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OPEN-FILE REPORT
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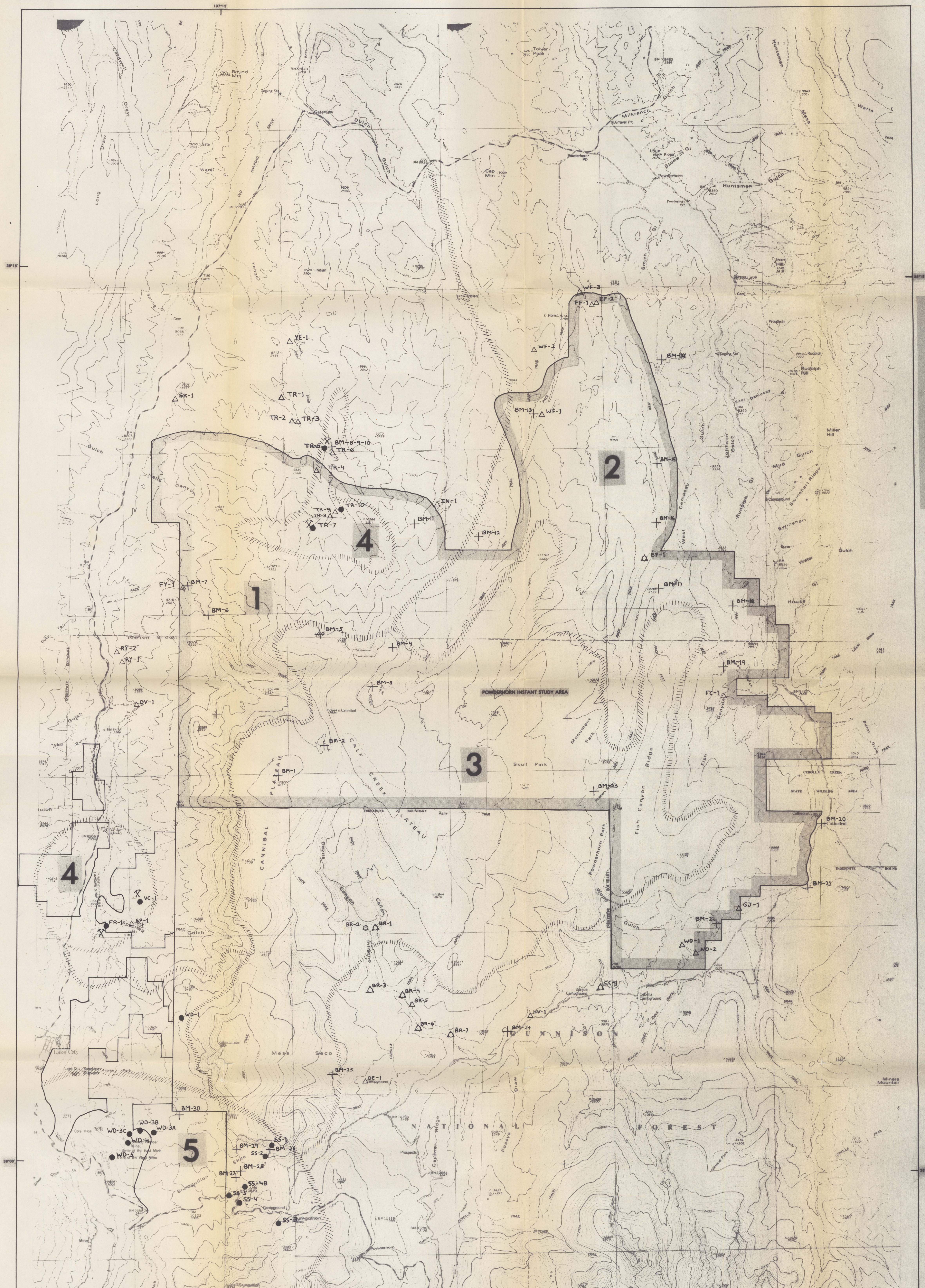
POWDERHORN INSTANT STUDY AREA, COLORADO
SHEET 2 OF 3



Base from U.S. Geological Survey County Map Series (Topographic)
Hinsdale Co. and Gunnison Co.

0 1 2 3 KILOMETERS
0 1 2 MILES
SCALE 1:50,000

Geochemical survey by W. N. Sharp, U.S. Geological Survey and
M.E. Lane, U.S. Bureau of Mines, July-August 1979

Map B–Geochemical terrane and sample map

MINERAL RESOURCES OF THE POWDERHORN INSTANT STUDY AREA, GUNNISON AND HINSDALE COUNTIES, COLORADO

by

William N. Sharp and R. A. Martin, U.S. Geological Survey
M. E. Lane, U.S. Bureau of Mines

1980

GEOCHEMICAL TERRANES

- (1) Older lavas and breccias, Tpl
- (2) Ash-flow tuff sheets, Taf
- (3) Flood basalt lava flows, Tbb
- (4) Intrusive Plugs, dikes and associated altered rocks, Tie and Til
- (5) Altered rock terrane

U.S. GEOLOGICAL SURVEY SAMPLE LOCALITIES

-Combined symbols indicate more than one type of sample-

- △ Stream-sediment sample
- ● Rock sample
- ○ Soil sample
- + U.S. BUREAU OF MINES SAMPLE LOCALITY
- ⚒ Prospect or mine site

Geochemical survey

By

William N. Sharp

More than 70 samples were collected for geochemical analyses in the Powderhorn Instant Study Area and adjacent areas (Map B), and were analyzed by semiquantitative spectrographic methods. Most samples were pan-concentrated stream-sediment samples. The heavy-mineral concentrates obtained are considered representative of the terrane drained by the streams sampled. A number of bedrock samples were also collected; most of these are from the highly altered terrane near Slumgullion Pass south and southwest of the study area where some mining and prospecting has been done in the past. A few soil samples were collected, to check the results from stream-sediment samples, and to test this technique as a possible evaluation tool in places where stream sediments are not available.

