96-960, December 22, 1980.

INTRODUCTION

Under provisions of the Wilderness Act (Public Law 88-577, September 3, 1964), the U.S. Geological Survey and the U.S. Bureau of Mines have been conducting mineral surveys of areas selected for possible inclusion in the National Wilderness Preservation System. This report presents results of geochemical studies carried out in June and July, 1982, as part of the investigation of the Buffalo Peaks Wilderness Study Area, Colo. Stream-sediment and panned-concentrate samples were collected from about 80 sites on streams draining the study area. Analytical results and a sample locality map were published by Domenico and others (1984). The geologic and mineral resource potential maps of the study area were prepared by Hedlund and others (1983). The Buffalo Peaks Wilderness Study Area encompasses a major portion of the Mosquito Range, which is structurally part of the east flank of the north-northwest-trending Sawatch anticline. Bedrock in the west two-thirds of the study area is made up of Precambrian igneous and metamorphic rocks of the core of the anticline, whereas bedrock in the east onethird is mostly east dipping Paleozoic sedimentary rocks. In the vicinity of East and West Buffalo Peaks, the sequence of Paleozoic sedimentary rocks is covered by Tertiary extrusive rocks. Major faults generally run parallel to the northnorthwest trend of the Arkansas River Valley, which is an expression of the Arkansas River segment of the Rio Grande depression, and the Sawatch anticline in the study area. Some faults are probably of late Precambrian age; major recurrent displacement is known

to have occurred on most faults during Laramide time and in the Pliocene and Miocene. The study area is bounded by several areas of known mineralization (Hedlund and others, 1983). Vein and bedding replacement deposits of silver, zinc, and lead were mined from 1890 until about 1918 in the vicinity of Weston Pass (map A), on the northeastern border of the study area. Gold and silver were mined from about 1860 until about 1880 from veins in the Granite area (map A), on the northwestern border of the study area; minor prospecting activity continues today. From 1935 to 1937, veins of gold, silver, and base metals were mined in the vicinity of Fourmile Creek, on the southwestern border of the study area (map A). Recently, active uranium prospecting has been taking place in the vicinity of the Middle Fork of Salt Creek, on the southeastern border of the study area (map A).

SAMPLING AND ANALYTICAL METHODS

Stream-sediment and panned-concentrate samples were collected about every square mile from first- and second-order streams. At almost every site, one stream-sediment and two panned-concentrate samples one for spectrographic analysis and one for gold analysis, were collected. Stream-sediment samples were dried, sieved through a 0.25-mm (60-mesh) sieve, and pulverized; the samples were then analyzed for 31 elements by six-step emission spectrography (Grimes and Marranzino, 1968); for arsenic, zinc, cadmium, bismuth, and antimony by a modification of the atomic absorption spectroscopic method described by Viets (1978); and for uranium by fluorimetry (Hopkins, 1978). One panned-concentrate sample from each site was panned until black minerals started to leave the pan; this concentrate was subjected to a series of heavy-liquid and electromagnetic separations in order to obtain a heavy, nonmagnetic fraction (nonmagnetic heavy-mineral concentrate). The minerals that had specific gravities greater than bromoform (specific gravity, 2.85) and that were nonmagnetic at a setting on the Frantz Isodynamic Separator equivalent to 0.6 amp, 10° forward slope, and 5° side tilt (R. B. Tripp, oral commun., 1983) were then pulverized and analyzed for 31 elements by six-step emission spectrography. A second panned-concentrate sample (raw panned concentrate) from each site was panned until the light-colored lightweight minerals were gone; the entire sample was then pulverized and a 10-gram-orless portion was analyzed for gold by atomic absorption spectroscopy (Thompson and others, 1968).

RESULTS OF ANALYSIS

Table 1 summarizes raw data and data after qualified values were replaced as follows: N, two spectrographic steps lower than lower limit of determination; L, one spectrographic step lower than lower limit of determination; and G. one spectrographic step higher than upper limit of determination. Emission spectrographic analyses are reported as one of the numbers 1, 1.5, 2, 3, 5, or 7, multiplied by a power of ten (Grimes and Marranzino, The correlation coefficients and percentiles

(tables 2 and 3) are based on the replaced data.

