	500	500	1,000	N
86CC002H	100	<20	N	100	N	<200	100	N	150	<500	1,000	N
86CC003H	70	<20	N	100	N	<200	100	N	200	500	200	N
86CC004H	30	<20	N	150	N	<200	100	N	200	500	500	N
86CC005H	50	20	N	100	N	<200	200	N	200	<500	500	N
86CC006H	100	<20	N	100	N	<200	200	N	300	<500	300	N
86CC007H	30	<20	N	100	150	<200	150	N	200	700	500	N
86CC008H	100	<20	N	150	N	200	200	N	500	500	500	N
86CC009H	20	<20	N	100	N	300	150	N	700	<500	700	N
86CC010H	20	<20	N	50	N	<200	100	N	200	<500	1,000	N
86CC011H	30	<20	N	100	N	<200	150	N	700	500	700	N
86CC012H	100	<20	N	100	N	<200	500	N	70	N	700	N
86CC013H	50	<20	N	100	N	200	200	N	500	<500	700	N
86CC014H	15	<20	N	50	N	200	200	N	500	500	1,000	N
86CC015H	30	100	N	70	N	200	200	N	700	500	1,000	N
86CC016H	100	<20	N	100	N	200	300	N	500	N	1,000	N
86CC017H	50	N	N	70	N	200	200	N	200	<500	500	N
86CC018H	20	200	N	50	N	300	200	N	500	<500	500	N
86CC019H	70	<20	N	100	N	<200	200	N	200	<500	300	N
86CC020H	100	<20	N	100	N	<200	300	N	300	<500	500	N

TABLE 5. ANALYTICAL RESULTS OF ROCK SAMPLES COLLECTED FROM THE CAMP CREEK WILDERNESS STUDY AREA, 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	B-ppm s	Ba-ppm s
86CC002R	43 41 25	117 45 40	2.0	.10	.30	.5	300	N	N	N	10	1,000
86CC003R	43 40 58	117 45 5	1.5	.10	.30	.5	300	N	N	N	15	1,000
86CC005R	43 40 13	117 45 16	1.5	.20	.15	.2	500	N	N	N	10	1,000
86CC006R	43 39 51	117 45 48	5.0	.30	.50	.5	500	N	N	N	10	1,000
86CC008R	43 39 4	117 46 37	1.5	.15	.15	.1	150	N	N	N	50	1,000
86CC010R	43 38 42	117 47 5	15.0	3.00	5.00	>1.0	3,000	N	N	N	10	700
86CC011R	43 38 13	117 47 28	10.0	2.00	3.00	>1.0	2,000	N	N	N	10	500
86CC012R	43 36 58	117 49 15	10.0	3.00	7.00	>1.0	3,000	N	N	N	10	200
86CC014R	43 36 17	117 50 18	2.0	.50	1.00	.2	300	N	N	N	100	200
86CC017R	43 37 45	117 48 10	15.0	2.00	5.00	>1.0	2,000	N	N	N	10	700

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
86CC002R	2	N	N	<5	<10	5	100	5	30	5	30	N	10	N
86CC003R	2	N	N	<5	<10	7	100	20	30	5	50	N	10	N
86CC005R	2	N	N	<5	<10	5	70	<5	<20	5	30	N	10	N
86CC006R	2	N	N	<5	<10	7	100	5	20	5	50	N	15	N
86CC008R	2	N	N	<5	<10	5	100	<5	<20	5	30	N	7	N
86CC010R	<1	N	N	50	<10	30	50	<5	N	7	30	N	50	N
86CC011R	<1	N	N	50	<10	30	50	N	N	7	15	N	50	N
86CC012R	<1	N	N	50	150	150	N	N	N	50	<10	N	30	N
86CC014R	1	N	N	<5	<10	10	70	<5	20	5	50	N	10	N
86CC017R	<1	N	N	30	<10	20	100	N	N	5	20	N	50	N

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 instr	As-ppm icp	Bi-ppm icp	Cd-ppm icp	Sb-ppm icp	Zn-ppm icp
86CC002R	150	10	N	70	<200	700	N	<.1	<.02	<5	<2	<.1	<2	95
86CC003R	200	15	N	70	<200	700	N	<.1	<.02	9	<2	<.1	<2	120
86CC005R	150	150	N	50	<200	300	N	<.1	.02	6	<2	<.1	<2	95
86CC006R	200	<10	N	70	<200	500	N	<.1	<.02	<5	<2	<.1	<2	120
86CC008R	<100	15	N	100	<200	500	N	<.1	.08	<5	<2	<.1	<2	98
86CC010R	500	200	N	50	200	150	N	<.1	<.02	<5	3	<.1	<2	84
86CC011R	300	200	N	50	<200	200	N	<.1	<.02	<5	4	<.1	<2	82
86CC012R	500	150	N	50	<200	100	N	<.1	<.02	<5	2	<.1	<2	44
86CC014R	150	100	N	70	<200	200	N	<.1	<.02	<5	<2	<.1	<2	76
86CC017R	200	200	N	50	<200	200	N	<.1	<.02	<5	<2	<.1	<2	89