The areas sampled, including both the Powderhorn Instant Study Area and contiguous areas of interest, were divided into the following 5 terranes that differ largely in lithologic character (see Map B): Terrane 1, early lavas and breccias of andesitic composition (Map A, unit Tpl); Terrane 2, ash-flow tuff sheets of rhyolitic to quartz latitic composition (Map A, unit Taf); Terrane 3, flood basalt lava flows capping the high plateaus and ridges (Map A, unit Tbb); Terrane 4, highly altered rocks related to the Lake City and Uncompahgre calderas; and Terrane 5, intrusive plugs and dikes and the peripheral altered zones (Map A, units Tie, Til).

The tables of analytical data (tables 1-7) are organized according to the same 5 terrane scheme. Analytical data from pan concentrated stream-sediment samples were separated into magnetic and nonmagnetic fractions, which were analyzed separately. Rock samples were ground and analyzed without further concentration. Soil samples were dried and screened to separate -80 mesh material for analysis. None of the analytical results indicated any anomalous metal contents that would indicate proximity to mineral deposits.

Data from terrane 1, early lavas and breccias (Tpl) are shown on tables 1a and 1b. The nonmagnetic fraction of panned concentrated samples consists largely of Fe-bearing minerals such as opaque oxides, amphibole, and biotite. Most of these mineral grains are altered somewhat by weathering to hydrated Fe-Mn oxides and hematite. Certain metals commonly are absorbed from solution onto these hydrated oxides. In these samples Fe, ranges from 10 to 50 percent, indicating dominant hematite or limonite; Ti, ranges from 0.5 to 2 percent depending largely on the content of ilmenite; Mn, ranges from 1,500 to 3,000 ppm and is generally mixed with nonmagnetic Fe oxides; Co, Cr, Cu, Ni, are 200 ppm or less and are probably associated with the Fe-Mn oxides; and Zn, as much as 700 ppm, unevenly distributed and probably absorbed on Fe-Mn oxides.

In the magnetic fraction, the following observations are made: Fe, Ti, Mn, are significantly more abundant than in nonmagnetic fractions and show a common tendency for magnetite to be mixed with ilmenite and Mn oxides. Co, Cr, Cu, are generally comparable in abundance with the nonmagnetic fraction, suggesting no loss or gain on weathering. Cr varies somewhat locally, probably owing to differences in the composition of magnetite which contains Cr as an essential component. Ni, V, Zn, vary considerably in abundance but probably within normal limits to be expected in concentrates with high magnetite content. A few minimum values of Mo (10 ppm) have been detected, but these probably are not significant.

Data from terrane 2, ash-flow tuff sheets (Taf) are shown on tables 2a and 2b. The following observations are taken from both nonmagnetic and magnetic analyses. Because silicic rocks yield less hematite and hydrated oxides than intermediate-composition or mafic rocks, the Fe content is lower than found in terrain 1 areas. The elements Be, Nb are detectable components in these materials because of the silicic composition of the source rocks but the values are not anomalous. Local relatively high values of Zn and Pb (as much as 500 ppm Zn) were found but these are distributed unevenly. Zn probably is absorbed on clay minerals or Fe-Mn oxides.

Data from terrane 3, late flood basalt lava flows (Tbb) are shown on tables 3a and 3b. The dominant metals in these samples are Fe, Mn, and Ti reflecting the high content of minerals such as hematite, magnetite, and ilmenite.

Data from terrane 4, intrusive plugs and peripheral altered zones (Tie, Til) are shown on tables 4a and 4b. Stream-sediment samples from terrane 4 are analytically similar to samples from terrane 1 (Tpl). The nonmagnetic fractions are high in Fe and Mn, and contain lesser quantities of Co, Cr, Cu, Zn, and V. The magnetic fractions are rich in magnetite-ilmenite and high in Ti-magnetite grains. The high values (as much as 1,500 ppm) of Zn probably reflect Zn within the structural lattice of magnetite, as well as in separate phases. None of the values suggest any uncommon enrichment of metals.

Data from terrane 5, altered rock terrane are shown on table 5. Some ash-flow tuffs, lava flows, and volcanic sediments near Slumgullion Pass and Lake City were intensely altered by hydrothermal activity related to the Lake City and Uncompahgre calderas. The area includes the Golden Wonder, Belle of the West, Belle of the East, Monte Queen, Golden Fleece, Black Crook, and Cora mines. Alteration generally produced rocks composed of yellow, brown, and red clays stained with Fe oxides. Unaltered sanidine and quartz crystals make up the remainder of the altered rocks. Fissure veins contain Fe-Cu sulfides and Cu, As, and Sb sulfosalts containing both Au and Ag. Barite and quartz are common gangue minerals.

