



MAP B. DISTRIBUTION OF ANOMALIES BASED ON SCORESUMS

Geochemical sampling 1978-79; geology modified from Seitz (1983)

U.S. Geological Survey
 1953, 1956, 1960
 1950, 1956, 1960

SCALE 1:62,500

CONTOUR INTERVAL 80 FEET

Table 1.--Summary of background and anomaly concentrations for 10 selected elements in 27 samples of rock, Morse Meadow, Log Cabin, Saddlebag, and Miga Lake Roadless Areas and Hall Natural Area, California

Element	Background samples		Anomalous samples	
	Value of range	Number of samples	Value of range	Number of samples
Ag	N(0.5)-<0.5	24	0.5-2.0	3
As	N(10)-110	12	10-40	4
B	N(0.005)-<0.005	2	0.007	1
Cd	N(0.05)-0.30	14	1.55-2.50	2
Cu	N(5)-30	26	70	1
Fe	N(5)-<5	24	5-10	3
Pb	N(10)-50	25	70-100	2
Mn	N(1)-2	2	3-5	1
Zn	N(50)	26	<50	1
W	10-85	20	90-200	7

¹Only 16 samples analyzed.
²Only 3 samples analyzed.

Table 2.--Summary of background and anomaly concentrations for 12 selected elements in 46 samples of stream-sediment, Horse Meadow, Log Cabin-Saddlebag, and Tioga Lake Roadless Areas and Hall Natural Area, California

Element	Background samples		Anomalous samples	
	Value or range	Number of samples	Value or range	Number of samples
Ag ₁	N(0.5)-<0.5	35	0.5-3	11
As ₂	N(10)-10	29	20-400	5
As ₁	N(0.005)-<0.005	34	0.005-3.5	9
Bi ₁	N(0.1)-1	33		1
Cd ₁	0.10-0.55	20	0.60-2.15	14
	5-50	43	70-100	3
Co	N(5)-10	45	15	1
Cu	10-50	41	70-300	5
Sb ₁	N(1)-10	33	3	1
Pb	N(10)-<10	45	50	1

Zn	15-95	37	100-180	9
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Only 13 samples analyzed.

Table 3.--Summary of background and anomaly concentrations for 14 selected elements in 33 samples of nonmagnetic heavy-mineral concentrate, Horse Meadow, Log Cabin-Saddlebag, and Tioga Lake Roadless Areas and Hall Natural Area, California

[Concentration value or range in parts per million except those for Fe, which are in percent. N_d not detected at the lower limit of determination shown in parentheses; <, detected but in a concentration below that shown]

Element	Background samples		Annular samples	
	Value or range	Number of samples	Value or range	Number of samples
Fe	0.2-3	32	5	1
Ag	N(1)	27	1-10	6
As	N(500)	32	1,000	1
Au	N(100)	32	500	1
S	N(200)-100	27	300-2,000	6
Si	<50-2,000	31	3,000-5,000	2
Ba	N(20)	30	20-100	3
Cu	N(100)	32	20-100	4
Mn	200-2,000	27	3,000-5,000	6
Pb	N(10)-100	29	50-100	4
Pb	<20-100	29	200-1,500	6
Se	N(100)	28	100-200	3
Sn	N(100)-700	29	1,000-4	1
Te	N(100)	28	100-200	3

Table 4.--Anomaly scores for 12 selected elements in 47 samples of stream sediment, Horse Meadow, Log Cabin-Saddlebag, and Tioga Lake Roadless Areas and Hall Natural Area, California

Element	Score1 (weak)		Score2 (moderate)		Score3 (strong)	
	Value or range	No. of samples	Value or range	No. of samples	Value or range	No. of samples
A _g	0.5	7	0.7	3	3	1
As	20	1	--	--	60-400	4
Ca	0.009-0.007	2	0.008-0.012	--	0.025-3.5	5
Bi	1	1	--	--	--	--
Co	0.60-0.90	2	1.20-1.25	3	1.50-2.15	3
Cu	8	2	--	--	--	--
Mo	15	1	--	--	--	--
Pb	70	3	100	1	300	1
Si	3	1	--	--	--	--
Sn	--	--	--	--	50	1
V	<50	3	--	--	--	--
Zn	100-120	5	130-170	3	180	1

Only 13 samples analyzed.

Table 5.--Anomaly scores for 14 selected elements in 33 samples of nonmagnetic heavy-mineral concentrate, Horse Meadow, Log Cabin-Saddlebag, and Tigua Lake Roadless Areas and Hall Natural Area, California

[Concentration value or range in parts per million except those for Fe, which are in percent. Leaders (--) indicate no data]

Element	Score=1 (weak)		Score=2 (moderate)		Score=3 (strong)	
	Value or range	No. of samples	Value or range	No. of samples	Value or range	No. of samples
Ag	1	3	2	1	7-10	2
Al	--	--	--	--	1,000	1
As	--	--	--	--	30	1
B	500	2	--	--	1,000-2,000	4
Bi	1,000-5,000	2	--	--	--	--
Br	20	2	--	--	100	1
Cu	700	2	100	1	200	1
Fe	5	1	--	--	--	--
Ge	3,000	3	5,000	3	--	--
Mn	50	3	100	1	--	--
Pb	200	3	200	1	500-1,500	2
Sn	100	4	300	1	--	--
Zn	1,000	4	--	--	--	--
W	150	1	200	2	700	1

All the samples were analyzed for 30 elements (Al, Ba, Be, Bi, B, Br, Ca, Cd, Co, Cr, Cu, Fe, La, Mg, Mn, Mo, Ni, Pb, Pd, Sb, Sr, Ti, V, W, Y, Zn, and Zr) by six-step sequential sensitive emission spectroscopy. All samples except those originally collected for Minarets Wilderness study were also analyzed for thorium by this method. The samples were stream sediment samples were also analyzed by atomic-absorption spectrometry and, except those from the Minarets Wilderness, were also analyzed for arsenic by colorimetry for bismuth, cadmium, and antimony by atomic-absorption spectrometry.

