

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

**Analytical results and sample locality map of stream-sediment
and heavy-mineral-concentrate samples from the
Snowbank Roadless Study Area, Valley and Gem Counties, Idaho**

By

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STUDIES RELATED TO WILDERNESS

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts requires the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands 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 Snowbank Roadless Study Area (RSA) in the Boise National Forest, Valley and Gem Counties, Idaho. The Snowbank Roadless Area was classified as a further planning area during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

INTRODUCTION

In August, 1990, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Snowbank Roadless Study Area, Valley and Gem Counties, Idaho.

The Snowbank Roadless Study Area comprises about 14.5 sq mi (37.8 km) along the southwest side of Valley County, and in the northern tip of Gem County, and lies about 4 mi (6.4 km) west of Cascade (see fig. 1). Access to the study area is provided on the east by several roads which lead off the gravel road that follows the western shore of Cascade Reservoir, and on the south to southwest by the road to the radio tower on Snowbank Mountain.

The study area is situated on a westward tilted fault block that is a part of a north-trending belt, about 30 mi (48 km) wide, of normal faults and monoclines coincident with the western border zone of the middle Cretaceous Idaho Batholith (Hamilton, 1962). Much of the study area is on the imposing east-facing scarp of the fault block. The study area is underlain in the southern half chiefly by hornblende gneiss, and in the northern half by grandiorite and quartz diorite gneiss of the Atlanta lobe of the Idaho batholith, which are overlain by Tertiary Columbia River Basalt along the western side of the study area (Mitchell and Bennett, 1979). Plutonic rocks of Cretaceous age in the Atlanta lobe of the Idaho batholith have been described by Kiilsgaard and Lewis (1985), and by Lewis and others (1987).

The topographic relief of the study area is about 2,300 ft (701 m), with a maximum elevation of about 8,320 ft (2,536 m) at the summit of Snowbank Mountain. The main topographic features of the study area are the north-south trending ridge which extends the length of the study area and the steep, and in places, very rugged east-facing slope. Somewhat parallel, northeast flowing streams have carved valleys in the eastern slope which increase in size and depth towards the southern end of the study area. Summers are warm and dry; most precipitation falls in winter as snow.