Altered rock samples are low in all metallic components. Even Fe ranges from less than 1 percent to no greater than 7 percent in the highly altered rocks. Sr and Ba show normal values because they occur in minerals of the alteration assemblage. Locally, Pb, Zn, Cu, and Mn in samples are as much as 1,000 ppm, probably due to proximity of metal-bearing veins; but, these anomalous areas are remote from the Powderhorn Instant Study Area.

Soil samples taken at a few places to check stream-sediment samples, or at places where stream-sediment samples could not be obtained, show no anomalous values (table 6).

Thirty samples of bedrocks and stream sediments were collected by the U.S. Bureau of Mines designated by BM prefix. Analytical results are shown on table 7. Twenty-three of these samples are within the Powderhorn Instant Wilderness Area; the remainder are from contiguous areas to the south. Semiquantitative spectrographic and fire assay results for Au and Ag showed no anomalous mineral values.

Table 1A.--Semiquantitative spectrographic analyses of stream sediment samples from terrane 1, representing early lavas and breccia, pan-concentrated, nonmagnetic fraction, Powderhorn Instant Study Area, Colorado

[Sample localities shown on Map B; N, not detected at limit of detection; L, detected but below limit of determination; G, major, greater than number shown in parentheses; Ag, As, Au, Bi, Cd, Sb, W, and Th were not detected]

Sample No.	Percent				Parts per million																		
	Fe	Mg	Ca	Ti	Mn	B	Ba	Be	Co	Cr	Cu	La	Mo	Nb	Ni	Pb	Sc	Sn	Sr	V	Y	Zn	Zr
TR-1B	30	2	1.5	2	2000	N	300	N	150	150	100	N	N	L	50	N	30	N	300	500	50	700	500
TR-2B	20	1.5	2	1.5	1500	N	300	N	70	150	50	N	N	N	50	N	20	N	500	500	20	500	100
TR-3B	20	2	2	1.5	2000	N	500	N	100	200	70	N	N	N	50	L	30	N	500	500	30	500	200
TR-4B	10	2	2	1	1500	L	700	N	50	30	30	N	N	N	20	N	20	N	500	200	30	L	150
TR-6B	30	1.5	1	G(2)	2000	20	500	N	100	200	70	N	N	50	70	100	20	100	300	700	30	700	200
SK-1B	10	1.5	2	.7	2000	L	500	N	30	50	30	N	N	N	20	N	15	N	700	200	20	N	200
YE-1B	15	2	2	1	2000	L	300	N	50	100	50	N	N	N	30	N	20	N	500	300	20	L	100
IN-1B	10	3	2	1	2000	L	700	N	50	100	50	N	N	N	30	N	30	N	700	200	30	L	150
FY-1B	10	3	3	.7	1500	L	500	N	50	30	20	N	N	N	20	N	30	N	700	200	50	N	100
RY-1B	10	1.5	2	.5	1500	L	1000	N	30	30	20	50	N	N	15	L	15	N	700	200	20	N	200
RY-2B	20	2	2	1.5	2000	20	1500	N	100	100	150	100	N	N	50	20	20	N	700	500	50	500	300
DV-1B	10	2	3	.5	1000	L	1000	N	30	20	20	50	N	N	30	N	20	N	700	150	50	N	300
WF-3B	20	1.5	2	1.5	1500	20	700	N	70	30	50	70	N	L	20	L	15	N	700	300	100	N	700
SP-1B	50	1	.7	2	3000	N	500	2	100	100	100	200	10	70	50	30	15	20	200	700	100	700	G(200)

Table 1B.--Semiquantitative spectrographic analyses of stream sediment samples from terrane 1, representing early lavas and breccia, pan-concentrated, magnetic fraction, Powderhorn Instant Study Area, Colorado

[Sample localities shown on Map B; N, not detected at limit of detection; L, detected but below limit of determination; G, major, greater than number shown in parentheses; Ag, As, Au, Bi, Cd, Sb, W, and Th were not detected]

