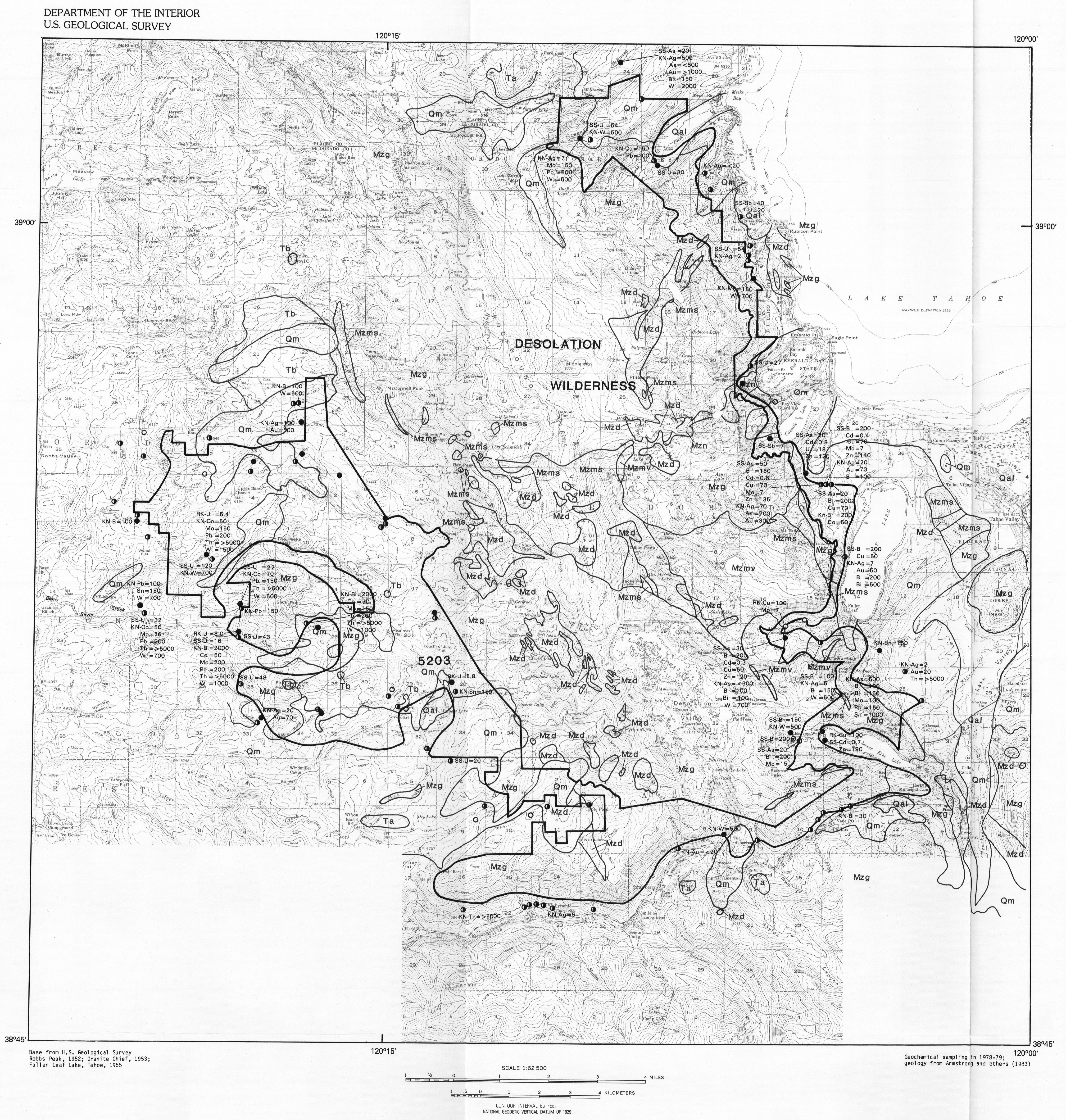
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1616-B



