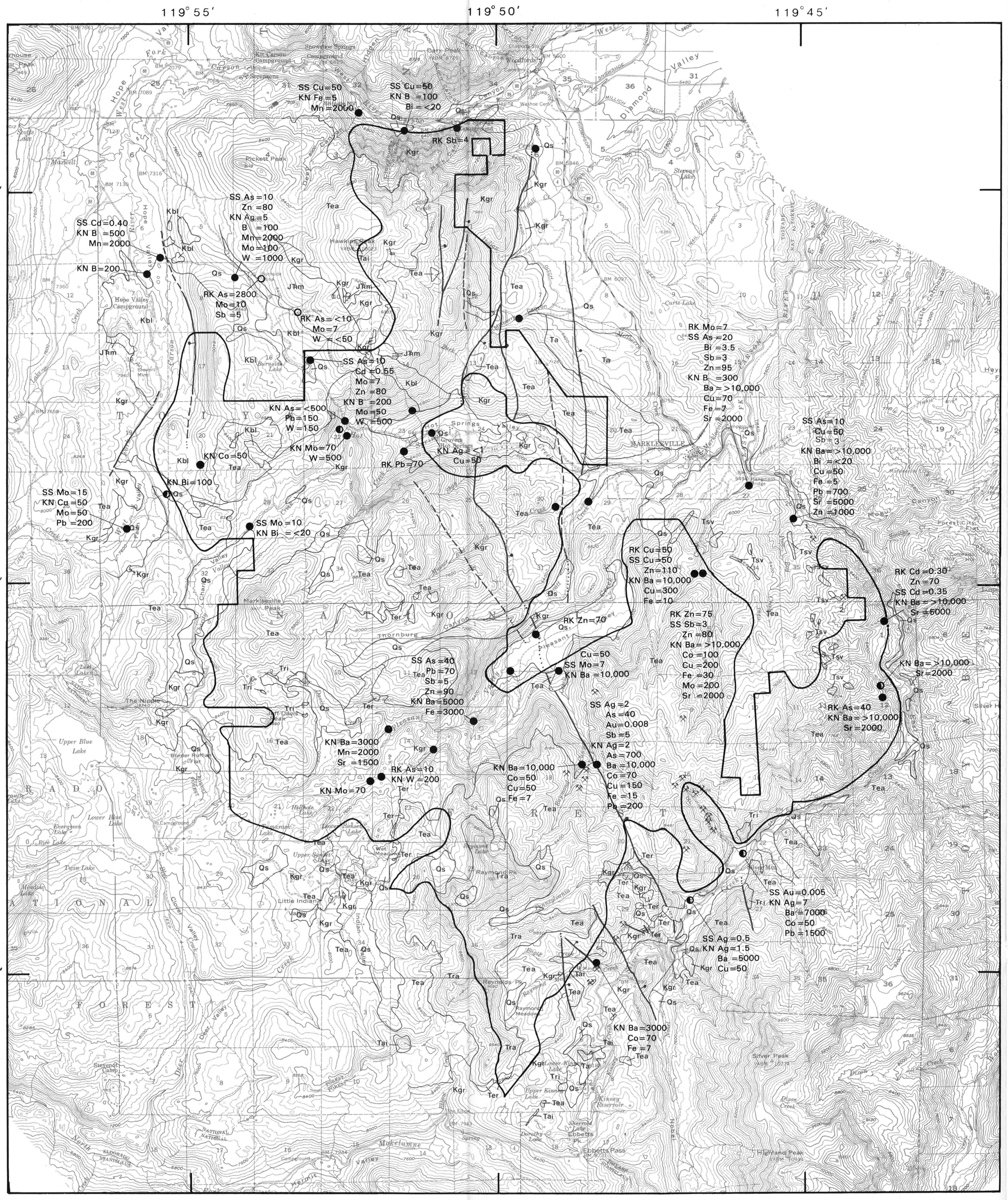


Base from U.S. Geological Survey
Freel Peak, Markleesville,
Topaz Lake, 1956

SCALE 1:62 500

1 ½ 0 1 2 3 4 MILES

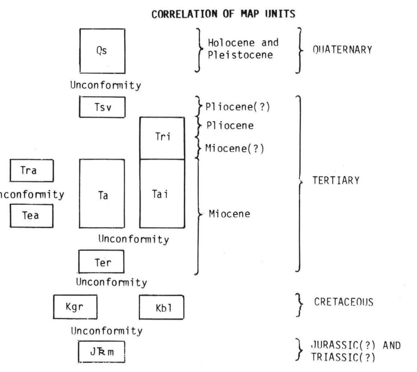
1 .5 0 1 2 3 4 KILOMETERS

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Geochemical sampling in 1978-79;
geology modified from Armin and others (1982)