Sample No.	Percent				Parts per million																		
	Fe	Mg	Ca	Ti	Mn	B	Ba	Be	Co	Cr	Cu	La	Mo	Nb	Ni	Pb	Sc	Sn	Sr	V	Y	Zn	Zr
TR-1A	50	1	.3	G(2)	3000	N	100	N	150	300	50	N	N	N	100	L	15	N	N	1000	20	1500	100
TR-2A	50	1	.3	G(2)	5000	N	150	N	150	300	50	N	N	N	100	L	15	N	N	1000	20	2000	150
TR-3A	50	1	.2	G(2)	2000	N	100	N	150	200	50	N	N	N	100	L	15	N	N	1000	20	1500	100
TR-4A	30	1.5	.7	2	2000	N	200	N	100	200	50	N	N	N	70	L	20	N	N	700	20	1500	100
TR-6A	50	.5	.2	G(2)	2000	N	150	N	100	300	20	N	N	N	100	L	15	N	N	1000	20	1500	150
SK-1A	50	1	.2	G(2)	5000	N	150	N	150	300	50	N	10	N	100	20	20	N	N	1000	20	1000	150
YE-1A	50	1.5	.2	G(2)	3000	N	100	N	150	500	50	N	N	N	150	L	20	N	N	1500	20	1500	100
IN-1A	50	1	.2	G(2)	3000	N	200	N	200	700	70	N	N	N	150	20	15	N	N	1500	30	2000	150
FY-1A	50	1	.5	G(2)	3000	N	300	N	150	300	50	N	N	N	100	50	20	N	N	1000	30	2000	150
RY-1A	50	.5	.2	G(2)	5000	N	100	N	100	150	50	N	N	N	70	L	10	N	N	1000	L	1500	200
RY-2A	50	.7	.2	G(2)	5000	N	100	N	150	300	70	N	N	N	100	20	15	N	N	1000	20	1500	200
DV-1A	50	.5	.3	G(2)	5000	N	70	N	100	100	50	50	N	N	50	N	15	N	N	1000	30	1500	500
WF-3A	50	.5	.3	G(2)	2000	N	150	N	150	100	50	N	N	N	50	L	15	N	N	1000	30	1500	200
SP-1A	50	.5	.3	G(2)	5000	N	150	N	150	150	70	70	10	50	100	20	15	N	N	1000	50	2000	700

Table 2A.--Semiquantitative spectrographic analyses of stream sediment samples from terrane, representing Ash-flow tuff sheets, pan-concentrated, nonmagnetic fraction, Powderhorn Instant Study Area, Colorado

[Sample localities shown on Map B; N, not detected at limit of detection; L, detected but below limit of determination; G, major, greater than number shown in parentheses; Ag, As, Au, Bi, Cd, Sb, W, and Th were not detected]

Sample No.	Percent				Parts per million																		
	Fe	Mg	Ca	Ti	Mn	B	Ba	Be	Co	Cr	Cu	La	Mo	Nb	Ni	Pb	Sc	Sn	Sr	V	Y	Zn	Zr
	Stream Sediment Samples																						
WO-1B	5	1	2	.5	700	L	1000	2	10	L	L	100	N	50	N	L	10	N	700	100	100	N	500
WO-2B	5	1	2	.7	700	L	1000	2	10	L	L	70	N	50	N	L	10	N	700	100	100	N	1000
BR-5B	7	2	3	.7	1500	L	1500	2	50	30	20	150	N	70	50	20	30	N	700	150	150	N	700
BR-7B	5	1.5	2	.5	700	L	1000	2	20	20	15	N	N	70	50	L	15	N	700	100	50	N	200
BR-4B	7	2	3	.5	1000	L	500	N	30	L	30	N	N	N	10	N	30	N	700	150	70	N	200
HV-1B	7	1	2	1	1000	L	1000	2	20	20	10	200	N	100	10	L	15	N	700	150	150	N	700
CC-1B	5	1	2	.5	1000	L	1000	2	10	20	15	100	N	L	N	L	15	N	700	100	100	N	300
FC-1B	15	1.5	2	1.5	2000	L	700	N	50	30	20	300	L	100	10	20	20	N	500	300	200	N	2000
EF-1B	7	1	2	2	1500	L	700	2	20	20	10	500	10	150	10	L	15	30	500	200	500	N	G(2000)
EF-2B	5	.7	2	2	1000	L	700	2	20	20	10	200	10	70	50	30	10	N	700	200	300	N	G(2000)
FF-1B	30	.3	1.5	2	1500	L	300	2	100	[illegible]	30	500	15	100	50	20	10	20	200	500	500	N	G(2000)
WF-1B	20	1.5	1	2	2000	L	200	N	100	70	70	200	N	50	30	N	15	N	200	500	150	500	G(2000)
WF-2B	15	1.5	1.5	1	2000	L	1000	N	50	20	70	50	N	N	10	L	15	N	700	300	50	N	500
WF-3B	20	1.5	2	1.5	1500	20	700	N	70	30	50	70	N	L	20	L	15	N	700	300	100	N	700
BR-3B	30	1.5	1	G(2)	2000	N	150	N	100	70	100	200	N	100	100	L	20	20	N	500	150	500	G(2000)
GJ-1B	7	2	2	.7	1500	L	700	2	30	L	10	200	N	L	N	L	50	N	700	150	100	N	1500
	Rock Samples																						
WF-2C	2	.7	1	.2	500	L	1000	1.5	10	L	15	50	N	N	L	20	7	N	500	50	20	N	100
FC-1C	5	1	1.5	.2	500	10	1500	1.5	10	10	15	50	N	N	5	20	10	N	500	100	N	20	100

Table 2B.--Semiquantitative spectrographic analyses of stream sediment samples from terrane, representing Ash-flow tuff sheets, pan-concentrated magnetic fraction, Powderhorn Instant Study Area, Colorado

[Sample localities shown on Map B; N, not detected at limit of detection; L, detected but below limit of determination; G, major, greater than number shown in parentheses; Ag, As, Au, Bi, Cd, Sb, W, and Th were not detected.