Base from U.S. Geological Survey
Robbs Peak, 1952; Granite Chief, 1953;
Fallen Leaf Lake, Tahoe, 1955

Geochemical sampling in 1978-79;
geology from Armstrong and others (1983)

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

CORRELATION OF MAP UNITS

Unit		
Qal Qm		QUATERNARY
Tb Ta	Miocene	TERTIARY
Mzg Mzn		CRETACEOUS
Mzd Mzmv Mzms		CRETACEOUS AND (OR) JURASSIC

DESCRIPTION OF MAP UNITS

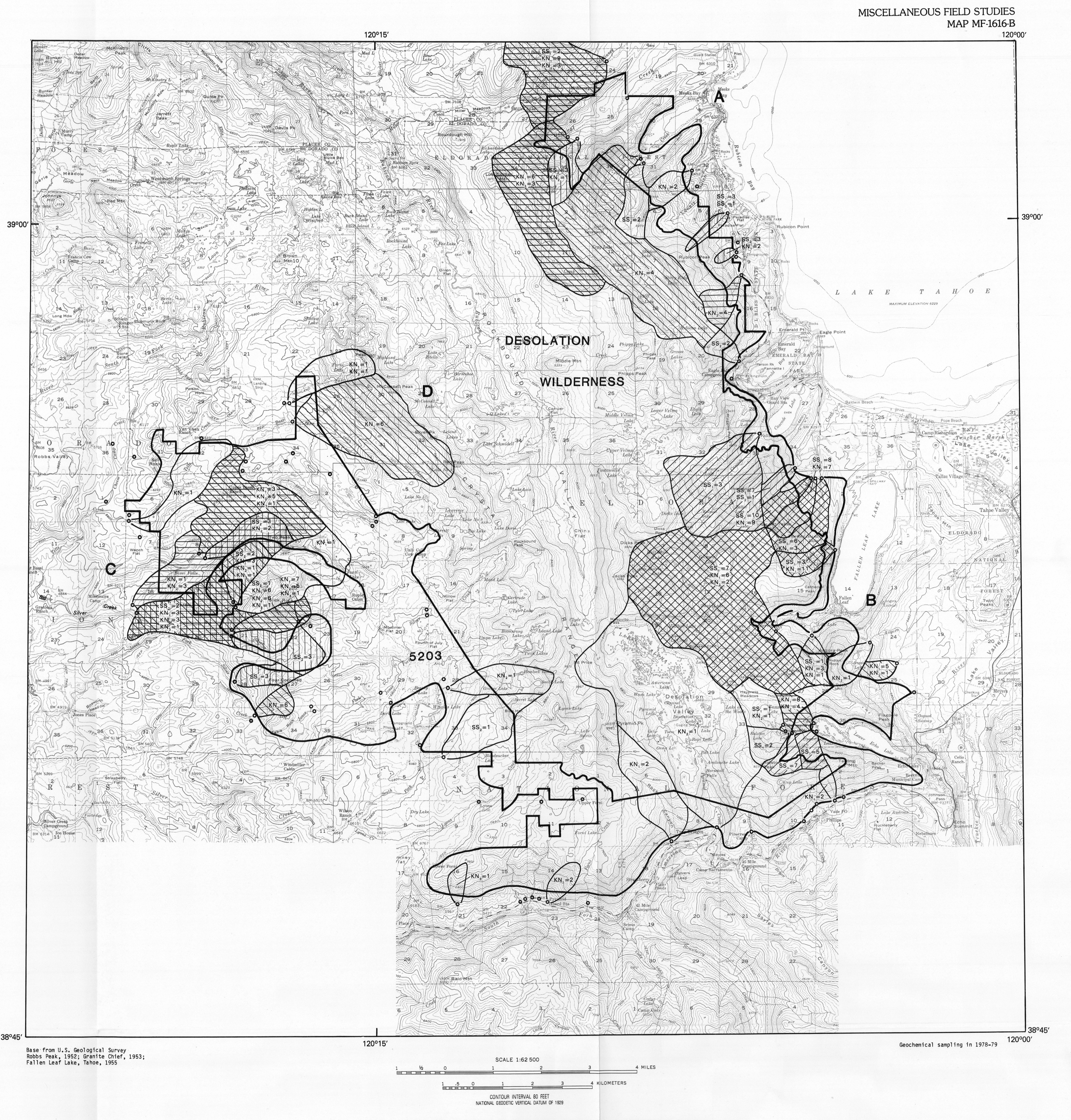
Qal	ALLUVIUM (QUATERNARY)--Fine- to medium-grained silt and sand and pebble conglomerate, deposited in lacustrine and fluvial environments
Qm	GLACIAL MORAINE AND OUTWASH GRAVEL DEPOSITS (QUATERNARY)--Boulder conglomerate to unconsolidated silt and clay
Tb	PORPHYRITIC OLIVINE BASALT (MIOCENE)--Basalt containing hypersthene, olivine, and augite microphenocrysts; groundmass of augite and labradorite
Ta	ANDESITE BRECCIAS AND INTERBEDDED EPICLASTIC STREAM CONGLOMERATE AND SANDSTONE (MIOCENE)--Andesitic lava flows, mudflows; sedimentary rocks ranging from siltstone to cobble conglomerates
Mzg	GRANODIORITE TO ALASKITE (CRETACEOUS)--Granodioritic intrusive masses ranging in composition from alaskite through quartz monzonite to quartz diorite; granodiorite is the most common rock type in the roadless area
Mzn	NORITIC ROCKS (CRETACEOUS)--Leucocratic norite containing plagioclase, hypersthene, hornblende, and magnetite; rocks show compositional banding
Mzd	DIORITIC ROCKS (CRETACEOUS AND (OR) JURASSIC)--Compositionally variable from quartz diorite to hornblende gabbro; hornblende-rich quartz diorite is most abundant
Mzmv	METAVOLCANIC ROCKS (CRETACEOUS AND (OR) JURASSIC)--Principally dark quartzo-feldspathic hornfels; relict textural features of volcanic rocks, parent rocks probably andesite or dacite (Dodge and Fillo, 1967)
Mzms	METASEDIMENTARY ROCKS (CRETACEOUS AND (OR) JURASSIC)--Fine-grained, calc- and quartzo-feldspathic hornfels derived from argillaceous limestone and shale are the most abundant rock type present. Hornfels grades into quartzite as the amount of feldspar and mafic minerals decreases