Variables with more than 50 percent of the analyses

qualified by N or G were not included in the table of correlation coefficients (table 2). The values shown on maps B-I are those falling between approximately the 75th and 90th percentiles and those above the 90th percentile (table 3). The elements in tables 1-3 are listed in an order that is based partially on Goldschmidt's classification (Levinson, 1974, p. 61-66), partially on groupings indicated by R-mode factor analysis of the analytical data, and partially on widely recognized geochemical associations (Beus and Grigorian, 1977; Levinson, 1974, 1980; Rose and others, 1979). For this study, the elements are grouped as follows: carbonate-mineral group, Ca, Mg, Sr; mafic-mineral group, B, Co, Cr, Fe, Mn, Ni, Sc, sulfide-mineral group, Ag, As, Ba, Bi, Cd, Cu, Pb, Zi and granitic/pegmatitic group, Be, La, Mo, Nb, Sn, Ti Th, U, W, Y, Zr. Analysis of the data indicates that many elements are associated with more than one group. For example, in the stream-sediment samples iron is strongly associated with both the maficmineral group and the granitic/pegmatitic group, lead is associated strongly with both the sulfide-mineral group and the granitic/pegmatitic group, copper is associated strongly with both the mafic-mineral group and the sulfide-mineral group, and boron is associated with the mafic-mineral group and to a lesser extent with the sulfide-mineral group, but not with the granitic/pegmatitic group. Elemental values at the 90th percentile and greater are generally considered anomalous in the Buffalo Peaks Wilderness Study Area. Table 4 summarizes the geochemical associations in the study

¹The use of trade names is for descriptive purposes only and does not imply endorsement by the U.S. Geological Survey.

area. Silver, molybdenum, and tin in stream sediment

or bismuth and tungsten in nonmagnetic heavy-mineral

detectable amount is considered anomalous.

concentrate, are detectable in so few samples that any

DISCUSSION

Geochemical patterns drawn on the basis of multiple anomalous sites are more significant than single-site, single-element anomalies. Maps B-I show the most significant geochemical patterns. Geochemical patterns that roughly coincide with areas of known mineral deposits, particularly of elements known to be part of the mineralization, are significant. In areas of no known mineral deposits, the coincidence of patterns of many variables may also Significant geochemical patterns are evident in

six general areas (table 4, maps B-I): Weston Pass-Union Gulch area, Granite-Two Bit area, Fourmile Creek area, Salt Creek area, Spring Creek area, and the vicinity of the Rough and Tumbling Creek stock. Geographically, the geochemical patterns shown on maps B-I are more closely related to areas of known mineral deposits than to specific bedrock units. Patterns of anomalous elements correlate well with the known mineralized areas.

There were relatively few highly anomalous elemental values determined in samples from the Buffalo Peaks Wilderness Study Area. However, subtle anomalous patterns were seen to cluster in areas of known mineralization and are consequently thought to be significant. For example, the maximum level of zinc recorded in the area was 200 ppm, copper, 70 ppm, and arsenic, 10 ppm; bismuth was not detected above 2 ppm, the lower limit of determination, in any sample although samples from the Weston Pass-Union Gulch, the eastern part of the Granite-Two Bit, and the Fourmile Creek mineralized areas contained 2 ppm bismuth. The elements zinc, copper, arsenic, and bismuth exhibit subtle anomalies when considered individually; however, the overlapping geochemical patterns from stream-sediment data emphasize the Weston Pass-Union Gulch and Granite-Two Bit mineralized areas where most of the past mining activity has taken place.

Geochemical patterns determined on the basis of

analysis of panned-concentrate samples outline areas of known mineral deposits better than do those