Sample No.	Percent				Parts per million																		
	Fe	Mg	Ca	Ti	Mn	B	Ba	Be	Co	Cr	Cu	La	Mo	Nb	Ni	Pb	Sc	Sn	Sr	V	Y	Zn	Zr
WO-1A	50	.7	.5	2	3000	N	300	N	100	100	50	100	10	L	30	20	15	N	N	1000	50	1000	1000
WO-2A	50	.3	.2	2	3000	N	100	N	100	100	15	50	N	L	30	L	10	N	N	1000	30	1500	1000
BR-5A	50	.5	.3	2	5000	N	70	N	100	150	30	50	N	N	50	20	10	N	N	700	50	2000	1000
BR-7A	50	.5	.5	2	5000	N	200	N	100	150	30	100	N	N	50	N	10	N	N	700	50	2000	700
BR-4A	50	.7	.3	2	5000	N	50	N	100	150	20	50	N	N	30	N	10	N	N	1000	30	2000	200
HV-1A	50	.7	.3	2	5000	N	200	N	150	150	30	70	N	N	30	20	10	N	N	1000	50	2000	1000
CC-1A	30	1	.5	2	5000	20	500	N	70	150	20	100	N	L	50	20	20	N	N	700	70	1000	700
FC-1A	50	.5	.3	2	5000	N	150	N	100	100	50	100	N	L	50	30	10	N	N	1000	70	2000	700
EF-1A	50	.5	.2	G(2)	3000	N	100	N	100	70	20	100	N	50	70	L	10	N	N	700	70	1500	1000
EF-2A	50	.5	.3	G(2)	3000	N	150	N	100	150	30	70	10	50	70	20	15	N	N	1000	50	2000	700
FF-1A	50	.2	.2	2	1500	N	50	N	100	100	30	50	10	L	50	L	N	N	N	700	30	700	1000
WF-1A	50	1	.3	G(2)	3000	N	100	N	150	150	30	N	N	N	70	L	15	N	N	1000	30	2000	200
WF-2A	50	1	.15	G(2)	2000	N	100	N	150	70	30	N	N	N	30	L	10	N	N	1000	N	2000	150
WF-3A	50	.5	.3	G(2)	2000	N	150	N	150	100	50	N	N	N	50	L	15	N	N	1000	30	1500	200
BR-3A	50	.7	.2	G(2)	3000	N	70	N	100	100	50	N	N	L	50	20	15	N	N	700	30	1500	700
GJ-1A	50	.5	.2	G(2)	5000	N	150	N	100	100	30	N	N	N	30	20	15	N	N	1000	30	2000	500

Table 3A.--Semiquantitative spectrographic analyses of stream sediment samples from terrane 3, representing late flood basaltic and andesitic lavas, pan-concentrated, nonmagnetic fraction, Powderhorn Instant Study Area, Colorado

[Sample localities shown on Map B; N, not detected at limit of detection; L, detected but below limit of determination; G, major, greater than number shown in parentheses; Ag, As, Au, Bi, Cd, Sb, W, and Th were not detected]

Sample No.	Percent				Parts per million																		
	Fe	Mg	Ca	Ti	Mn	B	Ba	Be	Co	Cr	Cu	La	Mo	Nb	Ni	Pb	Sc	Sn	Sr	V	Y	Zn	Zr
	Stream sediment samples																						
BR-1B	10	5	.2	.5	2000	20	1500	2	70	70	50	70	N	L	200	30	20	N	700	150	50	N	200
BR-2B	10	3	1.5	1	1000	20	700	N	50	50	30	100	N	70	200	20	20	N	500	200	150	N	1000
DE-1B	20	1.5	1.5	2	2000	20	700	2	70	20	70	300	N	150	50	20	20	N	500	300	100	500	1500
BR-5B	7	2	3	.7	1500	L	1500	2	50	30	20	150	N	70	50	20	30	N	700	150	150	N	700
BR-3B	30	1.5	1	G(2)	2000	N	150	N	100	70	100	200	N	100	100	L	20	20	N	500	150	500	G(2000)
	Rock samples																						
WD-1A	5	1.5	2	.7	700	L	1500	2	1.5	20	30	100	N	20	20	30	10	N	700	100	20	N	300
WD-1B	5	1.5	1.5	.5	1000	L	1500	2	15	20	20	150	5	30	20	20	10	N	700	150	30	N	300

Table 3B.--Semiquantitative spectrographic analyses of stream sediment samples from terrane 3, representing late flood basaltic and andesitic lavas, pan-concentrated, magnetic fraction, Powderhorn Instant Study Area, Colorado

[Sample localities shown on Map B; N, not detected at limit of detection; L, detected but below limit of determination; G, major, greater than number shown in parentheses; Ag, As, Au, Bi, Cd, Sb, W, and Th were not detected]

Sample No.	Percent				Parts per million																		
	Fe	Mg	Ca	Ti	Mn	B	Ba	Be	Co	Cr	Cu	La	Mo	Nb	Ni	Pb	Sc	Sn	Sr	V	Y	Zn	Zr
BR-1A	7	2	2	1	1000	L	1500	2	30	70	30	50	N	L	70	L	10	N	700	200	20	N	300
BR-2A	50	.5	.2	2	5000	N	50	N	100	100	15	50	N	N	30	L	15	N	N	700	50	2000	700
BR-5A	50	.5	.3	2	5000	N	70	N	100	150	30	50	N	N	50	20	10	N	N	700	50	2000	1000
DE-1A	50	1	.2	G(2)	3000	N	150	N	150	50	30	100	N	150	200	L	15	N	N	1000	30	2000	500
BR-3A	50	.7	.2	G(2)	3000	N	70	N	100	100	50	N	N	L	50	20	15	N	N	700	30	1500	700
BR-5A	50	.5	.3	2	5000	N	70	N	100	150	30	50	N	N	50	20	10	N	N	700	50	2000	1000