EXPLANATION FOR MAP A

━	APPROXIMATE BOUNDARY OF THE PYRAMID ROADLESS AREA
─	GEOLOGIC CONTACT--Approximately located
	SAMPLE SITE
○	Only rock sample collected
◉	Only stream-sediment sample collected
◐	Only rock and stream-sediment samples collected
◑	Only stream-sediment and concentrate samples collected
●	All three sample types (rock, stream sediment, and concentrate) collected
	ANOMALOUS SAMPLE--Showing element(s) and concentration(s) in ppm
RK Pb=200	Rock
SS As=50	Stream sediment
KN Ag=20	Concentrate

EXPLANATION FOR MAP B

━	APPROXIMATE BOUNDARY OF THE PYRAMID ROADLESS AREA
	SAMPLE LOCALITY AND OUTLINE OF DRAINAGE BASIN
▨	For samples that have SS_1 SCORESUMS ≥3
▧	For samples that have KN_1 SCORESUMS ≥3
▥	For samples that have (SS_2 + KN_3) SCORESUMS ≥3
▤	For samples that have KN_2 SCORESUMS ≥3
	SCORESUM
SS_1=2	For one or more of the elements As, B, Cd, Cu, Mo, Sb, or Zn in stream-sediment samples (characteristic of precious-metal deposits)
SS_2=2	For uranium in stream-sediment samples (characteristic of uranium deposits)
KN_1=2	For one or more of the elements Ag, As, Au, B, Bi, Co, Cu, or Pb in concentrate samples (characteristic of precious-metal deposits)
KN_2=3	For one or more of the elements Mo, Sn, or W in concentrate samples (characteristic of contact-metasomatic or vein-associated tungsten deposits)
KN_3=1	For thorium in concentrate samples (characteristic of uranium deposits)
A	AREA DISCUSSED IN TEXT