determined on the basis of stream-sediment samples, with the exception of the southern part of the Granite-Two Bit mineralized area. Except for elements such as chromium, lanthanum, and yttrium, which are commonly found in resistate minerals, there is poor correlation between an element in stream sediments and in nonmagnetic heavy-mineral concentrates (table 2), indicating that the processes of elemental dispersion reflected in stream-sediment samples and pannedconcentrate samples generally are not the same. Stream-sediment samples were dominantly silt and clay and concentrates could be panned at only one of the two sites in the southern part of the Granite-Two Bit mineralized area. Stream-sediment samples collected in the area were anomalous in cadmium, manganese, nickel, and zinc, probably as hydromorphic anomalies, that is, anomalies resulting from the movement of anomalous amounts of elements in solution with subsequent precipitation or sorbtion of those elements (Rose and others, 1979, p. 243, fig. 10.1). Known mineralized areas in the Buffalo Peaks Wilderness Study Area have been outlined using geochemical data (maps B-I). The association of arsenic, bismuth, cadmium, lead, and zinc in the Weston Pass-Union Gulch mineralized area (table 4, area A) is compatible with the known base-metal mineralization. The inclusion of gold and tungsten, along with other elements indicative of mineralization (table 4), is compatible with known gold mineralization in the Granite-Two Bit mineralized area. The only sample from this study that contains detectable silver is from the Granite-Two Bit area. High gold, molybdenum, and tungsten values in panned-concentrate samples collected in Buffalo Meadows (maps E, F) may represent an extension of the Granite-Two Bit mineralized area vein system. Although evidence of past mining or prospecting activity is not apparent in Buffalo Meadows, a pannedconcentrate sample collected in Buffalo Meadows had the highest gold value in this study (4.7 ppm). Because gold occurs as distinct grains and resists grinding, its distribution in the sample media is erratic; therefore, the significance of this anomalous sample cannot be evaluated without further study. In the vicinity of the Rough and Tumbling Creek rhyolite stock (table 4, area F) nonmagnetic heavymineral-concentrate samples taken from streams draining the east side of the stock contain as much as 1,500 ppm lead and as much or more than 10,000 ppm barium. The lead and barium concentrations are high compared with values from known mineralized areas in the study area, thus increasing the significance of the anomaly. Beryl and abundant pyrite are present in concentrates from near the Rough and Tumbling Creek stock, based on a preliminary mineralogical examination (K. C. Watts, oral commun., 1983). The association of elements near the stock (table 4) and the preliminary mineralogical examination suggest that there has been contact metamorphism. In the southeastern part of the study area (areas D, E), the association of elements, especially the iron and barium in panned-concentrate samples,

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indicates a geochemical similarity to the Rough and

Tumbling Creek stock and vicinity. Both areas drain

East and West Buffalo Peak and are in highly faulted

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Table 1.--Statistical summary for stream-sediment and panned-concentrate samples from streams draining the Buffalo Peaks Wilderness Study Area, Colorado [Leaders (---) indicate no data or not applicable. N, element not detected; L, element present in amount less than lower limit of determination; G, element present in amount greater than upper limit of determination; valid, number of unqualified values. Minimum, maximum, mean, and standard deviation (raw data) are for unqualified values only. Analyses by emission spectrography, except as noted. No statistics are listed for replaced data if more than half of the values are qualified by N or G. Elements looked for in stream-sediment samples but not detected at lower limit of determination given, in ppm: emission spectrography--As, 200; Au, 10; Bi, 10; Cd, 20; Sb, 100; W, 50; atomic absorption--Sb, 1. Elements looked for in nonmagnetic heavy-mineral-concentrate samples by emission spectrography but not detected at lower limit of determination given, in ppm: Ag, 1; As, 500; Au, 20; Cd, 50; Sb, 200; Zn, 500]

