UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of stream-sediment and heavy-mineral-concentrate samples from the Malheur-Bluebucket Wilderness Study Area (OR-002-014), Harney County, Oregon

By

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Open-File Report 89-164

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1989

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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 Malheur River-Bluebucket Creek Wilderness Study Area (OR-002-014), Harney County, Oregon.

INTRODUCTION

In May 1985, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Malheur River-Bluebucket Creek Wilderness Study Area Harney County, Oregon.

The Malheur River-Bluebucket Creek Wilderness Study Area, Harney County, Oregon comprises about 5,560 acres (8.7 mi^2) in northeast Harney County, Oregon. The study area is about 35 mi northeast of Burns, Oregon (see fig. 1). The northern boundary of the study area follows the Malheur National Forest boundary while the eastern boundary encompasses Ploffit Table, and the western boundary Battle Mountain. The area comprises the lower canyon of Bluebucket Creek and part of the Malheur River. Access to the area is obtained by driving east on Highway 20 from Burns to the junction of Pine Creek Road and then north about 15 mi. Access may also be obtained through the town of Drewsey, off of Highway 20, before Drinkwater Pass. Access within the area is limited; only a few four-wheel-drive and pack trails exist.

The topographic relief in the study area ranges from 5,437 ft in the northwest to 4,000 ft on the Malheur River at the southern boundary. Vegetation is mixed pine and spruce, and cottonwoods and aspen, with sage on the mesas (Lovering, written commun., 1986).

The oldest rock exposed consists of Miocene basalt and andesite flows, and covers the northern half of the study area. The southwestern part of the area is largely covered by tuffs and tuffaceous sedimentary rocks of late Miocene to early Pliocene age which locally contain beds of white diatomite. Olivine basalt covers much of the southeast and some of the southwest as well (T.J. Lovering, 1986).

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.