Base from U.S. Geological Survey
Robbs Peak, 1952; Granite Chief, 1953;
Fallen Leaf Lake, Tahoe, 1955

Geochemical sampling in 1978-79

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 Pyramid Roadless Area (5203) in the Eldorado National Forest and Lake Tahoe Basin Management Unit, El Dorado 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 Pyramid Roadless Area lies near the crest of the Sierra Nevada about 75 miles east of Sacramento, California. The area, which is adjacent to and almost encircles the Desolation Wilderness, encompasses approximately 31,400 acres in Eldorado National Forest and the Lake Tahoe Basin Management Unit in El Dorado County, California.

The area is dominated by deep rugged canyons that run eastward from the Sierra Nevada crest to Lake Tahoe basin and westward toward the Sacramento Valley. Elevations range from about 5,500 feet along Big Silver Creek on the west side of the study area to 8,895 feet at Echo Peak along the southeastern side of the roadless area.

Geochemical sampling was conducted during 1982. 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 (Armstrong and others, 1983).

Map A shows the locations of all sites sampled for this report and the distributions of anomalous concentrations of 3 elements in rock samples, 8 elements in stream-sediment samples, and 12 elements in nonmagnetic heavy-mineral concentrate samples derived from stream sediment. Map B shows outlines of those drainage basins containing samples of stream sediment and concentrate having anomalous element concentrations and also shows weighted values for each outlined basin. The weighted values are based on the number of elements having 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 (Loomis, 1964; Dodge and Fillo, 1967; Burnett, 1971; Armstrong and others, 1983). Only a brief summary is included here. The oldest rocks exposed in the study area comprise Jurassic and (or) Cretaceous metasedimentary and metavolcanic rocks. The metasedimentary rocks are calc-silicate and quartzo-feldspathic hornfelses derived from argillaceous limestones and shales. The metavolcanic rocks are quartzo-feldspathic hornfelses that were probably derived from pyroclastic rocks. The largest outcrops of metamorphic rocks are found in the Mount Tallac roof pendant in the southeastern part of the roadless area, just west of Fallen Leaf Lake.

Mesozoic plutonic rocks make up the greatest part of outcrops in and around the study area. These rocks include a number of different units. Granodiorite is the most common rock type; however, rocks of alaskite, quartz monzonite, quartz diorite, and hornblende gabbro compositions have been mapped. A small mass of norite is present near Emerald Bay.

Remnants of porphyritic olivine basalt flows of Tertiary age are present in scattered localities in the western part of the study area. Quaternary units, including glacial moraine and outwash deposits, as well as lacustrine and fluvial deposits, are also present throughout the study area. Although no mineral deposits have as yet been identified within the roadless area; hydrothermally altered roof-pendant rocks are present in several localities.

GEOCHEMICAL INVESTIGATIONS

This geochemical report is based on chemical analyses of 35 rock samples, 90 minus-60-mesh stream-sediment samples, and 88 nonmagnetic heavy-mineral concentrate samples processed from active stream alluvium.

The rock samples were collected as composite chips from outcrops in the vicinity of many 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, several 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 heavy-mineral 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 the 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) by six-step semiquantitative emission spectroscopy. All the rock and stream-sediment samples were also analyzed for arsenic, bismuth, cadmium, antimony, and zinc by atomic-absorption spectrometry and for uranium by fluorometry.

Further details concerning the collection, preparation, and analysis of the samples, as well as a tabulation of the analyses, have been published (Chaffee, Fey, and others, 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 16 elements (Ag, As, Au, B, Bi, Cd, Co, Cu, Mo, Pb, Sb, Sn, Th, U, W, and Zn) was selected as being indicative of mineral deposits expected to be present in or near the Pyramid Roadless Area.