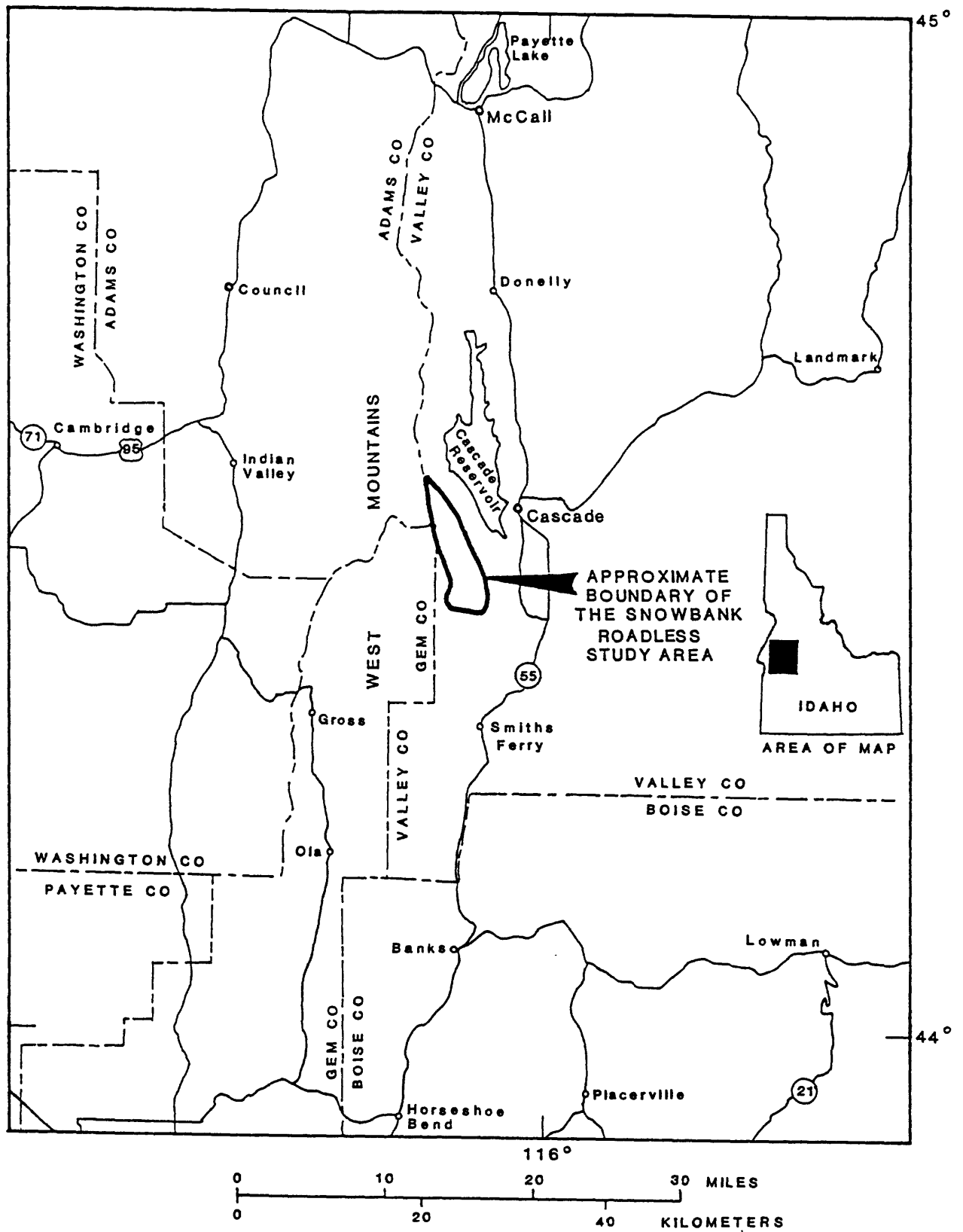


Figure 1. Location of the Snowbank Roadless Study Area, Valley and Gem Counties, Idaho.

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.

Sample Collection

Samples were collected at a total of 12 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 1.2 square miles. The area of the drainage basins sampled ranged from 0.3 to 5.5 square miles. Sufficient heavy-mineral-concentrate for spectrographic analysis (5 mg) was recovered from all sample sites.

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 center of the site symbol 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.