MAP A.--SAMPLE LOCALITIES AND DISTRIBUTIONS OF ANOMALOUS ELEMENTS

CORRELATION OF MAP UNITS



EXPLANATION FOR MAP A

APPROXIMATE BOUNDARY OF ROADLESS AREA

CONTACT--Approximately located

FAULT--Dashed where approximately located; dotted where concealed; bar and ball on downthrown side

MINE

SAMPLE LOCALITY

Only rock sample collected

Only stream-sediment and concentrate samples collected

Rock, stream-sediment, and concentrate samples collected

ANOMALOUS SAMPLE--Showing element and concentration in parts per million

RK Pb=200 Rock sample

SS As=50 Stream-sediment sample

KN Ag=20 Concentrate sample--Fe given in percent

LIST OF MAP UNITS

Qs SURFICIAL DEPOSITS (HOLOCENE AND PLEISTOCENE)--Consist of glacial, alluvial, and landslide deposits

Tsv SILICIFIED VOLCANIC ROCKS (PLIOCENE?)--Mostly quartz-pyrite jasperoid

Tri INTRUSIVE RHYOLITE (PLIOCENE AND LATE MIOCENE?)--Flow-banded, platy-weathering porphyritic rhyolite

Tra RAYMOND PEAK ANDESITES OF WILSHIRE (1957) (MIOCENE)--Generally unaltered, thick-bedded andesite lahars and minor andesite flows and tuffs

Ta ANDESITE, UNDIVIDED (MIOCENE)--Flows and autobrecciated flows

Tai INTRUSIVE ANDESITE (MIOCENE)--Columnar-jointed pyroxene andesite

Tea EARLY ANDESITE (MIOCENE)--Andesite lahars, interbedded with massive flows and andesitic sandstone and conglomerate, locally strongly propylitized

Ter EARLY RHYOLITE (EARLY MIOCENE)--Air-fall and ash-flow rhyolite tuff

Kgr GRANITIC ROCKS (CRETACEOUS)--Fine- to coarse-grained, equigranular to porphyritic granite and granodiorite

Kbl BURNSIDE LAKE ADAMELLITE OF PARKER (1961) (CRETACEOUS)--Coarse-grained, porphyritic granite containing potassium feldspar phenocrysts as long as 1.2 inches

JTRm METAMORPHIC ROCKS (JURASSIC? AND TRIASSIC?)--Mostly calcareous siltstone and sandstone and minor limestone and mafic volcanic rocks, all metamorphosed to amphibolite facies

EXPLANATION FOR MAP B

APPROXIMATE BOUNDARY OF ROADLESS AREA

SAMPLE SITE AND OUTLINE OF DRAINAGE BASIN

For samples that have SS SCORESUMS ≥3

For samples that have KN_1 SCORESUMS ≥3

For samples that have KN_2 SCORESUMS ≥3

For samples that have KN_3 SCORESUMS ≥3

SCORESUM

SS=2 For one or more of the elements Ag, As, Au, Bi, Cd, Cu, Mo, Pb, Sb, or Zn in stream-sediment samples (characteristic of precious-metal deposits)