Table 4A.--Semiquantitative spectrographic analyses of stream sediment and rock samples from terrane 4 representing early and late intrusives, pan-concentrated, nonmagnetic fraction, Powderhorn Instant Study Area, Colorado

[Sample localities shown on Map B; N, not detected at limit of detection; L, detected but below limit of determination; G, major, greater than number shown in parentheses; Ag, As, Au, Bi, Cd, Sb, W, and Th were not detected]

Sample No.	Percent				Parts per million																		
	Fe	Mg	Ca	Ti	Mn	B	Ba	Be	Co	Cr	Cu	La	Mo	Nb	Ni	Pb	Sc	Sn	Sr	V	Y	Zn	Zr
	Stream Sediment Samples																						
TR-3	20	2	2	1.5	2000	N	500	N	100	700	70	N	N	N	50	L	30	N	500	500	30	500	200
TR-4	10	2	2	1	1500	L	700	N	50	30	30	N	N	N	20	N	20	N	500	500	50	L	150
TR-6	30	1.5	1	G(2)	2000	20	500	N	100	200	70	N	N	50	70	100	20	100	300	700	30	700	200
TR-8	20	2	1.5	1	2000	20	1500	N	70	100	50	N	N	N	30	L	20	N	700	200	30	500	300
TR-9	20	3	2	1.5	2000	N	200	N	100	70	50	70	N	N	50	N	30	N	300	300	30	700	100
	Rock Samples																						
FR-1	2	.1	.05	.3	70	20	1000	1	N	20	10	20	N	N	5	20	7	N	150	70	15	N	100
TR-7A	3	.5	.05	.3	70	30	500	1	10	30	20	50	N	L	7	20	10	N	500	100	20	N	150
TR-7B	5	.03	.15	.2	100	10	1500	L	10	50	30	50	5	N	15	70	5	N	1000	70	10	N	100
TR-7C	5	2	2	.5	1000	L	1000	1	20	50	50	30	N	N	20	20	15	N	700	100	20	N	150
TR-10	5	1.5	2	.5	700	L	1000	1	30	50	50	50	N	N	20	15	15	N	1000	150	30	N	150
VC-1	5	.03	L	.2	100	10	200	1.5	7	15	30	20	15	N	7	L	10	N	100	70	10	N	100
TR-5	5	.7	1.5	.5	1000	10	2000	1	30	10	50	50	N	L	15	20	10	N	1000	100	20	N	200

Table 6.--Semiquantitative spectrographic analyses of screened soil samples taken along selected drainages, Powderhorn Instant Study Area, Colorado

[Sample localities shown on Map B; N, not detected at limit of detection; L, detected but below limit of determination; G, major, greater than number shown in parentheses; Ag, As, Au, Bi, Cd, Sb, W, and Th were not detected]

Sample No.	Percent				Parts per million																
	Fe	Mg	Ca	Ti	Mn	Ag	B	Ba	Be	Co	Cr	Cu	La	Nb	Ni	Pb	Sc	Sr	V	Y	Zr
BR-1C	5	1	1	.5	700	1	15	700	2	20	50	30	50	L	50	20	10	300	100	20	200
BR-2C	3	.7	.7	.2	500	N	15	500	3	10	30	30	50	L	20	20	7	200	70	20	150
BR-3C	5	.7	1	.5	700	N	15	700	2	15	20	20	50	L	10	20	7	300	100	20	300
BR-6C	3	.5	.7	.3	700	N	20	700	2	7	30	20	70	20	10	30	5	200	70	20	300
BR-7C	5	.7	.5	.3	500	N	20	1000	5	15	100	30	50	20	20	30	7	200	100	30	300
TR-3C	7	1	1.5	.3	2000	N	20	1000	2	30	30	30	30	L	15	15	10	500	150	20	300
CC-1C	3	.7	1	.2	2000	N	15	700	2	15	20	20	50	L	15	20	7	300	70	20	300
EF-1C	2	.7	1	.3	500	N	20	700	2	10	30	20	50	L	10	20	7	300	70	30	300

Table 7.--Semiquantitative spectrographic and fire assay analyses of stream sediment and rock samples taken by the U.S. Bureau of Mines, Powderhorn Instant Study Area, Colorado

[Sample localities shown on Map B; --, not detected in fire assay; Tr, trace amount in fire assay; As, Be, Bi, Cd, La, Li, Mo, Nb, P, Pd, Pt, Sb, Sc, Sn, Ta, Te, and Y were not detected]