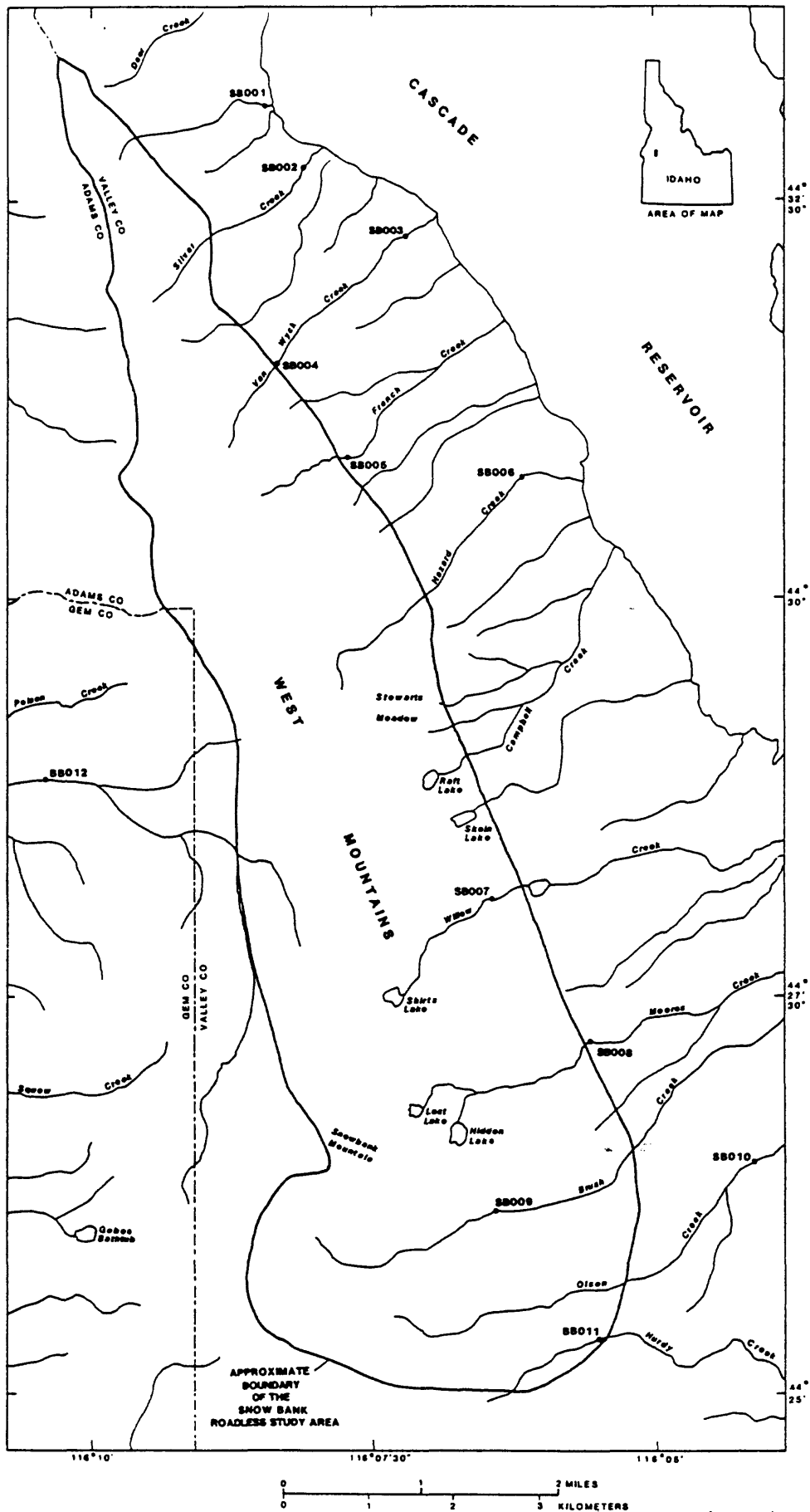


Figure 2. Localities of stream-sediment and heavy-mineral-concentrate samples from the Snowbank Roadless Study Area, Valley and Gem Counties, Idaho.

Samples that had been panned in the field were air dried and sieved to -35 mesh; 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 a 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.)

Sample Analysis

Spectrographic method

Stream-sediment and rock 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 those 35 elements plus platinum and palladium. 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, sodium, phosphorus, and titanium) are given in weight percent; all others are given in parts per million (micrograms/gram). Analytical data are listed in tables 3 and 4.

Other methods

The stream-sediment samples from the RSA were also analyzed by inductively coupled plasma atomic emission spectroscopy (ICP-AES) and atomic absorption spectroscopy (AA). Silver (Ag),

arsenic (As), gold (Au), bismuth (Bi), cadmium (Cd), copper (Cu), molybdenum (Mo), lead (Pb), antimony (Sb), and zinc (Zn) were analyzed by ICP (Motooka, 1988), and gold (Au) and mercury (Hg) were analyzed by AA. Limits of determination and references are listed in table 2. Analytical results using these methods are listed in table 3.

DATA STORAGE SYSTEM

Upon completion of all analytical work, the analytical results were entered into a U.S. Geological Survey computer data base called PLUTO. 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 these tables, the data are arranged so that column 1 contains the USGS-assigned sample numbers. These numbers correspond to the numbers shown on figure 2. Columns in which the element headings show the letter "s" following the element symbol indicate emission spectrographic analyses, "icp" indicates inductively couple plasma 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 (LLD) shown for that element in table 1. For emission spectrographic and AA 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. 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 the tables in place of the analytical value. Because of the formatting used in the computer program that produced the data tables, some of the elements listed in these tables (Fe, Mg, Ca, Ti, Ag, and Be) 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.

ACKNOWLEDGMENTS

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Table 1.--Limits of determination for spectrographic analyses of stream-sediment and heavy-mineral-concentrate samples from the Snowbank Roadless Study Area, Valley and Gem Counties, Idaho

[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, atomic absorption spectroscopy; ICP, inductively coupled plasma emission spectroscopy; ss, stream-sediment]

Element determined	Sample type	Method	LLD (PPM)	References
Silver (Ag)	ss	ICP	0.045	Motooka, 1988.
Arsenic (As)	do	do	0.6	
Gold (Au)	do	do	0.15	
Bismuth (Bi)	do	do	0.6	
Cadmium (Cd)	do	do	0.03	
Copper (Cu)	do	do	0.03	
Molybdenum (Mo)	do	do	0.09	
Lead (Pb)	do	do	0.6	
Antimony (Sb)	do	do	0.6	
Zinc (Zn)	do	do	0.03	
Gold (Au)	do	AA	0.05	Thompson and others, 1968; O'Leary and Meier, 1986.
Mercury (Hg)	do	AA	0.02	Koirttyohann and Khalil, 1976.