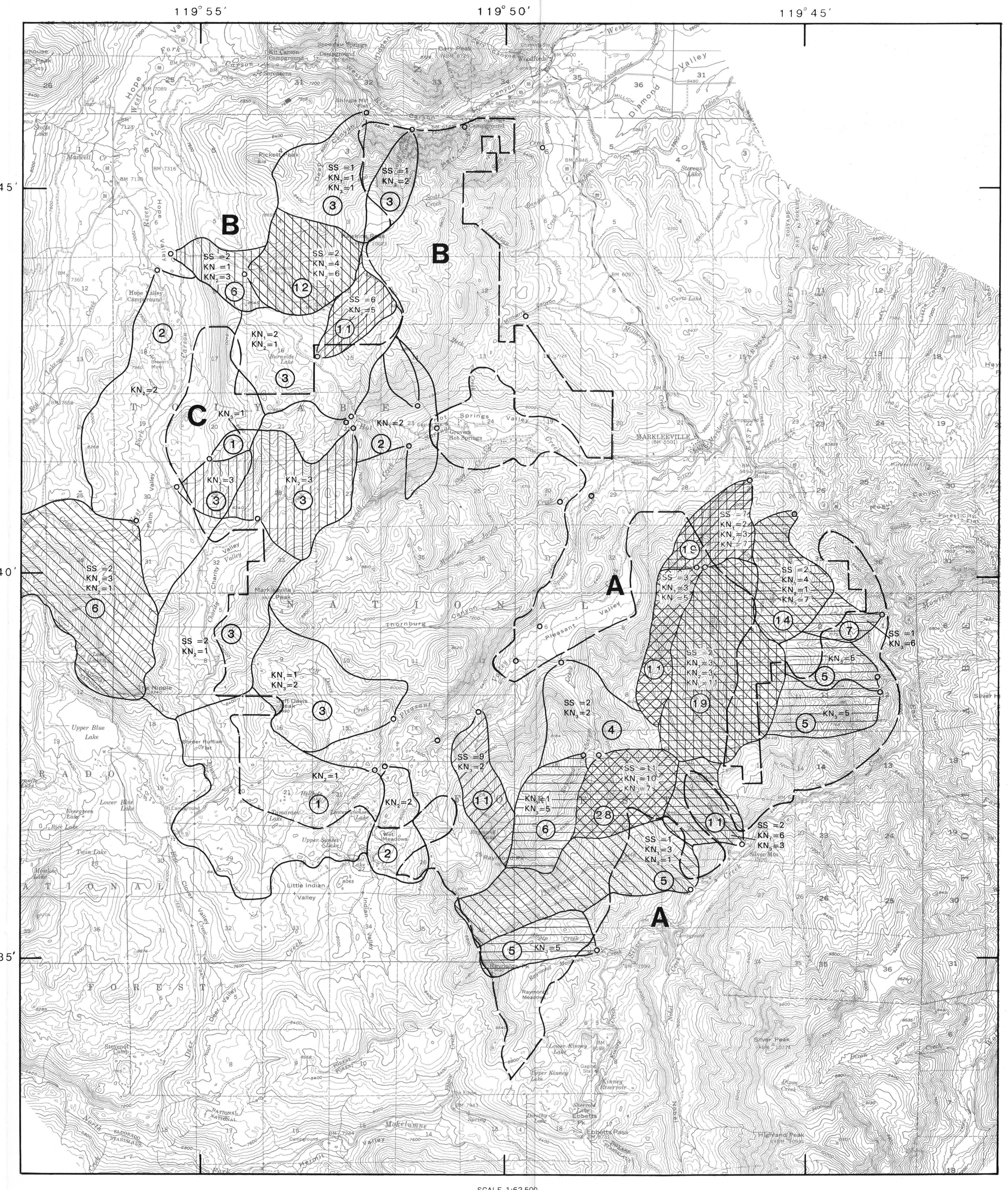
KN_1=2 For one or more of the elements Ag, As, Cu, Pb, Sb, or Zn in concentrate samples (characteristic of precious-metal deposits)

KN_2=3 For one or more of the elements B, Bi, Mo, Sn, or W in concentrate samples (characteristic of vein Mo-W deposits or contact-metasomatic W deposits)

KN_3=1 For Ba, Co, Fe, or Sr in concentrate samples (characteristic of hydrothermal alteration, especially in volcanic rocks)

3 TOTAL SCORESUM--Sum of all stream-sediment (SS) and concentrate (KN_1, KN_2, and KN_3) SCORESUMS for each outlined drainage basin

A AREA DISCUSSED IN TEXT



Base from U.S. Geological Survey
Freel Peak, Markleesville,
Topaz Lake, 1956

SCALE 1:62 500

1 ½ 0 1 2 3 4 MILES

1 .5 0 1 2 3 4 KILOMETERS

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Geochemical sampling in 1978-79;
geology modified from Armin and others (1982)

MAP B.--DISTRIBUTIONS OF ANOMALIES BASED ON SCORESUMS

STUDIES RELATED TO WILDERNESS

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands to determine their mineral values, if any, that may be present. 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 east part of the Raymond Peak (4985) Roadless Area in the Toiyabe National Forest, Alpine County, California. This 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

The Raymond Peak Roadless Area consists of two separate units. The west part (5985), about 12 miles southwest of Markleeville in Stanislaus National Forest, has been studied separately as part of the Mokelumne Wilderness and vicinity (McKee and others, 1982). The east part (4985) is discussed here.

The east part of the Raymond Peak Roadless Area (the study area) encompasses about 58 square miles along the crest and eastern slope of the Sierra Nevada, approximately 13 miles south-southeast of Lake Tahoe. Markleeville, the county seat of Alpine County, lies about 1.5 miles east of the study area. The topography of the area is characterized by deeply incised canyons with glacially scoured canyon walls. Elevations range from about 5,600 feet near Markleeville to more than 10,000 feet on Hawkins and Raymond Peaks.

Geochemical sampling was conducted during 1978 and 1979. This report summarizes the results of that investigation and provides details of the geochemical evaluation used in producing the final mineral resource assessment of the study area (John, Armin, Plouff, Chaffee, Federspiel, and others, 1983).