Sample No.	OZ\TON		Percent																
	Au	Ag	B	Ba	Co	Cr	Cu	Fe	Ga	K	Mg	Mn	Ni	Pb	Sr	Ti	V	Zn	Zr
BM-1	—	—	<.003	.1	<.002	<.002	<.0006	6	<.0003	<1	2	.1	.004	.01	.03	.4	.02	.01	.01
BM-2	—	0.2	<.005	.1	<.001	<.0008	<.0006	4	<.0003	<.9	2	.1	.004	<.007	.03	.3	.01	.02	.003
BM-3	—	0.2	<.007	.07	<.001	<.0008	<.0006	3	<.0002	4	1	.1	.001	.06	.01	.2	<.005	.007	<.003
BM-4	—	0.2	<.006	.1	<.001	<.002	.0009	5	<.0002	<2	1	.2	.003	.02	.06	.2	<.005	.01	<.003
BM-5	—	0.1	<.005	.06	<.002	<.001	<.0009	5	<.0003	<.9	2	.2	.002	.02	.03	.2	<.007	.03	<.004
BM-6			<.007	.02	<.003	.005	<.0006	4	.002	4	1	.06	.002	.02	.05	3	.02	<.0009	.01
BM-7			<.005	.2	<.001	<.0008	<.0006	8	<.0004	6	.9	.2	<.001	<.002	.08	.4	<.005	<.003	<.003
BM-8			<.005	.2	<.001	<.0008	<.0006	7	<.0003	5	.7	.1	<.001	<.002	.1	.4	<.005	<.0002	<.003
BM-9			<.005	.2	<.001	<.0008	<.0006	6	<.0004	5	.6	.03	.001	<.002	.3	.3	<.005	<.001	<.003
BM-10			<.005	.2	<.002	.003	.0006	7	.002	6	2	.2	.003	<.002	.1	.5	.03	.01	.009
BM-11			.009	.1	<.001	<.0009	<.0006	6	.002	3	1	.2	.001	<.002	.08	.2	<.009	.01	.004
BM-12	—	0.3	<.004	.1	<.001	<.0008	<.0006	5	<.0002	<2	1	.2	.002	.01	.07	.2	<.005	.009	<.003
BM-13			.009	.08	<.001	<.0008	<.0006	4	<.0009	3	1	.2	<.0007	<.002	.03	.2	<.008	.007	<.003
BM-14	—	0.1	<.006	.06	<.001	<.001	<.0006	2	<.0002	5	.5	.09	.001	.01	.002	<.05	<.005	.002	<.003
BM-15			<.007	.04	<.001	<.0008	<.0006	4	<.0002	4	.5	.06	<.0006	<.002	.02	.1	<.005	.005	<.003
BM-16			.01	.1	<.001	<.0008	.003	6	<.0005	4	.6	.09	<.0007	<.003	.04	.2	<.005	.02	<.003
BM-17																.6			
BM-18			<.007	.1	<.001	<.0008	<.0006	6	<.0002	7	.7	.05	.001	<.002	.04	.2	<.005	<.0005	<.003
BM-19			.009	.07	<.001	<.0008	<.0006	5	<.0003	3	.6	.1	<.0005	<.002	.03	.2	<.005	.006	<.003
BM-20			<.003	.09	<.001	<.001	<.0006	7	<.0005	3	1	.03	.001	<.002	.04	.3	<.006	<.001	<.003
BM-21			.01	.04	.004	.006	.002	4	.002	5	.3	.07	.003	<.005	.0008	.2	.02	<.0003	.009
BM-22			<.008	.1	<.001	<.0008	.0009	5	<.0004	4	.9	.08	<.0007	<.002	.04	.2	<.005	.008	<.003
BM-23																.01			
BM-24	—	—	<.02	.02	.005	.04	.001	>10	<.002	<.6	1	>2	<.02	<.002	.002	>10	.3	.07	.6
BM-25	—	—	<.01	.02	.01	<.002	.003	>10	.004	<1	2	.8	<.02	<.002	.002	>10	.2	.1	.4
BM-26	Tr	—	<.01	.1	<.002	<.001	.002	4	<.0003	<3	.05	.006	<.0009	<.002	.05	.6	<.02	.003	<.004
BM-27	Tr	—	<.006	.1	<.001	<.0008	.002	5	<.0004	<.6	.01	.007	<.0007	<.002	.1	.3	<.005	.001	<.003
BM-28	Tr	Tr	<.008	.04	<.001	<.0008	<.0006	4	<.0002	<.1	.7	.01	.001	<.002	.03	.3	<.005	.001	<.003
BM-29	Tr	0.1	<.008	.03	<.001	<.0008	.0006	6	<.0002	<.6	1	.2	.002	<.002	.006	.3	<.01	.01	<.003
BM-30	Tr	—	.009	.05	<.001	<.0008	<.0006	3	<.0002	5	1	.03	.001	<.002	.001	.1	<.005	.005	<.003

Table 4B.--Semiquantitative spectrographic analyses of stream sediment samples from terrane 4 representing early and late intrusives pan-concentrated, magnetic fraction, Powderhorn Instant Study Area, Colorado

[Sample localities shown on Map B; N, not detected at limit of detection; L, detected but below limit of determination; G, major, greater than number shown in parentheses; Ag, As, Au, Bi, Cd, Sb, W, and Th were not detected]