EVALUATION PROCEDURES

Element map

On the basis of analyses of samples collected in both mineralized and unmineralized localities in this and other roadless and wild areas in the Sierra Nevada region, a suite of 17 elements (Ag, As, Ba, Bi, Br, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Se, Zn) was selected as being indicative of mineral deposits expected to be present in the area.

In the area studied for this report, the elements silver, sulfur, barium, bismuth, cadmium, cobalt, chromium, copper, iron, mercury, manganese, molybdenum, nickel, lead, selenium, zinc, and arsenic are associated with the ore or pre-ore related minerals argentic (or arsenic-bearing) sulfides, sulfates, silicates, carbonates, and various types of sphalerite (for their oxidation products), respectively. The most common element, arsenic commonly indicates the presence of arsenopyrite and/or arsenic sulfosulfates; bornite indicates thauemite; bluish gray bornite indicates chalcocite; white, colorless, or yellowish arsenic usually present in various gangue oxides; antimony indicates stibnite; tellurium indicates tellurotelluride; cadmium can substitute for zinc in zinc minerals; and silver occurs in native form, argentite, and silver pyrrhotite. Cobalt, particularly in concentrate samples from iron ores, may indicate the presence of cobaltite.

EVALUATION PROCEDURES

Element map

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In the area studied for this report, the elements silver, sulfur, barium, bismuth, cadmium, cobalt, chromium, copper, iron, mercury, manganese, molybdenum, nickel, lead, selenium, zinc, and arsenic are associated with the ore or pre-ore related minerals argentic (or argentiferous), bornite, chalcocite, covellite, galena, hematite, malachite, pyrite, sphalerite (for their oxidation products), respectively. The most common element, arsenic commonly indicates the presence of arsenopyrite and/or arsenic sulfosalts; bornite indicates tsamualite; bluish gray coloration indicates the presence of native silver; silver is usually present in various gangue oxides; antimony indicates stibnite; barium indicates barite; cadmium can substitute for zinc in zinc minerals; cobalt substitutes for iron in magnetite; copper occurs in malachite, carbonate, particularly in concentrate samples from lownickel veins.

The range of background and anomalous concentrations for each selected element was determined by studying percent-frequency distribution histograms for these elements, the spatial distribution of background and anomalous element concentrations relative to known types in the study area, and similar information in other areas of Sierra Nevada. (See, for example, Brown and others, 1964; Chaffee, Banister, and others, 1980; Chaffee, Hill, and others, 1980; Chaffee,

and thus only represent background concentrations. Other anomalies may result from known or suspected hydrothermal mineralization. Nine of the rock samples contained anomalous concentrations of one or more of the elements antimony, arsenic, cadmium, copper, gold, molybdenum, lead, silver, tungsten, or zinc. In all nine cases the samples were altered metamorphic or metavolcanic rocks from roof pendents. None of the plutonic rock samples contained anomalous concentrations of any of the selected elements.

sediment samples (table 2) and of the 14 selected elements in the concentrate samples (table 3) are also shown on map A. Most of the anomalous elements in these two sample types are thought to be related to either precious-metal or tungsten mineralization in altered metasedimentary or metavolcanic roof-pendant rocks. Some of these anomalies are related to known mineralization or mining activity; the sources of other anomalies have not been identified. A more detailed description of the stream sediment and concentrate anomalies is given

and in the Log Cabin and Reservoir Creek Terranite Area and in the Log Cabin-Saddleback and the Meadow Lakes Area. No significant anomalies were found in samples collected from streams draining the Tioga Lake Roadless Area. Most of the anomalies outlined on map B are related to weak to strong gold and silver mineralization present in various altered metamorphic units. The gold and silver anomalies are often accompanied by other anomalous elements thought to represent sulfide minerals (As, Bi, Cd, Cu, Fe, Pb, Se, and Zn), alteration minerals (B, Ba, Fe, Mn, and Sr), or tungsten-molybdenum-

DISCUSSION OF SCORED ANOMALIES

For purposes of discussion, the drainage basins containing anomalous samples have been divided into six areas, labeled A through F on map 3.

Area A includes the extreme northern part of the Hall Natural Area and the extreme northwestern part of the Log Cabin-Saddlebag Roadless Area. The samples from this area are from the Hall Natural Area side show weak concentrations of lead, manganese, boron, and tungsten. This basin is probably on an extension of the structures and geologic units forming the shell-belt-belted fault zone and the West side, north of the Hall Natural Area. The samples from the drainage basin on the Log Cabin-Saddlebag Roadless Area side are highly anomalous for a number of elements and are discussed separately.

Strong anomalies of base and precious metals as well as tungsten are also present in the samples collected below the May Lundy and Hess mines. These anomalies are probably related to contamination from mining activity but do further emphasize that tungsten, as well as other metals, may be present in the metamorphic rocks of the northern parts of the Hall Natural Area and the Log Cabin-Saddleback Roadless Area.

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