Map A shows the locations of all sites sampled for this report and shows the distributions of anomalous concentrations of 7 selected elements in 38 samples of rock, 10 elements in 41 samples of minus-60-mesh stream sediment, and 14 elements in 41 samples of nonmagnetic heavy-mineral concentrate derived from stream sediment. Map B shows outlines of those drainage basins containing samples of stream sediment and concentrate with anomalous element concentrations and also shows weighted values for each outlined basin. The values are based on the number of elements with anomalous concentrations in each stream-sediment and concentrate sample and on the degree to which these concentrations are anomalous in each sample.

GEOLOGY

The geology of the study area has been described in detail (Armin and John, 1983; Armin and others, 1981, 1982; Curtis, 1951; John and others, 1981; and Wachter, 1971). Only a brief summary, mainly based on Armin and others (1982), is included here.

The oldest rocks, exposed in several localities in the northwestern part of the study area, are primarily metasedimentary roof-pendant rocks of Triassic(?) and Jurassic(?) age. These rocks, which originally consisted of graywacke, calcareous siltstone, marl, and impure limestone, have been converted to skarn or hornfels.

Late Cretaceous plutonic rocks intrude and metamorphose the roof-pendant rocks. Granodiorite is the most common plutonic rock type; however, rocks of quartz monzonite and quartz diorite compositions have also been mapped.

Rocks of Miocene age, which are predominantly volcanic in origin and andesitic in composition, crop out over about half the study area. These rocks consist of rhyolite ash-flow and air-fall tuffs and of andesitic flows, flow breccias, lahars, plugs, and volcaniclastic sedimentary rocks. Small plugs of rhyolite intruded the older rocks during Pliocene time. Quaternary units, including glacial moraine and outwash deposits, as well as lacustrine, fluvial, and landslide deposits, are also present throughout the study area.

The major fault system along the east side of the Sierra Nevada crosses the study area. Most of the faults trend north to north-northwest.

Three types of mineralization have been recognized in or near the study area. The most extensive type consists of gold and silver mineralization, often accompanied by such elements as copper, lead, zinc, barium, arsenic, and antimony. This mineralization is associated with quartz veins in silicified, argillized, and pyritized zones in the andesitic rocks in the southeastern part of the roadless area.

The second type of mineralization produced contact-metasomatic tungsten deposits, locally accompanied by base and precious metals, in the metamorphosed roof-pendant rocks in the northwestern part of the roadless area. The third type is vein-associated molybdenum-tungsten deposits associated with plutonic rocks. The fourth type, which is recognized near but not in the roadless area, is uranium mineralization in fluvial deposits at the base of the Tertiary volcanic sequence (John, Armin, Plouff, Chaffee, Federspiel, and others, 1983).

GEOCHEMICAL INVESTIGATIONS

This geochemical report is based on chemical analyses of 38 rock samples, 41 minus-60-mesh stream-sediment samples, and 41 nonmagnetic heavy-mineral concentrate samples processed from active stream alluvium.

The rock samples were collected as composite chips from outcrops in the vicinity of most of the plotted sites (map A). Most samples were of fresh rock. These samples provide background geochemical information on elements in rocks that have not been affected by alteration or mineralization. In addition, some altered and mineralized rocks were collected to provide information as to the specific elements present in mineralized areas and the relative abundances of these elements. Each rock sample was selected to represent the chemistry of the rocks exposed in the vicinity of the sample site; however, the actual areal extent represented by a specific sample is not known. Thus, the rock-sampling program was designed only to provide some general information on the geochemical nature of the rock units present.

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. Each sample was composited from several localities within an area that may extend as much as 100 feet from the center of each plotted site (map A). The samples were sieved and the minus-60-mesh material was retained for analysis. The chemical analyses of the stream-sediment samples reflect the chemistry of rock material eroded from the drainage basin upstream from each sample site and may reveal unusually high concentrations of elements related to mineral deposits.

The concentrate samples were prepared from the same active alluvium used to make the stream-sediment samples. The bulk sediment was panned and dried, and the resulting heavy-mineral fraction was treated with bromoform. The grains that were heavier than the bromoform were saved and separated into magnetic and relatively nonmagnetic fractions in a Frantz Isodynamic Separator[1]. The nonmagnetic fraction was analyzed for this study. The analyses of the concentrate samples provide information about the chemistry of a limited number of minerals present in rock material eroded from the drainage basin upstream from each sample site. The concentrating procedures may produce a sample rich in heavy minerals commonly associated with many types of mineral deposits. The selective concentration of ore-related minerals permits determination of some elements, such as tungsten, that are not easily detected in bulk stream-sediment samples. The chemical composition of a nonmagnetic heavy-mineral concentrate may also indicate specific minerals. For example, the cobalt content in a stream-sediment sample may be related to a number of different minerals, many of which normally have no relation to hydrothermal mineralization. Anomalous cobalt concentrations in a concentrate sample, however, often indicate the presence of minerals such as pyrite, or possibly other iron-rich minerals, commonly associated with mineralization.