Element	Limits of de	etermination				Raw data						Re	placed da	ta		
-2.	Lower	Upper	Minimum	Maximum	Mean	Standard deviation	Number N	of L	values G	Valid	Geometric mean	Geometric deviation	Valid	Rep1 N	acement L	values G
						Stre	eam-sedir	nent	samples							
Ca pct Mg pct	0.05 .02		0.2	20 5	1.4 .88	2.1	0	0	0	84	1.1	1.7	84			
Sr ppm	100		100	1,000	250	200	0	0	0	84 84	79 200	1.5	84 84			
В ррт	10		10	200	35	33	0	4	0	80	24	2.3	84		7	
Co ppm	5		5	30	9.5	4.4	0	0	0	84	8.7	1.5	84			
Cr ppm	10		10	100	43	20	2	0	0	82	37	1.8	84	5		
Fe pct Mn ppm	.05 10		2 100	10 5,000	4.5 1,200	1.7 790	0	0	0	84 84	4.2	1.5	84			
Ni ppm	5		5	30	14	7.4	0	0	0	84	990 12	1.8 1.8	84 84			
Sc ppm	5		5	20	7.3	4.5	0	0	0	84	6.3	1.6	84			
V ppm	10		30	300	97	46	0	0	0	84	89	1.5	84			
Ag ppm ₁	5		3	3	3		83	0	0	1						
As ppm ¹	5		5	10	5.8	1.9	31	40	0	13	2.8	1.4	84	2	3	
Ba ppm	20 2		150 2	700 2	410 2	130 0	0 5	0 51	0	84	390	1.4	84			
Bi ppm ¹ Cd ppm ¹	.1		.2	9	.66	.98	0	0	0	28 84	1.6 .51	1.2 1.8	84	1	1.5	
Cu ppm	5		10	70	28	11	0	0	0	84	26	1.5	84 84			
Pb ppm	10		15	300	76	49	Ö	0	Ő	84	64	1.8	84			
Zn ppm ¹	5		40	190	95	30	0	0	0	84	91	1.4	84			
Zn ppm	200		200	200	200		73	10	0	1						
Be ppm	1		1	1 000	2	.61	0	0	0	84	2	1.4	84			
La ppm Mo ppm	20 5		20 5	1,000	210 5.5	250 1	0 80	0	0	84 4	130	2.7	84			
Nb ppm	20		20	20	20	0	19	60	0	5	14	1.2	84	10	15	
Sn ppm	10		10	30	20	14	82	0	0	2						
Ti pct	.002		.15	1	.49	.20	0	0	0	84	.46	1.5	84			
Th ppm	100		100	500	150	100	56	13	0	15						
U ppm ²	.05 10		.45	53	9.4	11	0	0	0	84	5.2	3.2	84			
Y ppm Zr ppm	10	1,000	15 30	1,000 1,000	91 440	130 240	0	0	0	84 83	62 390	2.2 1.8	84 84			1 500
												1.0				1,500
					No	nmagnetic hea	vy-miner	al-c	oncentr	ate samp	les					
Ca pct	0.1		3	30	12	6.7	0	0	0	78	10	1.7	78			
Mg pct	.05 200		.05	5	.33	.72	0	20	0	58	.096	3.3	78		.0	3
Sr ppm B ppm	20		200 20	1,500 150	600 38	390 33	61 52	0 7	0	17						
Co ppm	10		10	70	18	17	61	1	0	19 16						
Cr ppm	20		20	200	53	32	î	7	0	70	40	1.9	78	10	15	
Fe pct	.1		.1	3	.3	.39	0	2	0	76	.23	2.0	78		.0	7
Mn ppm	20		200	2,000	700	370	0	0	0	78	610	1.7	78			
Ni ppm	10 10		10 15	30 50	18	7.1	70	0	0	8						
Sc ppm V ppm	20		20	200	23 39	5.5 42	0 18	0 11	0	78 49	22	1.2	78	10	15	
Ba ppm	50	10,000	50	10,000	720	1,800	0	5	1	72	21 210	2.0 4.2	78 78	10	15 30	15 000
Bi ppm	20		50	200	100	87	75	0	0	3		4.2				15,000
Cu ppm	10		10	30	13	5.9	36	27	0	15	6.7	1.5	78	5	7	
Pb ppm	20		20	1,500	140	260	0	0	0	78	81	2.3	78			
Be ppm	2	2 000	100	15	2.6	2.3	32	13	0	33	1.5	1.6	78	1	1.5	
La ppm Mo ppm	50 10	2,000	100 10	2,000 150	990 31	610 49	0	0	8	70	880	2.4	78			3,000
Nb ppm	50		50	100	60	14	68 30	2 28	0	8 20	30	1.5	70	20	20	
Sn ppm	20		20	70	35	17	53	7	0	18		1.5	78 	20	30	
Ti pct	.005	2	.1	2	1.1	.64	0	0	18	60	1.2	2.4	78			3
Th ppm	200		200	2,000	530	500	27	7	0	44	230	2.3	78	100	150	
W ppm	100		100	200	130	50	71	3	0	4						
Y ppm Zr ppm	20 20	2,000	200 2,000	2,000 2,000	880 2,000	390 0	0	0	76	78 2	790	1.6	78 2			
						Raw pann	ed-conce	ntra	te samp	les						
. 1			<u>.</u>													
Au ppm ¹	0.05		0.05	4.7	0,.82	1.4	67	1	0	10			10			
																-

¹Analyses by atomic absorption.

²Analyses by fluorimetry.