In the area studied for this report, the elements arsenic, gold, copper, molybdenum, lead, and zinc are most commonly associated with the ore or ore-related minerals arsenopyrite, native gold, chalcopyrite, molybdenite, galena, and sphalerite (or their oxidation products), respectively. The mineral residences of the other selected elements are not known. Silver commonly occurs as the sulfide argentite or acanthite or may be found in galena or in complex sulfosalt minerals. Boron in concentrate samples often occurs as 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. Cobalt, particularly in a concentrate, thus often indicates the presence of pyrite, especially in samples low in nickel. Antimony may occur in stibnite or in complex sulfosalt minerals. Tin is most likely present as cassiterite, and tungsten as scheelite. The mineral residences of the thorium and uranium are not known; these two elements often are enriched together, suggesting a common mineralogy, possibly in a rock-forming accessory mineral.

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, Brem and others, 1984; Chaffee and others, 1980; Chaffee and others, 1983a,b,c; Huber and others, 1983; John, Armin, Plouff, Chaffee, Federspiel, 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, 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. Only 3 of the selected elements were found to have anomalous concentrations in the rock samples; 8 elements were found to have anomalous concentrations in the stream-sediment samples and 12 elements in the concentrate samples (table 1).

SCORESUM map

A suite of 16 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: (1) precious-metal deposits (with or without the base metals copper, lead, and zinc) associated with metamorphosed and pyritized roof-pendant rocks; (2) contact-metasomatic or vein-type tungsten deposits; and (3) uranium deposits.

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 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 to best represent the three possible types of deposits considered to be present in the study area. These groups are as follows:

SS_1 - As, B, Cd, Cu, Mo, Sb, and (or) Zn in stream-sediment samples
SS_2 - U in stream-sediment samples
KN_1 - Ag, As, Au, B, Co, Cu, and (or) Pb in concentrate samples
KN_2 - Bi, Mo, Sn, and (or) W in concentrate samples
KN_3 - Th in concentrate samples.

The elements in groups SS_1 and KN_1 are mainly related to base- and precious-metal mineralization but in some cases may be related to tungsten mineralization, both associated with metamorphosed roof-pendant rocks. The elements in group KN_2 are most closely associated with contact-metasomatic or vein-type tungsten deposits. The elements in groups SS_2 and KN_3 are related to uranium mineralization.

After the anomaly scores were assigned to all 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. 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 to these drainage basins on map B 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. Only five of the 35 rock samples collected for this study contained anomalous concentrations of the selected elements. Three granodiorite samples on the west side of the study area contained weakly anomalous concentrations of uranium. Two samples from the Mount Tallac roof-pendant, one metasedimentary rock and one metavolcanic rock, contained weakly anomalous concentrations of copper, and of copper and molybdenum, respectively. The anomalies in all these samples probably only represent abnormally high background concentrations for the respective rock types. These analytical results corroborate those of Dodge and Fillo (1967) for the adjacent Desolation Wilderness. Their findings indicated that, with the exception of rock samples collected from several previously known prospects, none of the rock samples collected in that wilderness area contained anomalous concentrations of any elements that might be indicative of hydrothermal mineral deposits.

Stream-sediment and concentrate samples

The anomalous concentrations of the eight selected elements in the stream-sediment samples and of the twelve selected elements in the concentrate samples (table 1) are also shown on map A. Most of the anomalous concentrations of elements in these two sample types are thought to be related to precious-metal or tungsten mineralization in altered roof-pendant rocks, to tungsten mineralization in quartz veins, or to uranium enrichment in felsic plutonic rocks. Some of these anomalies are related to mapped roof-pendant rocks; however, the sources of many of the anomalies, particularly the tungsten and uranium anomalies, have not been identified. A more detailed description of the stream-sediment and concentrate anomalies is given below.

DISCUSSION OF SCORESUM ANOMALIES

For purposes of discussion the drainage basins containing anomalous samples have been divided into four areas, A through D on map B.