All three types of samples were analyzed for 31 elements (Ag, As, Au, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, La, Mg, Mn, Mo, Nb, Ni, Pb, Sb, Sc, Sn, Sr, Th, Ti, V, W, Y, Zn, and Zr) using a six-step semiquantitative emission spectrographic method. The rock and stream-sediment samples were also analyzed for arsenic by colorimetry and for bismuth, cadmium, antimony, zinc, and gold by atomic-absorption spectrometry.

Further details concerning the collection, preparation, and analysis of the samples, as well as a tabulation of the analyses, have been published (Sutley, Chaffee, Fey, and Hill, 1983).

EVALUATION PROCEDURES

Element map

On the basis of analyses of samples collected in both mineralized and unmineralized localities in this and other roadless and wilderness areas in the Sierra Nevada region, a suite of 17 elements (Ag, As, Au, B, Ba, Bi, Cd, Co, Cu, Fe, Mn, Mo, Pb, Sb, Sr, W, and Zn) was selected as being indicative of mineral deposits expected to be present in or near the Raymond Peak Roadless Area.

In the area studied for this report, the elements arsenic, gold, barium, copper, molybdenum, lead, tungsten, and zinc are most commonly associated with the ore or ore-related minerals arsenopyrite, native gold, barite, chalcopyrite, molybdenite, galena, scheelite, and sphalerite (or their oxidation products), respectively. Antimony is present in stibnite and, along with silver, in pyrargyrite. Manganese is found in various manganese oxides. The most important mineral residences of the other selected elements are not known. Boron in concentrate samples often indicates the presence of tourmaline. Bismuth is commonly found in bismuthinite or in lead or rare-earth minerals. Cadmium usually substitutes for zinc in zinc-rich minerals. Cobalt can substitute for Fe^{2+} in minerals such as pyrite; thus cobalt, particularly in a concentrate that is low in nickel, often indicates the presence of pyrite. Iron in a concentrate sample commonly indicates pyrite or arsenopyrite, or oxidized products of these minerals. Strontium substitutes for barium and calcium in their minerals. Strontium in a concentrate, particularly in a sample low in calcium, thus may also indicate barite.

The range of background and anomalous concentrations for each selected element was determined by studying percent-frequency distribution histograms for these elements, the spatial distributions of background and anomalous element concentrations relative to known rock types in the study area, and similar information developed for mineral assessments in other areas in the Sierra Nevada. (See, for example, Armstrong and others, 1983; Brem and others, 1984; Chaffee and others, 1983a,b,c; Huber and others, 1983; John, Armin, Plouff, Chaffee, Peters, and others, 1983; John, Chaffee, and Stebbins, 1983; Keith and others, 1983; McKee and others, 1982; Sutley and others, 1982; Sutley, Chaffee, Brem, and others, 1983.)

For the study area considered here, some of the selected elements were not found in anomalous concentrations in any of the three media sampled. Seven of the selected elements had anomalous concentrations in the rock samples; 10 elements had anomalous concentrations in the stream-sediment samples, as had 14 elements in the concentrate samples (table 1).

SCORESUM Map

A suite of 17 selected elements in the samples of stream-sediment and concentrate (tables 2 and 3) were evaluated in terms of three types of deposits suspected or known to exist in or near the study area. These are (1) precious-metal deposits, with or without base metals (defined here as Cu, Pb, Zn, As, and (or) Sb), associated with altered volcanic rocks; (2) contact-metasomatic tungsten deposits (possibly containing precious metals) in roof-pendant rocks; and (3) vein-associated molybdenum-tungsten deposits in plutonic rocks.

To emphasize the relative importance of the stream-sediment and concentrate anomalies for each sample site, the anomalous concentrations for each sample were evaluated using a technique called SCORESUM (Chaffee, 1983). The SCORESUM values shown on map B were created in the following manner. First the threshold value for each element was determined, as described above. All background concentrations were assigned an anomaly score of 0. Next, the anomalous concentrations for each element of interest were divided into three categories, as shown in tables 2 and 3. Anomaly scores of 1 (weakly anomalous), 2 (moderately anomalous), or 3 (strongly anomalous) were substituted for all of the analytical values. As a rough guide, the concentrations assigned to the weakly anomalous category commonly included those values between the threshold value and the 95th percentile value, moderately anomalous generally fell between the 95th and 98th percentiles, and strongly anomalous were generally restricted to the upper 2 percent of the samples.