Table 3.--Percentiles for chemical analyses of stream-sediment and panr

[Analyses by emission spectrography except as noted. Based on raw data. N, element not detected at listed value; L, element detected in amount less than listed value; G, element present in amounts greater than listed value]

El	ement	Number		Pe	ercentiles		
		of values	10	25	50	75	90
-			(Stream sedim	ent		
-		0.4					
Mg	pct	84 84	0.7 .5	.7	1 •7	1 1	2
Sr		84	100	100	200	300	500
В	ppm	84	10	10	20	50	70
Co		84	5	7	10	10	15
Cr	ppm	84 84	20 3	30	30 5	50	70
	ppm	84	500	700	1000	5 1500	7 2000
Ni	ppm	84	5	10	15	15	25
Sc		84	5	5	5	5	15
V	ppm	84	70	70	100	100	200
Ag	ppm ppm1	84 84	.5N 5N	.5N 5N	.5N 5L	.5N	5N
Ba	ppm,	84	300	300	300	5L 500	5 500
Βi	ppm ¹	84	2L	2L	2L	2	2
Cd	p pm ¹	84	.3	.4	.5	.7	.9
Cu		84	15	20	30	30	50
Pb Zn	ppm ppm1	84	30 65	50 75	70	100	100
Zn		84	200N	200N	90 200N	120 200N	130 200L
Be	ppm	84	1	2	2	3	3
La	ppm	84	40	70	100	300	300
Mo	ppm	84	5N	5N	5N	5N	5N
Nb Sn	p pm	84 84	20N 10N	20L 10N	20L	20L	20L
Ti	pct	84	.3	.3	10N .5	10N .5	10N .7
Th	p pm	84	100N	100N	100N	100L	100
U	ppm ²	84	1	2.2	5.8	11	23
γ	ppm	84	20	50	70	100	150
Zr	p pm	84	200	300	300	500	700
			Nonmagnetic h	neavy-minera 	1 concentrat	es	
	pct	78	5	7	10	15	20
Mg Sr	pct	78 78	.05L	.05	.07	.2	.7
В	p pm p pm	78 78	200N 20N	200N 20N	200N 20N	200N 20L	700 30
Co	ppm	78	10N	10N	10N	10N	10
Cr	ppm	78	20	20	50	70	70
	pct	78	.10	.15	.2	.3	.6
	p pm p pm	78 78	300	500	700	1000	1000
	p pm	78	10N 20	10N 20	10N 20	10N 30	10 30
٧	ppm	78	20N	20L	20	30	50
	ppm	78	50	70	150	500	2000
	p pm	78	20N	20N	20N	20N	20 N
	p pm p pm	78 78	10N 30	10N 50	10L	10L	10
	ppm	78	2N	2N	70 2L	100 2	200 3
	ppm	78	300	500	1000	1500	2000G
	ppm	78	10N	10N	10N	10N	10
	p pm	78	50N	50N	50L	50	70
	ppm	78 78	20N •5	20N •7	20N	20L	30
	ppm	78	200N	200N	1.5 200	2 300	2G 700
W	ppm	78	100N	100N	100N	100N	100N
Y 75	ppm	78	500	700	700	1000	1500
Zr	p pm	78	2000G	2000G	2000G	2000G	2000G
			Raw pa	anned concen	trates		
Au	ppm ¹	78	0.05N	0.05N	0.05N	0.05N	0.05

Analyses by atomic absorption.

Analyses by fluorimetry.

concentrate samples from sites on streams draining the Buffalo Peaks Wilderness Study Area, Colorado