Area A, in the northeastern part of the study area, extends from McKinney Creek on the north to Emerald Bay on the south. This area is composed entirely of granodiorite containing as much as 5 percent dioritic inclusions. Strong anomalies for group KN_1 (Ag, As, Au, Cu, and (or) Pb) are present in the McKinney Creek, General Creek, and Meeks Creek drainage basins. Anomalies for group SS_2 (U) are present in three scattered drainage basins in Area A. The concentrate samples from the McKinney and General Creek drainages also exhibit anomalous concentrations of group KN_2 elements (B, Mo, and (or) W). Other anomalies that are less significant in terms of mineral resource potential are found scattered throughout Area A.

No sources for any of the anomalies in Area A are known; the only known mine near this area, the Noonchester mine, is located outside the study area about 1 mile north of McKinney Creek. This mine was developed for gold but no production had been recorded as of 1967 (Dodge and Fillo, 1967). The metasedimentary rocks associated with this mine do not extend into the study area but might be the source of the anomaly in McKinney Creek. Tungsten anomalies may result from tungsten-rich quartz veins in the granodioritic rocks; however, no such veins have been identified. The uranium concentrations in the three anomalous samples (20 to 30 ppm) probably have been derived from accessory, rock-forming minerals in the granodiorites.

Area B, in the east-central part of the study area, extends from Cascade Lake on the north to the two Echo Lakes on the south. This area is characterized by metamorphosed blocks of Jurassic and (or) Cretaceous sedimentary and volcanic sequences that have been intruded mainly by granodioritic plutons of the Sierra Nevada batholith. Anomalous concentrations of elements in groups SS_1, KN_1, and KN_2 (Ag, As, Au, B, Bi, Cd, Co, Cu, Mo, Sb, Sn, W, and (or) Zn) are present in the drainage basins radiating away from Mt. Tallac as well as in the basin of Glen Alpine Creek and the basins above Upper Echo Lake. The anomalous samples were all collected in or near roof-pendant rocks, suggesting that precious-metal deposits and (or) contact-metasomatic tungsten deposits might be present in one or more of these drainage basins. One stream-sediment sample from this area contained weakly anomalous uranium (18 ppm). The sample is from a basin containing granodioritic rocks.

Area C, in the western part of the study area, extends from Tells Creek on the north to the Jones Fork of Silver Creek on the south. Granodioritic plutonic rocks of the Sierra Nevada batholith predominate here. Outcrops of metamorphosed roof-pendant rocks and of Tertiary andesitic or basaltic flow rocks are present locally. An anomaly for group KN_1 elements (Ag and Au) is present in the drainage basin at the extreme southern end of Area C. Anomalies for group KN_2 elements (Bi, Mo, and (or) W) are present in other drainage basins in Area C, particularly those basins associated with Big Silver Creek, and suggest the possibility of undiscovered tungsten deposits. In addition, anomalies for group SS_2 (U) occur in various branches of Bassi Fork, Big Silver Creek, and the Jones Fork of Silver Creek. No sources for any of these anomalous elements are known. The tungsten anomalies are probably associated with quartz veins and the uranium anomalies with accessory, rock-forming minerals. Most of these anomalous elements thus probably represent unusually high but normal concentrations relative to the rock types present in the respective source areas.

Area D, representing one of the upper tributaries to Bassi Fork in the extreme northern end of the western part of the study area, exhibits a strong anomaly for group KN_1 elements (Ag and Au). The source of this precious-metal anomaly is not known; a few small outcrops of metasedimentary rocks are exposed in the upper parts of this basin.

SUMMARY AND CONCLUSIONS

A number of anomalies thought to indicate mineralized areas were found as a result of this geochemical study. Four areas, each representing clusters of drainage basins whose samples were found to be anomalous, have been identified in the Pyramid Roadless Area. Areas A and B contain important precious-metal- and (or) tungsten-related anomalies. Area C contains important anomalies of precious-metal-, tungsten-, and uranium-related elements. Area D contains precious-metal anomalies.

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

ACKNOWLEDGMENTS

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REFERENCES CITED

Armstrong, A. K., Chaffee, M. A., and Scott, D. F., 1983, Mineral resource potential map of the Pyramid Roadless Area, El Dorado County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1616-A, scale 1:62,500.