Sample No.	Percent				Parts per million																		
	Fe	Mg	Ca	Ti	Mn	B	Ba	Be	Co	Cr	Cu	La	Mo	Nb	Ni	Pb	Sc	Sn	Sr	V	Y	Zn	Zr
TR-3	50	1	2	G(2)	2000	N	100	N	150	200	50	N	N	N	100	L	15	N	N	1000	20	1500	100
TR-4	30	1.5	.7	2	2000	N	200	N	100	200	50	N	N	N	70	L	20	N	N	700	20	1000	100
TR-6	50	.5	.2	G(2)	2000	N	150	N	100	300	20	N	N	N	100	L	15	N	N	1000	20	1500	150
TR-8	50	1	.3	G(2)	3000	N	150	N	150	300	50	N	N	N	100	20	15	N	N	750	20	1500	150
TR-9	50	1.5	.2	G(2)	3000	N	100	N	150	200	50	N	N	N	100	L	15	N	N	1000	L	1500	100

Table 5A.--Semiquantitative spectrographic analyses of whole rock samples from terrane 5, representing rocks from altered areas, Powerhorn Instant Study Area, Colorado

[Sample localities shown on Map B; N, not detected at limit of detection; L, detected but below limit of determination; G, major, greater than number shown in parentheses; Ag, As, Au, Bi, Cd, Sb, W, and Th were not detected]

Sample No.	Percent				Parts per million																		
	Fe	Mg	Ca	Ti	Mn	B	Ba	Be	Co	Cr	Cu	La	Mo	Nb	Ni	Pb	Sc	Sn	Sr	V	Y	Zn	Zr
SS-1	1	.02	.05	.2	30	N	1000	N	N	10	50	N	N	N	N	20	5	N	500	70	N	N	100
SS-2	3	1.5	.2	.3	2010	10	500	1	5	10	15	30	N	N	N	15	15	N	150	100	20	N	150
SS-3	2	.7	.1	.2	300	10	1000	2	N	N	L	30	N	N	N	15	7	N	100	50	20	N	150
SS-4A	7	.3	.5	.2	200	L	700	1	N	L	70	20	N	N	N	15	10	N	300	70	20	N	100
SS-4B	.7	.2	.07	.5	30	30	700	1.5	N	N	5	50	L	L	N	50	10	N	500	70	20	N	200
SS-5	.7	1	.05	.5	150	100	200	1	N	N	5	50	N	L	N	10	15	N	N	100	30	N	150
WD-3A	.2	.02	L	.05	20	.5	70	N	N	N	20	20	N	N	N	50	N	N	100	N	N	N	100
WD-3B	.2	.02	L	.05	20	.5	N	N	N	N	10	20	N	L	N	30	N	N	N	N	N	N	100
WD-3C	1	L	L	.05	70	1.5	N	1	N	10	20	N	L	N	5	50	N	N	100	N	N	N	70
WD-4A	1	.15	L	.07	100	10	20	2	N	10	30	20	N	L	L	200	5	N	N	L	10	N	70
WD-5A	1.5	.02	L	.1	50	15	1000	1.5	N	N	300	50	N	L	N	1500	7	N	150	N	20	500	150
BR-4C	5	1.5	2	.5	1000	10	2000	1.5	15	10	200	50	N	N	L	50	10	N	700	100	30	N	150
TR-7B	5	.03	.15	.2	100	10	1500	L	10	50	30	50	5	N	15	70	5	N	1000	70	10	N	100
TR-7C	5	2	2	.5	1000	L	1000	1	20	50	50	30	N	N	20	20	15	N	700	100	20	N	150

Table 5B.--Semiquantitative spectrographic analyses of whole rock samples from terrane 5, representing mineralized rocks and ore rocks, Powderhorn Instant Study Area, Colorado

[Sample localities shown on Map B; N, not detected at limit of detection; L, detected but below limit of determination; G, major, greater than number shown in parentheses; Ag, As, Au, Bi, Cd, Sb, W, and Th were not detected]

Sample No.	Percent	Parts per million																				
	Fe	Mn	Ag	As	Au	Ba	Bi	Cd	Cu	La	Mo	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y	Zn	Zr
VC-1	5	100	.7	2000	IN	200	N	N	30	20	15	N	7	L	N	10	N	100	70	L	10	N	100
WD-4B	3	70	3	N	IN	100	N	N	200	50	L	N	5	2000	500	L	N	700	10	N	N	1500	70
WD-4C	10	15	70	2000	1100	300	70	500	5000	N	20	N	10	15000	700	L	N	2000	20	N	N	G(10000)	50
WD-5B	2	1000	100	G(10000)	IN	500	N	N	15000	30	N	N	N	1000	1000	L	20	200	10	N	10	N	70
WD-5C	10	200	1500	G(10000)	115	G(5000)	100	500	G(20000)	N	15	N	7	10000	G(10000)	N	150	1000	N	N	N	G(10000)	50
WD-5D	7	L	50	1000	IN	G(5000)	30	N	2000	100	N	N	N	700	300	N	N	G(5000)	N	N	N	500	N
TR-5	5	1000	1.5	N	IN	2000	N	N	50	50	N	L	15	20	N	10	N	1000	100	N	20	N	200
FR-1	2	70	N	200	IN	1000	N	N	10	20	N	N	5	20	N	7	N	150	70	N	15	N	100