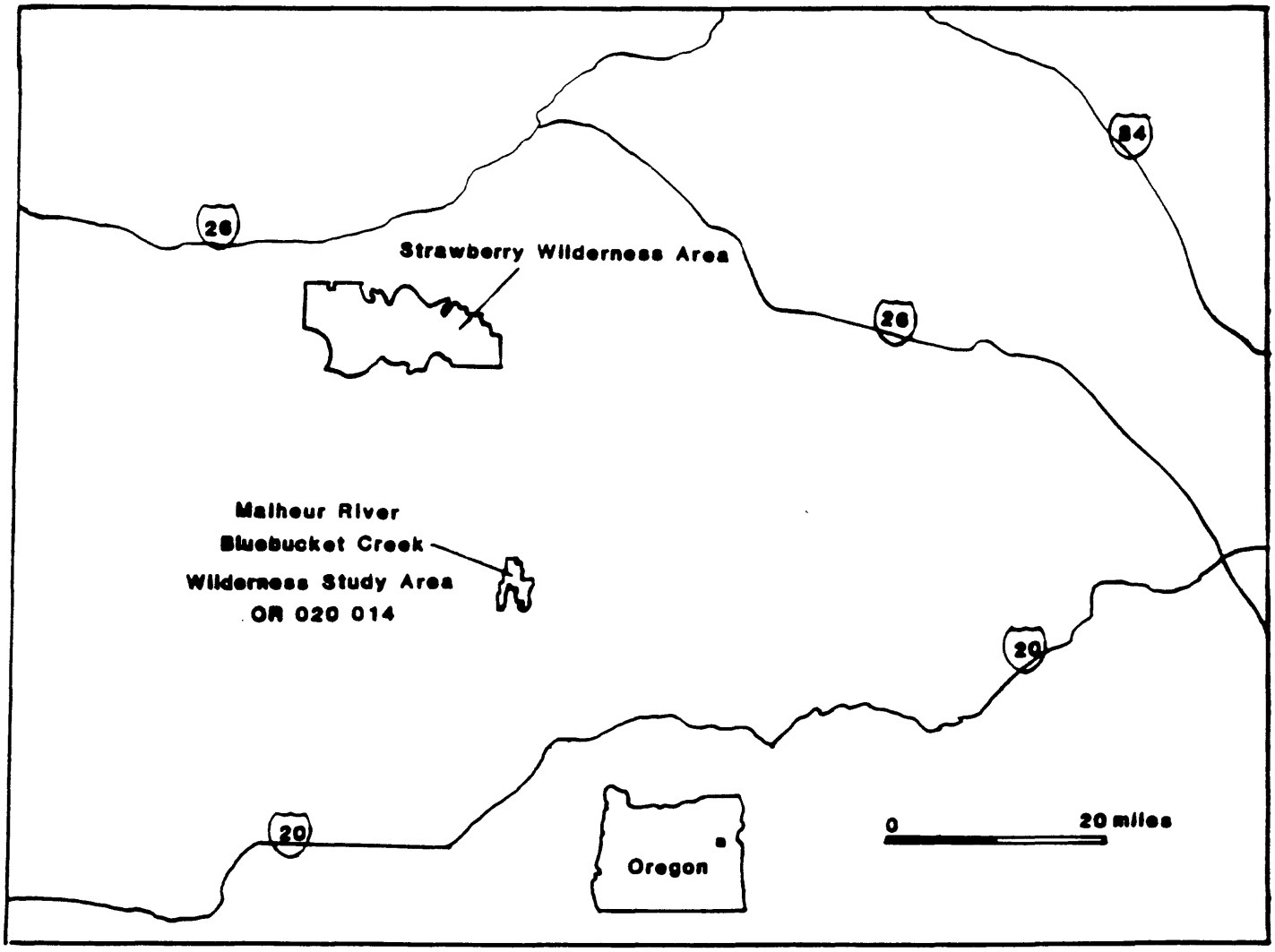

Figure 1. Index map of the location of the Malheur River-Bluebucket Creek Wilderness Study Area (OR-002-014), Harney County, Oregon.

Sample Collection

Heavy-mineral-concentrate and stream-sediment samples were collected at seven sites (fig. 2). No rock samples were collected. 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 map (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.

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. The analyses for heavy-mineral-concentrate samples were performed by analysts in the Branch of Exploration Geochemistry using the method of Grimes and Marranzino (1968). The elements analyzed and their lower