Brem, G. F., Chaffee, M. A., Plouff, Donald, Lambeth, R. H., Campbell, H. W., Scott, D. F., and Spear, J. M., 1984, Mineral resource potential map of the Sweetwater Roadless Area, Mono County, California, and Lyon and Douglas Counties, Nevada: U.S. Geological Survey Miscellaneous Field Studies Map MF-1535-A, scale 1:62,500.

Burnett, J. L., 1971, Geology of the Lake Tahoe Basin, California: California Geology, California Division of Mines and Geology, v. 27, no. 7, p. 119-130.

Chaffee, M. A., 1983, SCORESUM--A technique for displaying and evaluating multi-element geochemical information, with examples of its use in regional mineral assessment programs: Journal of Geochemical Exploration, v. 19, nos. 1-3, p. 361-381.

Chaffee, M. A., Fey, D. L., Grimes, D. J., and Leinz, R. W., 1983, Chemical analyses and statistical summaries for samples of rock, minus-60-mesh (0.25-mm) stream sediment, and nonmagnetic heavy-mineral concentrate, Pyramid Roadless Area, El Dorado County, California: U.S. Geological Survey Open-File Report 83-644, 25 p., 1 plate.

Chaffee, M. A., Hill, R. H., Speckman, W. S., and Sutley, S. J., 1980, Preliminary data set containing geochemical analyses of samples of rock, stream sediment, and nonmagnetic heavy-mineral concentrate, Walker Lake 2° quadrangle, California and Nevada: U.S. Geological Survey Open-File Report 80-881, 235 p., 1 plate.

Chaffee, M. A., Hill, R. H., and Sutley, S. J., 1983a, Summary geochemical maps, Hoover Wilderness and adjacent study area, Mono and Tuolumne Counties, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1101-B, 3 sheets, scale 1:62,500.

______1983b, Geochemical element maps, Hoover Wilderness and adjacent study area, Mono and Tuolumne Counties, California: U.S. Geological Survey Open-File Report 82-283, 11 sheets, scale 1:62,500.

______1983c, Geochemical maps showing distributions of anomalous element concentrations and of anomalous drainage basins, Mokelumne Wilderness and contiguous roadless areas, central Sierra Nevada, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1201-C, 2 sheets, scale 1:62,500.

Dodge, F. C. W., and Fillo, P. V., 1967, Mineral resources of the Desolation Primitive Area of the Sierra Nevada, California: U.S. Geological Survey Bulletin 1261-A, 27 p., 1 plate.

Huber, N. K., Chaffee, M. A., Griscom, Andrew, Capstick, D. O., and Iverson, S. R., 1983, Mineral resource potential map of the Mount Raymond Roadless Area, central Sierra Nevada, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1417-B, scale 1:62,500.

John, D. A., Armin, R. A., Plouff, Donald, Chaffee, M. A., Federspiel, F. E., Scott, D. R., and Cather, E. E., 1983, Mineral resource potential map of the east part of the Raymond Peak Roadless Area, Alpine County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1365-C, scale 1:62,500.

John, D. A., Armin, R. A., Plouff, Donald, Chaffee, M. A., Peters, T. J., Scott, D. F., Federspiel, F. E., Cather, E. E., and Campbell, H. W., 1983, Mineral resource potential map of the Freel and Dardanelles Roadless Areas, Alpine and El Dorado Counties, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1322-C, scale 1:62,500.