Next, as a result of element associations seen for different deposit types in other areas studied in the Sierra Nevada, the selected elements for each sample type were assigned to groups. These groups are as follows:

SS--Ag, As, Au, Bi, Cd, Cu, Mo, Pb, Sb, and (or) Zn in stream-sediment samples
KN_1--Ag, As, Cu, Pb, Sb, and (or) Zn in concentrate samples
KN_2--B, Bi, Mo, Sn, and (or) W in concentrate samples
KN_3--Ba, Co, Fe, and (or) Sr in concentrate samples.

The elements in the stream-sediment samples (group SS) are mainly related to precious-metal mineralization but may in some cases be related to base-metal and (or) tungsten-molybdenum mineralizaton. The elements in group KN_1 are mainly associated with precious-metal mineralization but may also be associated with base-metal and contact-metasomatic types of mineralization. The elements in group KN_2 are thought to be mainly associated with quartz-vein-associated molybdenum and (or) tungsten mineralization or with contact-metasomatic tungsten deposits. Group KN_3 comprises elements that are commonly enriched, particularly in volcanic rocks, where hydrothermal alteration (silicification, argillization, and pyritization) has occurred with or without other types of mineralization.

After the anomaly scores were assigned to all of the selected elements, the scores for each group of elements were summed for each sample type at each site (SCORESUM) and plotted on the map for each drainage basin containing a sample with one or more anomalous elements. In addition, the total of all of the stream-sediment and concentrate SCORESUMS was also determined and plotted as a circled number in each appropriate drainage basin. The higher the individual or total SCORESUM is for the samples from one site, the more anomalous and significant is the associated drainage basin in terms of mineral potential. If the total SCORESUM for the samples from a site was zero, then the associated drainage basin was not outlined on the map.

Those drainage basins whose samples have SCORESUMS equal to or greater than 3 for any of the four element groups shown on the map were deemed to be the most significant in terms of mineral potential. Patterning has been added on map B to these drainage basins to identify the types of mineralization suspected of causing the anomalies.

DISCUSSION OF ELEMENT ANOMALIES

Rock samples

Anomalous concentrations of the selected elements in rock samples (table 1) are shown on map A. Twenty-one of the 38 rock samples collected for this study contained one or more anomalous concentrations of the selected elements. The two samples of metasedimentary roof-pendant rocks collected in the vicinity of the Burnside and Cal-Pine mines, in the northwestern part of the study area, contained anomalous concentrations of arsenic, antimony, molybdenum, and (or) tungsten. This suite of elements typically characterizes contact-metasomatic deposits in this region.

Scattered samples of andesitic rocks from the southeastern part of the roadless area contained weakly anomalous concentrations of arsenic, cadmium, copper, molybdenum, and (or) zinc. These elements, as well as others, are known to be present locally in strongly altered and mineralized andesitic rocks associated with known mineralization in this volcanic environment (Benedict and others, 1981).

Three samples of plutonic rocks contained weakly anomalous arsenic, antimony, or lead. These anomalies probably represent only unusually high background concentrations for the respective elements and are probably not related to any type of mineral deposit.

Stream-sediment and concentrate samples

The anomalous concentrations of the 10 selected elements in the stream-sediment samples and of the 14 selected elements in the concentrate samples (table 1) are also shown on map A. Most of both types of samples were found to be anomalous, especially those from streams draining the areas of andesitic and metamorphic rocks. It is probable that many of the samples are anomalous as a result of contamination from old mine dumps and prospect pits; however, the sources of all of the anomalies have not as yet been identified.

DISCUSSION OF SCORESUM ANOMALIES

For purposes of discussion the drainage basins containing anomalous samples have been divided into three areas, shown as A through C on map B.

Area A is bounded roughly by the drainage divide between Raymond and Reynold Peaks on the southwest, by Pleasant Valley Creek on the north, by the East Fork of the Carson River on the east, and by Silver Creek on the southeast. Weak to strong anomalies are present in both stream-sediment and concentrate samples for most of the 17 selected elements, but particularly those elements associated with base- and precious-metal deposits (SS and KN_1), and those elements in the alteration suite (KN_3). The strongest anomalies are in the IXL Canyon, Raymond Canyon Creek, Indian Creek, and Poor Boy Creek drainage basins and also in the south fork of the upper Pleasant Valley Creek drainage basin.

Area A is characterized by locally intensely silicified, argillized, and pyritized Tertiary volcanic rocks that are known to be favorable hosts for base- and, especially, precious-metal deposits, such as that of the Zaca mine, just east of the eastern boundary of the roadless area. Some of the geochemical anomalies in area A may have resulted from contamination from past mining activity.