	Stream sediment													
Ca	pct	84	0.7	1	1	1	2							
	pct	84	.5	.7	.7	1	2							
Sr	ppm	84	100	100	200	300	1 500							
B	ppm	84	10	10	200	50	70							
	ppm	84	5	7	10	10	15							
	ppm	84	20	30	30									
	pct	84	3	3	5	50 5	70 7							
	ppm	84	500	700	1000									
	ppm	84	5	10	15	1500	2000							
	ppm	84	5	5	5	15	25							
1	ppm	84	70	70		5	15							
	ppm ₁	84	.5N		100	100	200							
19	ppm1	84	5N	.5N	.5N	.5N	.5N							
23	ppm ₁	84	300	5N	5L	5L	5							
2 i	ppm1	84		300	300	500	500							
7	ppm1	84	2L	2L	2L_	2	2							
			.3	.4	.5	.7	.9							
Cu	ppm	84	15	20	30	30	50							
75	ppm ₁	84	30	50	70	100	100							
-11 7n	ppm ¹	84	65 200N	75	90	120	130							
-11	ppm	84	200N	200N	200N	200N	200L							
	ppm	84	1	2	2	3	3							
.d	ppm	84	40	70	100	300	300							
10	ppm	84	5N	5N	5N	5N	5N							
(D)	p pm	84	20N	20L	20L	20L	20L							
Sn .	ppm	84	10N	10N	10N_	10N	10N							
7	pct	84	.3	.3	.5	.5	.7							
n	ppm ₂	84	100N	100N	100N	100L	100							
	ppm ²	84	1	2.2	5.8	11	23							
	ppm	84	20	50	70	100	150							
r	ppm	84	200	300	300	500	700							
			Nonmagnetic	heavy-miner	al concentrat	es								
a	pct	78	5	7	10	15	20							
	pct	78	.05L	.05	.07	.2	.7							
r	ppm	78	200N	200N	200N	200N	700							
1	ppm	78	20N	20N	20N	20L	30							
0	ppm	78	10N	10N	10N	10N	10							
	ppm	78	20	20	50	70	70							
e	pct	78	.10	.15	.2	.3	.6							
In	ppm	78	300	500	700	1000	1000							
i	ppm	78	10N	10N	10N	10N	10							
	ppm	78	20	20	20	30	30							
	ppm	78	20N	20L	20	30	50							
	ppm	78	50	70	150	500	2000							
	ppm	78	20N	20N	20N	20N	20N							
	ppm	78	10N	10N	10L	10L	10							
	ppm	78	30	50	70	100	200							
	ppm	78	2N	2N	2L	2	3							
	p pm	78	300	500	1000	1500								
	ppm	78	10N	10N	1000 10N	10N	2000G							
	ppm	78	50N	50N	50L		10							
	ppm	78	20N	20N	20N	50	70							
	pct	78				20L	30							
	ppm	78 78	.5	.7	1.5	2	2G							
			200N	200N	200	300	700							
	p pm	78 79	100N	100N	100N	100N	100N							
	ppm	78	500	700	700	1000	1500							
rı	ppm	78	2000G	2000G	2000G	2000G	2000G							
			Raw p	anned conce	entrates									
	1													

Table 2.--Correlation coefficients for stream-sediment and nonmagnetic heavy-mineral-concentrate samples from 78 sites on streams draining the Buffalo Peaks Wilderness Study Area, Colorado [Based on replaced data. Sed, stream-sediment sample; pan, panned-concentrate sample]