TABLE 3--ANALYTICAL RESULTS OF STREAM-SEDIMENT SAMPLES FROM THE SNOWBANK ROADLESS STUDY AREA, VALLEY COUNTY, IDAHO.

[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
SB001S	44 33 5	116 8 27	5	7	2	1.5	<.2	1	N	N	N
SB002S	44 32 43	116 8 7	7	5	3	2	N	.7	N	N	N
SB003S	44 32 15	116 7 12	3	5	2	2	N	.7	N	N	N
SB004S	44 31 27	116 8 21	5	5	2	1.5	N	1	N	N	N
SB005S	44 30 53	116 7 42	3	7	2	1.5	N	1	N	N	N
SB006S	44 30 45	116 6 11	1.5	5	1	2	<.2	1	N	N	N
SB007S	44 28 7	116 6 27	2	7	1.5	2	N	1	N	N	N
SB008S	44 27 12	116 5 35	5	5	1.5	2	<.2	1	N	N	N
SB009S	44 26 9	116 6 25	3	5	2	2	N	1	N	N	N
SB010S	44 26 27	116 4 9	2	5	1.5	2	<.2	.7	N	N	N

SB011S	44 25 20	116 5 29	2	5	1.5	2	N	1	N	N	N
SB012S	44 28 52	116 10 25	1.5	7	1.5	2	<.2	>1	N	N	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	Ga-ppm s	Ge-ppm s	La-ppm s	Mn-ppm s	Mo-ppm s
SB001S	N	500	<1	N	N	50	150	30	30	N	<50	1,000	N
SB002S	<10	500	<1	N	N	30	150	30	30	N	50	1,000	N
SB003S	N	500	<1	N	N	30	150	30	20	N	<50	1,000	N
SB004S	N	300	<1	N	N	30	200	50	20	N	<50	1,000	N
SB005S	N	300	<1	N	N	50	150	50	20	N	50	1,000	N
SB006S	<10	700	1	N	N	20	70	20	20	N	300	1,000	N
SB007S	10	700	<1	N	N	20	100	20	30	N	200	1,000	N
SB008S	<10	1,000	<1	N	N	20	70	7	30	N	300	1,500	N
SB009S	<10	700	<1	N	N	20	100	20	30	N	150	1,500	N
SB010S	<10	700	1	N	N	20	70	7	30	N	150	1,000	N

SB011S	<10	500	<1	N	N	20	100	10	30	N	200	1,500	N
SB012S	10	700	<1	N	N	20	100	20	30	N	700	1,500	N

Sample	Nb-ppm s	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
SB001S	<20	30	50	N	50	N	500	N	300	N	50	N	>1,000
SB002S	20	30	50	N	30	N	500	N	200	N	50	N	1,000
SB003S	<20	30	30	N	20	N	300	N	200	N	20	N	100
SB004S	<20	50	30	N	30	N	300	N	300	N	30	N	100
SB005S	<20	70	30	N	30	N	300	N	200	N	30	N	100
SB006S	30	15	30	N	15	N	500	100	100	N	50	N	700
SB007S	20	20	50	N	30	N	300	N	150	N	70	N	700
SB008S	20	7	50	N	50	N	500	100	150	N	100	N	1,000
SB009S	<20	20	50	N	30	N	500	<100	200	N	70	N	500
SB010S	<20	10	50	N	20	N	500	N	150	N	50	N	700

SB011S	<20	30	50	N	30	N	300	N	150	N	70	N	700
SB012S	20	20	50	N	20	N	500	150	150	N	100	N	700

Sample	Au-ppm aa	Hg-ppm aa	Ag-ppm icp	As-ppm icp	Au-ppm icp	Bi-ppm icp	Cd-ppm icp	Cu-ppm icp	Mo-ppm icp	Pb-ppm icp	Sb-ppm icp	Zn-ppm icp
SB001S	N	.02	N	N	N	N	.071	24	.19	8.6	N	53
SB002S	N	N	.046	N	N	N	.15	31	.2	6	N	55
SB003S	N	.02	N	N	N	N	.16	69	.26	7	N	76
SB004S	N	N	N	N	N	N	.14	75	.31	5.9	N	72
SB005S	N	N	N	N	N	N	.13	66	.32	6.3	N	73
SB006S	N	N	N	N	N	N	.078	7.5	.2	5.8	N	52
SB007S	N	N	N	N	N	N	.14	12	.57	6.9	N	54
SB008S	N	N	N	N	N	N	.11	4.9	.53	4.4	N	31
SB009S	N	N	N	1.1	N	N	.085	13	.61	5.3	N	50
SB010S	N	N	N	1.1	N	N	.094	4.2	.31	5.2	N	54