TABLE 6. ANALYTICAL RESULTS OF STREAM-SEDIMENT SAMPLES COLLECTED FROM THE COTTONWOOD CREEK WILDERNESS STUDY AREA, 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	B-ppm S
86CW001	43 39 41	117 45 49	7	1.5	1.5	>1	1,500	N	N	N	30
86CW002	43 38 59	117 46 29	10	1.5	1.5	>1	5,000	N	N	N	50
86CW003	43 36 57	117 48 58	10	1.0	2.0	>1	3,000	N	N	N	50
86CW004	43 35 17	117 49 32	10	1.0	2.0	>1	2,000	N	N	N	50
86CW005	43 35 31	117 49 28	10	1.0	2.0	>1	2,000	N	N	N	50
86CW006	43 36 31	117 47 18	10	1.5	3.0	>1	3,000	N	N	N	20
86CW007	43 36 28	117 47 26	7	1.0	1.5	1	2,000	N	N	N	50
86CW008	43 36 28	117 47 32	15	1.0	2.0	>1	5,000	N	N	N	70
86CW009	43 37 13	117 47 5	15	1.5	2.0	>1	3,000	N	N	N	50
86CW010	43 37 38	117 47 13	10	1.5	2.0	>1	5,000	N	N	N	50
86CW011	43 37 38	117 47 28	10	1.5	1.5	1	2,000	N	N	N	20

Sample	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	Ni-ppm S	Pb-ppm S
86CW001	1,000	2.0	N	N	20	50	50	50	N	N	15	30
86CW002	700	1.5	N	N	30	70	50	30	<5	N	20	50
86CW003	1,000	1.5	N	N	20	30	30	100	N	<20	10	30
86CW004	1,000	3.0	N	N	15	50	30	100	5	30	15	30
86CW005	1,000	2.0	N	N	20	20	50	100	7	20	15	30
86CW006	1,500	2.0	N	N	30	70	50	100	<5	<20	20	30
86CW007	1,000	1.5	N	N	20	50	30	100	N	<20	15	50
86CW008	1,500	2.0	N	N	15	70	30	100	5	30	15	50
86CW009	1,500	2.0	N	N	20	70	50	150	5	30	15	50
86CW010	1,500	2.0	N	N	15	20	30	100	5	20	15	50
86CW011	1,500	2.0	N	N	15	10	20	100	5	20	10	30

Sample	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	Au-ppm AA	Hg-ppm AA
86CW001	N	20	N	500	150	N	50	<200	200	N	<.1	.05
86CW002	N	20	N	300	150	N	50	<200	200	N	<.1	.03
86CW003	N	20	N	700	100	N	100	<200	300	N	<.1	.05
86CW004	N	20	N	500	100	N	150	<200	500	N	<.1	.03
86CW005	N	20	N	300	100	N	150	500	300	N	<.1	.03
86CW006	N	20	N	500	150	N	100	<200	300	N	--	.04
86CW007	N	15	N	300	100	N	70	<200	200	N	<.1	.03
86CW008	N	20	N	500	70	N	150	200	200	N	--	.03
86CW009	N	30	N	500	100	N	100	200	200	N	<.1	.04
86CW010	N	20	N	500	70	N	100	<200	300	N	--	.11
86CW011	N	15	N	200	100	N	100	<200	300	N	--	.03

TABLE 7. ANALYTICAL RESULTS OF HEAVY-MINERAL-CONCENTRATE SAMPLES COLLECTED FROM THE CUTTONWOOD CREEK WILDERNESS STUDY AREA, 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
P6CW001H	43 39 41	117 45 49	30	5.0	3	>2	>10,000	N	[illegible]	[illegible]
86CW002H	43 39 59	117 46 29	30	7.0	3	>2	>10,000	N	N	[illegible]
86CW003H	43 36 57	117 48 58	50	3.0	3	>2	>10,000	N	[illegible]	[illegible]
86CW004H	43 35 17	117 49 32	30	2.0	3	>2	>10,000	N	N	[illegible]
86CW005H	43 35 31	117 49 28	30	3.0	5	>2	>10,000	[illegible]	[illegible]	[illegible]
86CW006H	43 36 31	117 47 18	30	5.0	5	>2	>10,000	N	N	[illegible]
86CW007H	43 36 28	117 47 26	30	3.0	[illegible]	>2	>10,000	N	[illegible]	[illegible]
86CW008H	43 36 28	117 47 32	50	2.0	5	>2	>10,000	N	[illegible]	[illegible]
86CW009H	43 37 13	117 47 5	30	2.0	10	>2	10,000	N	[illegible]	[illegible]
86CW010H	43 37 38	117 47 13	30	2.0	7	>2	>10,000	N	[illegible]	[illegible]
86CW011H	43 47 38	117 47 20	50	1.5	5	>2	>10,000	N	[illegible]	N