		sed Ca	pan Ca	sed Mg	pan Mg	sed Sr	sed B	sed Co	sed Cr	pan Cr	sed Fe	pan Fe	sed Mn	pan Mn	sed Ni	sed Sc	pan Sc	sed V	pan V	sed As	sed Ba	pan Ba	sed Bi	sed Cd	sed Cu	pan Cu	sed Pb	nan Ph	sed 7n	sed Pe	nan Pe								sed U		
pa se pa	Ca d Mg n Mg	.03 .56 .46	1.00 02 12	1.00	12 .60 1.00	05 .43 .38	.04 .25 .23	22 .51 .38	.0 .24 .14	.16 .18	. 07 . 24 . 05	08 .32 .58	06 .05 04	03 59 22 09	.14 02 .48 .26	.14 22 .26 .25	-04 05 11 21	- 09 - 56 - 42	.10 .06 .15	34 .03 01	06 .20 .0 11	- 49 - 10 - 50 - 62	21 01 .02 .21	20 .01 .0	01 .10 .28	.02 18 .40	49 .33 35 45	.06 11 .02	12 .06 02	3.3 .42 42	01 09 09	31 .05 42	28 .45 39	27 .34	18 .19 22	04 .12 .04	24 .22 38	17		30	0439 .51 .14 2939
• se se se	d Sr d B d Co d Cr d Cr d Fe	.70 .09 .17 .05 .03	05 .04 22 .0 .16 .07	. 43 . 25 . 51 . 24 . 18	. 38 . 23 . 38 . 14 . 31	1.00 10 .33 .04 .10	10 1.00 .12 .44	.33 .12 1.00 .39 .22	.04 .44 .39 1.00	.10 .28 .22 .36 1.00	.07 .14 .49 .37	.11 .53 .20 .27	01 .01 .44 .12 06	09 13 25 12	.04 .45 .59 .60	.24 .0 .36 .35	02 07 17 21 10	.33 .62 .34	.11 .18 .21 .17	24 .18 .17 .19	.13 .01 .01 .13	.36 .28 .32 .24	19 .07 .05 .11	21 -54 .02 .26	08 .22 .48 .30	.05 .13 .27 .17	- 44 - 10 - 24 - 09	07 07 02 01 16	04 16 .0 .11 .08	38 33 01 38 01	07 06 .01 05 .12 10	34 11 31 03	32 28 01 39 10	30 33 33	10 11	10 .07 03 .16	35 17 19 24 11	16 19 08	22 25 .12 19	53 25 .0 39	3451 2527 2004 4819 23 .06
pa s e p a s e	n Fe	.16 12 03 .14	08 06 . 59 02 22	.32 .05 22 .48	.58 04 09 .26	.11 01 09 .04	.14 .53 .01 13 .45	.49 .20 .44 25 .59	. 37 . 27 . 12 12 . 60 . 35	.06 .42 06 .23 .43	1.00 .05 .40 16 .31	.05 1.00 .06 07 .27 .18	.40 .06 1.00 .01 .13	16 07 .01 1.00 07 33	.31 .27 .13 07 1.00	.18 .16 33 .10	.01 13 .01 .16 10	.62 .12 .26 26 .38 .34	.12 .29 .01 .13 .14	.09 .09 .09 .0	.24 .04 .06 .04 .03	.10 .24 07 20 .22 .26	.02 .17 .0 .17 .32	.17 .41 .17 09 .31 08	.37 .19 .21 .04 .53	.06 .36 02 18 .27	20 .16 .20	11 .18 10 12 02	04 16 06	02 06 -40 18	.04 .01 10	31 .20 .11 27	.07 08 .04 .0 .42 20	03 .16 .0 10 .38 22	. 44 . 04 . 20 . 03 . 23 . 02	07 .51 18 .19 .06	12 05 31 17	.04 01 .13 07 .0		17 .12 34 .10 .26	*.1224 14 .33 2043 18 .0 .53 .0 2209
s e pa s e	S C d V n V d As d Ba	.04 .20 .10 34 06	05 09 .06 .03	11 .56 .15 01	21 .42 .26 .07 11	02 .33 .11 24 .13	07 .13 .18 .18	17 .62 .21 .17	21 .34 .17 .19	10 .11 .34 .19	.01 .62 .12 .0	13 .12 .29 .09	.01 .26 .01 .09	.16 26 .13 .0	10 .38 .14 .25	20 .34 02 01 05	1.00 05 15 14	05 1.00 .16 .08	15 .16 1.00 .15	14 .03 .15 1.00	.01 .10 05 13	.02 .47 .09 03	15 02 .12 .21	22 .0 .18 .50	17 .46 .13 .31	27 .19 .46 .21	23 02 03 03 32	.17 06 09 .25 .24 23	20 16 .15 .08 .18	31 06 28 .15 04			21 07 44 .07 .03	17 .14 09 .09 08	07 20 16 .20 .15	01 44 12	33 .01 34 .19	26 33 .07	17 .05 24 .11 01	18 .07 18 10	3616 02 .22 44 .38 0510 0208
s e s e s e p a	d Cd d Cu d Cu	.49 21 20 01	10 01 .01 .10 18	.50 .02 .0 .28 .40	.62 .21 .02 .25	- 36 - 19 - 21 - 08 - 05	.28 .07 .54 .22	.32 .05 .02 .48 .27	.24 .11 .26 .30	.07 .18 .31 .01	.10 .02 .17 .37	.24 .17 .41 .19	07 .0 .17 .21	20 .17 09 .04 18	.22 .32 .31 .53	.26 15 08 .10	.02 15 22 17 27	- 47 02 .0 .46	.09 .12 .18 .13	03 .21 .50 .31	06 .21 05 .0 06	1.00 08 12 .07 02	08 1.00 .26 .27	12 .26 1.00 .23 .29	.07 .27 .23 1.00	02 .20 .29 .21 1.00	43 .16 .50 .23	.12 07 .18 13	25 .23 .34 .37	37 .01 .20 .0	• 14 = • 08 - • 09 - • 08	47 14 03 08	48 .15 .26 10			03 03 06 28	54 -0 -20 20	12 34 .05 .19 08	.30 .04	08 .03 .01	.0 .30 4431 .0706 .0709 15 .01