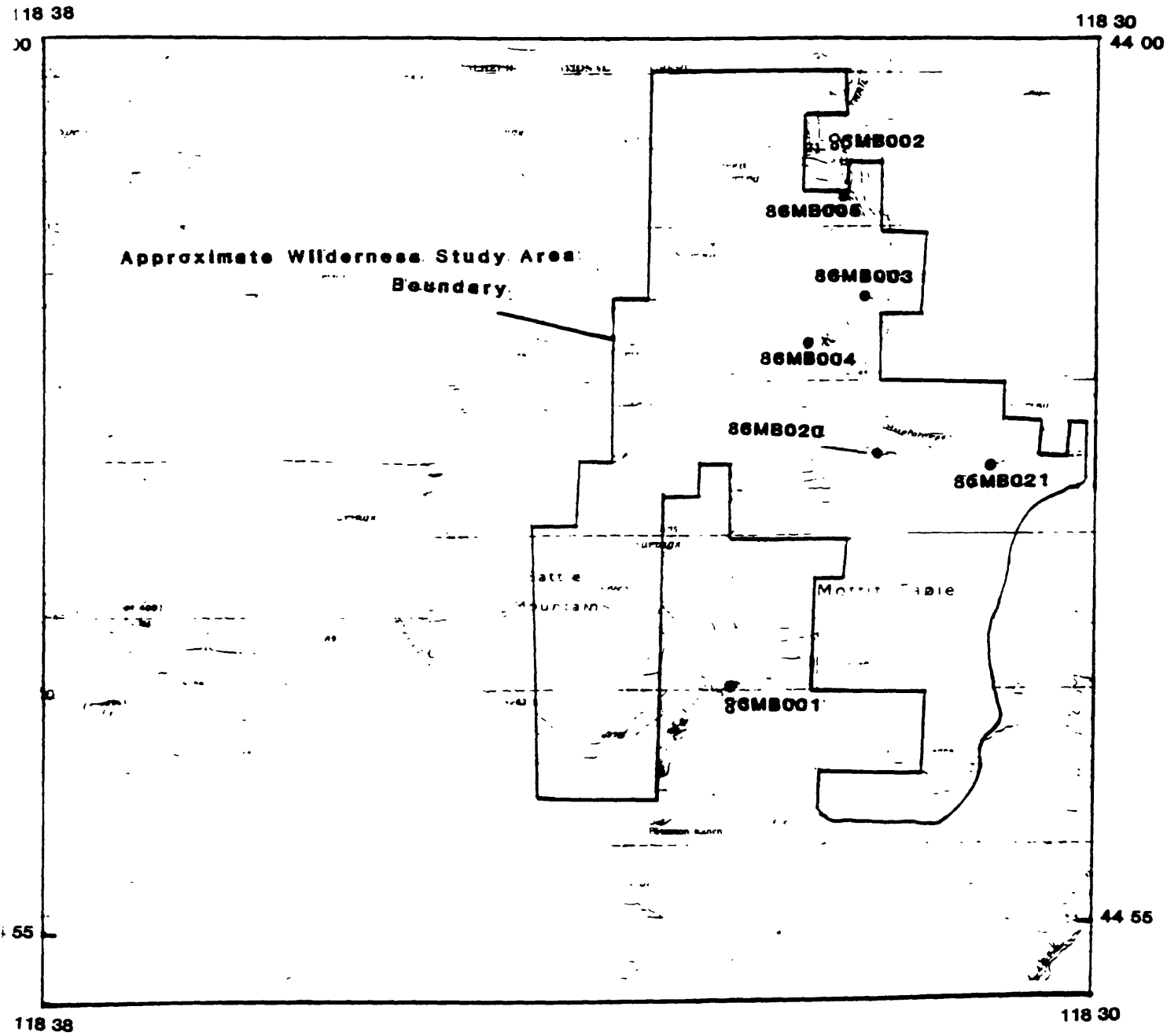

Figure 2. Localities of heavy-mineral-concentrate (C) and stream-sediment (S) samples from the Malheur River-Bluebucket Creek Wilderness Study Area, Harney County, Oregon.

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 Malheur River-Bluebucket Creek Wilderness Study Area are listed in tables 3 and 4.

Chemical methods

Other analytical methods used on samples from the Malheur River-Bluebucket Creek Wilderness Study Area are summarized in table 2.

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

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 (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 map (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. 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 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 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 in the collection and analyses of these samples: Robert L. Turner, Scott A. Minor, and Alonzo Love.

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TABLE 1.--Limits of determination for the spectrographic analysis of stream sediments and heavy-mineral concentrates, 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
	Part per million		
Manganese (Mn)	10		5,000
Silver (Ag)	0.5		5,000
Arsenic (As)	200	(700)	10,000
Gold (Au)	10	(15)	500
Boron (B)	10		2,000
Barium (Ba)	20		5,000
Beryllium (Be)	1		1,000
Bismuth (Bi)	10		1,000
Cadmium (Cd)	20	(30)	500
Cobalt (Co)	5		2,000
Chromium (Cr)	10		5,000
Copper (Cu)	5		20,000
Lanthanum (La)	20	(30)	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	(200)	2,000

TABLE 2.--Chemical methods used

[AA = atomic absorption]

Element or constituent determined	Sample type	Method	Determination limit (micrograms/ gram or ppm)	Reference
Gold (Au)	rock	AA	0.1	Modification of Thompson and others, 1968.
Mercury (Hg)	rock	AA	0.02	Koirtyohann and Khalil, 1976.