SB011S	N	N	N	.75	N	N	.086	8.3	.37	5.6	N	50
SB012S	N	N	N	1.4	N	N	.13	9.9	.46	8.3	N	58

TABLE 4--ANALYTICAL RESULTS OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE SNOWBANK ROADLESS STUDY AREA, VALLEY COUNTY, IDAHO.

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
S8001C3	44 33 5	116 8 27	10	.3	.2	N	7	>2	N	N	N	N
S8002C3	44 32 43	116 8 7	7	.5	1	N	5	>2	N	N	N	N
S8003C3	44 32 15	116 7 12	10	1.5	1.5	<.2	7	>2	N	N	N	N
S8004C3	44 31 27	116 8 21	10	2	2	.5	7	1.5	N	N	N	20
S8005C3	44 30 53	116 7 42	7	1.5	2	N	7	2	N	N	N	N
S8006C3	44 30 45	116 6 11	10	1	.5	<.2	10	>2	N	N	N	N
S8007C3	44 28 7	116 6 27	15	1	.5	1	10	2	N	N	N	N
S8008C3	44 27 12	116 5 35	15	.7	.3	1	7	1	N	N	N	N
S8009C3	44 26 9	116 6 25	15	.7	1	1	10	2	N	N	N	N
S8010C3	44 26 27	116 4 9	15	.7	.7	<.2	7	>2	N	N	N	N

S8011C3	44 25 20	116 5 29	15	.2	.5	1.5	7	1	N	N	N	N
S8012C3	44 28 52	116 10 25	20	.3	1	1	10	2	N	N	N	N

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
S8001C3	N	N	N	N	N	30	N	N	N	300	500	20	100
S8002C3	50	N	N	N	20	70	N	N	N	300	500	20	150
S8003C3	200	N	N	N	30	150	N	<10	N	700	700	10	100
S8004C3	3,000	N	N	N	20	200	<10	<10	N	1,000	700	N	70
S8005C3	70	N	N	N	N	200	N	N	N	1,000	500	N	50
S8006C3	150	N	N	N	N	50	N	<10	N	1,000	300	N	70
S8007C3	700	N	N	N	N	30	N	10	N	1,000	300	10	N
S8008C3	3,000	N	N	N	N	<20	N	10	N	700	500	<10	N
S8009C3	1,500	N	N	N	N	70	N	15	N	1,000	700	20	<50
S8010C3	2,000	N	N	N	N	50	N	<10	N	1,000	700	20	70
S8011C3	700	N	N	N	N	20	N	10	N	1,000	500	N	N
S8012C3	300	N	N	N	N	70	N	10	N	1,500	700	N	<50

Sample	Ni-ppm s	Pb-ppm s	Pd-ppm s	Pt-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
S8001C3	N	50	N	N	N	15	100	N	N	300	N	500	N	>2,000
S8002C3	N	30	N	N	N	15	70	N	N	200	N	500	N	>2,000
S8003C3	50	<20	N	N	N	20	70	N	N	300	N	500	N	>2,000
S8004C3	50	<20	N	N	N	50	N	200	300	300	N	300	N	>2,000
S8005C3	50	<20	N	N	N	50	N	N	300	200	N	300	N	>2,000
S8006C3	<10	<20	N	N	N	20	30	N	<200	150	100	500	N	>2,000
S8007C3	N	30	N	N	N	20	50	700	200	150	<50	500	N	>2,000
S8008C3	N	<20	N	N	N	20	N	700	<200	100	200	500	N	>2,000
S8009C3	N	50	N	N	N	30	N	700	500	150	500	700	N	>2,000
S8010C3	N	<20	N	N	N	20	70	500	N	300	N	500	N	>2,000
S8011C3	N	20	N	N	N	30	N	700	200	100	150	300	N	>2,000
S8012C3	N	30	N	N	N	50	70	700	300	150	<50	700	N	>2,000