Area B is on the east side of the Hope Valley and roughly encompasses the drainage basins between Burnside Lake on the south and Hawkins and Pickett Peaks on the north. Samples from this area contain anomalous concentrations of some of the base- and precious-metal suites (SS and KN_1), as well as anomalous concentrations of the tungsten suite (KN_2). The strongest anomalies are in concentrate samples from the basins draining the Burnside and Cal-Pine mines and in the basin draining upper Hot Springs Creek. Area B contains the highly altered and metamorphosed roof-pendant rocks that are known to contain contact-metasomatic-type tungsten deposits as well as precious metals. Thus, the anomalous elements are compatible with the known geologic environment. Much of this anomalous area, including known mineralized localities at the Burnside and Cal-Pine mines, is just outside the roadless area; however, the favorable roof-pendant rocks extend for approximately one mile into the roadless area.

Area C is about 2-3 miles south of area B in the drainage basins of Charity Valley Creek and in the headwaters of the West Fork of the Carson River, in Faith Valley. Concentrate samples contain weakly to moderately anomalous concentrations of elements in the tungsten group (KN_2). None of the elements in the corresponding stream-sediment samples was found to be anomalous, however. The area is underlain mostly by Cretaceous plutonic rocks and local outcrops of Tertiary volcanic rocks. No mineralization is known in area C; the anomalous elements are thought to be derived from molybdenum- and tungsten-rich quartz veins within the plutonic rocks.

Other, less significant anomalies for both types of samples are found throughout the roadless area. Most of these anomalies are thought to be the result of unusually high background values for the respective elements and thus are probably not related to potential mineral resources.

SUMMARY AND CONCLUSIONS

A number of anomalies that are thought to be related to mineralized areas were found as a result of this study. Area A is represented by anomalies for a considerable number of elements and contains altered host rocks considered favorable for mineral deposits, possibly precious-metal deposits accompanied by base metals. A small area in the northwestern part of the roadless area (area B) is characterized by anomalous elements and a geologic environment that suggest the presence of tungsten deposits. These deposits may also contain base or precious metals. Another small area south of area B (area C) is represented by generally weakly anomalous concentrations of bismuth, molybdenum, and tungsten in a geologic environment that suggests the presence of quartz vein-associated tungsten-molybdenum deposits.

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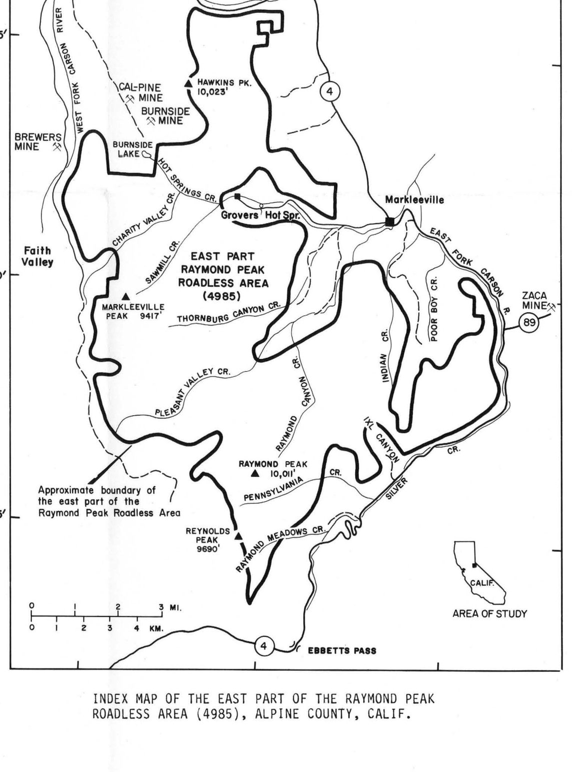

INDEX MAP OF THE EAST PART OF THE RAYMOND PEAK ROADLESS AREA (4985), ALPINE COUNTY, CALIF.

Table 1.--Summary of background and anomaly concentrations for 38 samples of rock, 41 samples of stream sediment, and 41 samples of concentrate, Raymond Peak Roadless Area, California

[Concentration value or range in parts per million, except those for Fe, which are in percent. N, not detected at the lower limit of determination shown in parentheses; <, detected but in a concentration less than that shown; >, greater than values shown. Leaders (--) indicate insufficient data; only 2 samples analyzed]