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
86CW001H	100	3,000	<2	N	N	70	300	150	300	<10	70
86CW002H	70	5,000	2	N	N	100	200	150	70	<10	<50
86CW003H	200	2,000	5	N	N	30	50	70	100	<10	50
86CW004H	100	3,000	10	N	N	10	20	50	500	<10	50
86CW005H	100	3,000	7	N	N	15	50	70	200	<10	70
86CW006H	100	1,500	2	N	N	20	100	100	300	<10	70
86CW007H	70	1,000	2	N	N	30	50	100	200	<10	50
86CW008H	100	3,000	3	N	N	30	20	70	500	<10	50
86CW009H	70	300	<2	N	N	15	<20	50	70	<10	50
86CW010H	100	2,000	3	N	N	15	<20	50	100	<10	50
86CW011H	70	2,000	5	N	N	15	<20	50	150	<10	50

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
86CW001H	100	50	N	100	N	<200	200	N	200	<500	500	N
86CW002H	100	<20	N	70	N	<200	300	N	150	<500	500	N
86CW003H	20	<20	N	50	N	<200	200	N	300	<500	500	N
86CW004H	30	20	N	50	N	300	200	N	1,000	<500	1,500	N
86CW005H	30	30	N	150	N	300	200	N	700	<500	500	N
86CW006H	50	<20	N	100	N	200	200	N	300	500	500	N
86CW007H	50	50	N	150	N	200	150	N	200	<500	500	N
86CW008H	30	30	N	100	N	200	150	N	500	<500	300	N
86CW009H	15	<20	N	200	N	<200	50	N	200	<500	500	N
86CW010H	15	<20	N	150	N	200	100	N	300	500	200	N
86CW011H	15	<20	N	100	N	<200	100	N	500	<500	500	N

TABLE 8. ANALYTICAL RESULTS OF ROCK SAMPLES COLLECTED FROM THE COTTONWOOD CREEK WILDERNESS STUDY AREA, 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	B-ppm s	Ba-ppm s
86CW005R	43 35 31	117 49 28	3	.07	.2	.15	200	N	N	N	15	700
86CW006R	43 36 31	117 47 18	3	.30	.2	.20	500	N	N	N	15	1,000
86CW007R	43 36 28	117 47 26	3	.30	.3	.20	100	N	N	N	20	1,000
86CW008R	43 36 28	117 47 32	3	.20	.5	.20	500	N	N	N	15	1,000
86CW009R	43 37 13	117 47 5	3	.10	.5	.20	500	N	N	N	15	2,000
86CW010R	43 37 38	117 47 13	15	2.00	5.0	>1.00	1,000	N	N	N	<10	500
86CW011R	43 37 38	117 47 20	15	2.00	5.0	>1.00	2,000	N	N	N	<10	500

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
86CW005R	2.0	N	N	N	<10	<5	70	N	<20	5	30	N	7	N
86CW006R	1.5	N	N	N	<10	5	70	<5	20	5	50	N	10	N
86CW007R	1.5	N	N	N	<10	7	100	<5	30	5	50	N	10	N
86CW008R	2.0	N	N	N	<10	7	50	<5	20	5	50	N	10	N
86CW009R	1.5	N	N	N	<10	5	100	<5	20	5	50	N	10	N
86CW010R	<1.0	N	N	50	<10	15	N	N	N	7	15	N	30	N
86CW011R	1.0	N	N	50	<10	15	20	N	N	7	15	N	50	N

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 last	As-ppm icp	Bi-ppm icp	Cd-ppm icp	Sb-ppm icp	Zn-ppm icp
86CW005R	200	<10	N	50	<200	500	N	<.1	<.02	<5	<2	<.1	<2	150
86CW006R	200	<10	N	70	<200	500	N	<.1	<.02	<5	<2	<.1	<2	140
86CW007R	150	10	N	70	<200	500	N	<.1	<.02	<5	<2	<.1	<2	140
86CW008R	150	<10	N	50	<200	500	N	<.1	<.02	<5	<2	<.1	<2	140
86CW009R	200	10	N	70	<200	700	N	<.1	<.02	<5	<2	<.1	<2	87
86CW010R	200	200	N	30	<200	150	N	<.1	<.02	<5	<2	.2	<2	87
86CW011R	300	200	N	50	<200	150	N	<.1	<.02	<5	<2	<.1	<2	72