TABLE 3. Results of analyses of heavy-mineral concentrate samples from the Malheur-Bluebucket 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	B-ppm s	Ba-ppm s
86MB001H	43 56 20	118 32 57	20	20	10	>2	>10,000	N	N	N	20	200
86MB002H	43 59 20	118 32 5	20	10	5	>2	3,000	N	N	N	30	500
86MB003H	43 58 30	118 31 50	20	15	5	>2	2,000	N	N	N	100	500
86MB004H	43 58 20	118 32 10	20	10	5	>2	2,000	N	N	N	100	500
86MB005H	43 59 7	118 32 3	20	15	5	>2	3,000	N	N	N	30	300
86MB020H	43 57 41	118 31 45	15	15	5	>2	2,000	N	N	N	50	150
86MB021H	43 57 30	118 30 52	20	15	5	>2	2,000	N	N	N	50	150

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
86MB001H	<200	700	N	30	N	700	N	--	--	--	--	--	--	--
86MB002H	200	300	N	30	<500	300	N	--	--	--	--	--	--	--
86MB003H	200	300	N	50	<500	300	N	--	--	--	--	--	--	--
86MB004H	200	300	N	50	<500	300	N	--	--	--	--	--	--	--
86MB005H	200	200	N	50	N	500	N	--	--	--	--	--	--	--
86MB020H	200	200	N	70	N	500	N	--	--	--	--	--	--	--
86MB021H	200	200	N	70	N	500	N	--	--	--	--	--	--	--

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
86MB001H	<2	N	N	100	2,000	100	<50	<10	50	300	<20	N	100	N
86MB002H	<2	N	N	70	1,000	100	N	<10	50	150	N	N	70	N
86MB003H	<2	N	N	100	700	100	N	<10	<50	200	N	N	70	N
86MB004H	<2	N	N	100	1,000	100	N	<10	<50	200	N	N	100	N
86MB005H	<2	N	N	100	500	100	N	<10	50	100	N	N	100	N
86MB020H	<2	N	N	70	1,500	70	500	<10	50	300	N	N	100	N
86MB021H	<2	N	N	70	1,500	70	700	<10	70	200	N	N	100	N

TABLE 4. Results of analyses of stream-sediment samples from the Malheur-Bluebucket 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	P-ppm s	Pa-ppm s
86MB001	43 56 20	118 32 57	10	5.0	5.0	>1	2,000	N	N	N	30	1,000
86MB002	43 59 20	118 32 5	10	2.0	3.0	>1	2,000	N	N	N	50	1,000
86MB003	43 58 30	118 31 50	10	2.0	3.0	>1	2,000	N	N	N	50	1,000
86MB004	43 58 20	118 32 10	10	1.5	2.0	>1	1,000	N	N	N	50	1,000
86MB005	43 59 7	118 32 3	7	1.5	2.0	>1	3,000	N	N	N	50	700
86MB020	43 57 40	118 31 45	5	1.0	2.0	1	1,000	N	N	N	70	500
86MB021	43 57 30	118 30 52	5	1.0	1.5	>1	1,000	N	N	N	50	300

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
86MB001	1.0	N	N	50	300	70	50	N	N	70	10	N	30	N
86MB002	1.0	N	N	50	200	70	30	N	<20	50	15	N	20	N
86MB003	1.5	N	N	30	200	100	30	N	N	50	20	N	20	N
86MB004	1.5	N	N	30	150	70	30	N	N	50	20	N	20	N
86MB005	1.5	N	N	30	150	70	50	N	<20	50	15	N	20	N
86MB020	1.0	N	N	20	100	50	50	N	20	50	30	N	15	N
86MB021	1.0	N	N	20	100	50	50	N	20	50	20	N	15	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 aa	As-ppm aa	Bi-ppm aa	Cd-ppm aa	Sb-ppm aa	Zn-ppm aa
86MB001	500	200	N	50	<200	200	N	<.1	<.02	--	--	--	--	--
86MB002	500	200	N	50	<200	200	N	<.1	.03	--	--	--	--	--
86MB003	500	200	N	50	<200	200	N	<.1	.03	--	--	--	--	--
86MB004	500	200	N	50	<200	200	N	<.1	.03	--	--	--	--	--
86MB005	500	150	N	30	<200	200	N	.2	.03	--	--	--	--	--
86MB020	300	100	N	50	<200	200	N	--	.03	--	--	--	--	--
86MB021	300	100	N	50	<200	200	N	<.1	.03	--	--	--	--	--