Element	Background samples: Value or range	Background samples: Number of samples	Anomalous samples: Value or range	Anomalous samples: Number of samples
		Rock samples		
As	N(10)	34	<10-2,800	4
Cd	N(0.05)-0.20	37	0.30	1
Cu	N(5)-30	37	50	1
Mo	N(5)-<5	35	7-10	3
Sb	<1-3	36	4	2
W	N(50)	37	<50	1
Zn	10-65	35	70-75	3
		Stream-sediment samples		
Ag	N(0.5)-<0.5	39	0.5-2	2
As	N(10)<10	35	10-40	6
Au	N(0.005)	--	0.005-0.008	--
Bi	N(0.5)-1.5	40	3.5	1
Cd	N(0.05)-0.30	38	0.35-0.55	3
Cu	7-30	36	50	5
Mo	N(5)-5	37	7-15	4
Pb	20-50	40	70	1
Sb	N(1)-2	36	3-5	5
Zn	30-75	35	80-110	6
		Concentrate samples		
Ag	N(1)	36	<1-7	5
As	N(500)	39	<500-700	2
B	N(20)-70	35	100-500	6
Ba	50-1,500	26	3,000->10,000	15
Bi	N(20)	37	<20-100	4
Co	<10-30	35	50-500	6
Cu	N(10)-30	32	50-300	9
Fe	0.1-3	32	5-30	9
Mn	300-1,500	37	2,000	4
Mo	N(10)-30	35	50-200	6
Pb	N(20)-100	36	150-1,500	5
Sr	N(200)-700	34	1,500-5,000	7
W	N(100)-100	36	150-1,000	5
Zn	N(500)	40	1,000	1

Table 2.--Anomaly scores for 10 selected elements in samples of minus-60-mesh stream sediment, Raymond Peak Roadless Area, California

[Concentration value or range in parts per million. N, not detected at the lower limit of determination shown in parentheses. Leaders (--) indicate no data; only 2 samples analyzed for gold]

Element	Score=1 (weak): Value or range	Score=1 (weak): Number of samples	Score=2 (moderate): Value or range	Score=2 (moderate): Number of samples	Score=3 (strong): Value or range	Score=3 (strong): Number of samples
Ag	0.5	1	--	--	2	1
As	10	3	20	1	40	2
Au	--	--	0.005-0.008	--	--	--
Bi	--	--	3.5	1	--	--
Cd	0.35	1	0.40	1	0.55	1
Cu	50	5	--	--	--	--
Mo	7	2	10-15	2	--	--
Pb	70	1	--	--	--	--
Sb	3	3	--	--	5	2
Zn	80	3	90-110	3	--	--

Table 3.--Anomaly scores for 14 elements in samples of nonmagnetic heavy-mineral concentrate, Raymond Peak Roadless Area, California

[Concentration value or range in parts per million, except those for Fe, which are in percent. <, detected but in a concentration below that shown; >, greater than value shown. Leaders (--) indicate no data]

Element	Score=1 (weak): Value or range	Score=1 (weak): Number of samples	Score=2 (moderate): Value or range	Score=2 (moderate): Number of samples	Score=3 (strong): Value or range	Score=3 (strong): Number of samples
Ag	<1	1	1.5-3	2	5-7	2
As	<500	1	--	--	700	1
B	100	2	200	2	300-500	2
Ba	3,000-5,000	4	7,000-10,000	5	>10,000	6
Bi	<20	3	--	--	100	1
Co	50	3	70	2	100-500	1
Cu	50	5	70	1	150-300	3
Fe	5	3	7	3	10-30	3
Mn	2,000	4	--	--	--	--
Mo	50-70	4	100	1	200	1
Pb	150	1	200	2	700-1,500	2
Sr	1,500	1	2,000	4	5,000	2
W	150	1	200-500	3	1,000	1
Zn	--	--	--	--	1,000	1

Table 3.--Anomaly scores for 14 elements in samples of nonmagnetic heavy-mineral concentrate, Raymond Peak Roadless Area, California

[Concentration value or range in parts per million, except those for Fe, which are in percent. <, detected but in a concentration below that shown; >, greater than value shown. Leaders (--) indicate no data]

Element	Score=1 (weak): Value or range	Score=1 (weak): Number of samples	Score=2 (moderate): Value or range	Score=2 (moderate): Number of samples	Score=3 (strong): Value or range	Score=3 (strong): Number of samples
Ag	<1	1	1.5-3	2	5-7	2
As	<500	1	--	--	700	1
B	100	2	200	2	300-500	2
Ba	3,000-5,000	4	7,000-10,000	5	>10,000	6
Bi	<20	3	--	--	100	1
Co	50	3	70	2	100-500	1
Cu	50	5	70	1	150-300	3
Fe	5	3	7	3	10-30	3
Mn	2,000	4	--	--	--	--
Mo	50-70	4	100	1	200	1
Pb	150	1	200	2	700-1,500	2
Sr	1,500	1	2,000	4	5,000	2
W	150	1	200-500	3	1,000	1
Zn	--	--	--	--	1,000	1

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

SUMMARY GEOCHEMICAL MAPS FOR SAMPLES OF ROCK, STREAM SEDIMENT, AND NONMAGNETIC HEAVY-MINERAL CONCENTRATE, EAST PART OF THE RAYMOND PEAK ROADLESS AREA, ALPINE COUNTY, CALIFORNIA

By

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