pa se se pa	Pb IZn IBe Be	49 06 12 33 01	09	35 .02 02 42 09	45 . 20 04 38 07	44 07 16 33 06	.10 .07 .0 01	24 02 .11 38 05	.09 01 .08 01	.0 .16 .09 .01 10	.34 11 .25 .01	20 .18 04 02 04	.16 10 .16 06	.20 12 .06 .40 10	.02 02 .30 18	23 .17 20 31 05	02 06 16 06	03 09 .15 28	03 .25 .08 .15	.32 .24 .18 04	.08 23 .09 .19 11	43 .12 25 37 .14	.16 07 .23 .01 08	.50 .18 .34 .20	.23 13 .37 .0 08	04 .15 .33 11	1.00 14 .47 .51	14 1.00 02 04 01	.47 02 1.00 .31	-51 -04 -31 1.00	.01 01 .0 .07	.51 09 .03 .22	• 41 • 21 • 08 • 50 • 05	49 18 05	.23 .05 .24 .27	.31 22 .18	.26 .11 .12 .29	.21 .45 .0 .35	43 03 .29	.56 16 .05	1122 .34 .47 .0518 .10 .10 .39 .31 10 .22
pa se pa se	La I Nb I Nb I Ti	31 28 27 18 04	.34 .19 .12	42 39 23 22 .04	54 32 28 10 10	34 28 30 11 .07	11 01 .03 .0 03	31 39 33 01 .16	03 10 .05 01 .26	26 .07 03 .44 07	.20 08 .16 .04	31 .04 .0 .20 18	.20 .0 10 .03	.11 .42 .38 .23	27 20 22 .02	.15	20 01	11 44 09 16 - 44	.07 .09 .20	07 .03 08 .15	.07 .01 .24 .0	47 48 26 34 03	14 .15 .06 .12	03 .26 .08 .39 06	08 10 .06 .05	33 12 01 .20	.51 .41 .49 .23	09 .21 18 .05 22	.03 .08 .05 .24	.22 .50 .46 .27	.15 .05 .06 18	1.00 .36 .40 15	.36 1.00 .44 .31	1.00 .18	15 .31 .18 1.00	.39 .0 .43 09	.10 .35 .26 .59	.27 .67 .20 .19	.27 .43 .34 .27	.70 .36 .41 08	10 .22 .37 .55 .58 .18 .37 .47 .2215
pa se se pa	Th U Y Y	24 17 .01 30 04	. 24 . 24 . 51	27 17 46 29	35 16 22 53 34	17 19 25 25 25	19 08 .12 .0 20	- 24 - 24 - 19 - 39 - 48	11 .01 .0 .09 23	.36 .04 .05 17 .12	11 01 .18 .12 14	12 .13 .12 34 20	05 07 .07 .10 18	.31 .0 .18 .26	17 22 .06 18 22	33 . 17 17 18 36	.01 26 .05 .07 02	34 33 24 18 44	.19 .07 .11 10	.12 .0 01 08 02	-03 -12 -03 -25	54 34 31 41	.0 .05 .11 08	.20 .19 .30 .03	20 08 .04 .01 15	.13 01 .01 33 11	. 26 . 21 . 43 . 56 . 34	.11 .45 03 16	.12 .0 .29 .05	. 29 . 35 . 37 . 42 . 39	17 .04 .11 .05 10	.10 .27 .27 .70	.35 .67 .43 .36	.26 .20 .34 .41	.59 .19 .27 08	07 .0 .06 .36	1.00 .18 .28 .22	.18 1.00 .31 .21	.28 .31 1.00	.22 .21 .29	.51 .11 .42 .09 .46 .15 .34 .60 1.00 .19
		• 3 /		7)	21	04	19	•00	24	• 33	43	• 0	.0	09	16	.22	.08	10	5.08	.30	31	06	09	.01	22	. 47	18	.10	.31	. 22	. 55	.18	. 47	 15	•50	.11	•09			.19 1.00

STREAM-SEDIMENT AND PANNED-CONCENTRATE GEOCHEMICAL MAPS OF THE BUFFALO PEAKS WILDERNESS STUDY AREA, LAKE, PARK, AND CHAFFEE COUNTIES, COLORADO

Box 25286, Federal Center, Denver, CO 80225

MISCELLANEOUS FIELD STUDIES

D, E

pan

sed

Table 4.--Summary of geochemical associations evident in stream-sediment and panned-concentrate samples from selected parts of

[Anomalous, two or more samples from the area have concentrations greater than approximately the 90th percentile. High, two or

sed pan

Mn, Nb,

Sample type.... sed

more samples from the area have concentrations greater than approximately the 75th percentile. See map A for locations of the

the Buffalo Peaks Wilderness Study Area, Colorad

sed

Anomalous

MAP MF-1628-B

SHEET 2 OF 2

sed