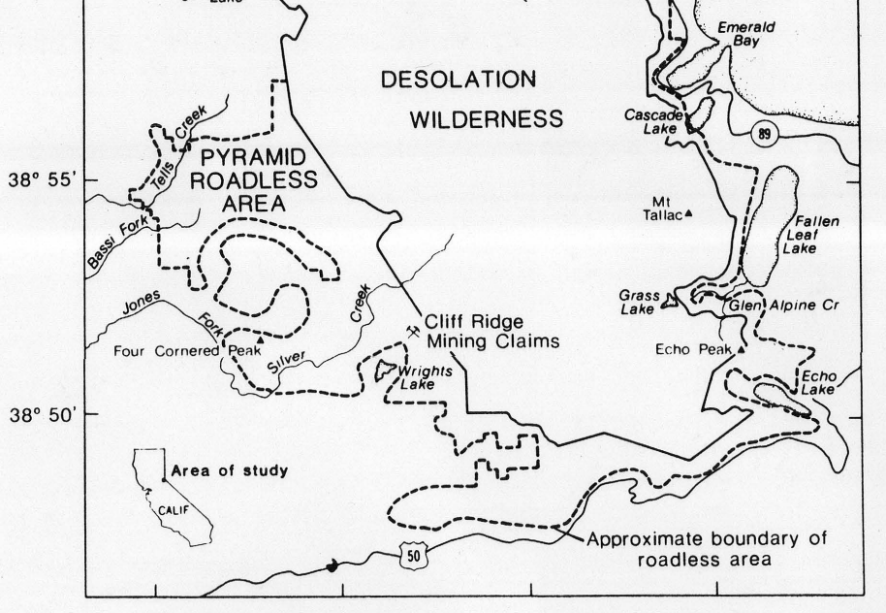
John, D. A., Chaffee, M. A., and Stebbins, S. A., 1983, Mineral resource potential map of the Lincoln Creek Roadless Area, Douglas County, Nevada: U.S. Geological Survey Miscellaneous Field Studies Map MF-1545, scale 1:62,500.

Keith, W. J., Chaffee, M. A., Plouff, Donald, and Miller, M. S., 1983, Mineral resource potential map of the Carson-Iceberg Roadless Area, central Sierra Nevada, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1416-B, scale 1:62,500.

Loomis, A. A., 1964, Geology of the Fallen Leaf quadrangle: California Division of Mines and Geology Open-File Report, 174 p.

McKee, E. H., Chaffee, M. A., Federspiel, F. E., McHugh, E. L., Cather, E. E., Scott, D. F., and Rumsey, C. M., 1982, Mineral resource potential map of the Mokelumne Wilderness and contiguous roadless areas, central Sierra Nevada, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1201-E, scale 1:62,500.

Sutley, S. J., Chaffee, M. A., Brem, G. F., Fey, D. L., and Hill, R. H., 1983, Chemical analyses and statistical summaries for samples of rock, minus-60-mesh (0.25-mm) stream sediment, and nonmagnetic heavy-mineral concentrate, Sweetwater Roadless Area, Mono County, California, and Lyon and Douglas Counties, Nevada: U.S. Geological Survey Open-File Report 83-647, 44 p., 1 plate.



INDEX MAP SHOWING LOCATION OF PYRAMID ROADLESS AREA, CALIFORNIA

Table 1.--Summary of background and anomaly concentration ranges for selected elements in 35 samples of rock, 90 samples of stream sediment, and 88 samples of concentrate, Pyramid Roadless Area, California

[Concentration value or range in parts per million. N, not detected at the lower limit of determination shown in parentheses; <, detected but in a concentration below that shown. Leaders (--) indicate no data]

Element	Background samples: Value or range	Background samples: Percent of samples	Anomalous samples: Value or range	Anomalous samples: Percent of samples
Rock samples				
Cu	N(5)-50	94	100	6
Mo	N(5)-<5	97	7	3
U	0.16-4.0	91	5-8	9
Stream-sediment samples				
As	N(10)-<10	94	20-70	6
B	<10-70	90	100-200	10
Cd	N(0.10)-0.20	95	0.30-0.80	5
Cu	N(5)-30	95	50-70	5
Mo	N(5)-5	97	7-15	3
Sb	N(1)	98	7-40	2
U	0.50-15	86	16-120	14
Zn	10-75	95	120-190	5
Concentrate samples				
Ag	N(1)	88	2-500	12
As	N(500)	96	<500-700	4
Au	N(20)	90	<20->1,000	10
B	N(20)-70	90	100-200	10
Bi	N(20)	93	30-2,000	7
Co	<10-30	94	50-70	6
Cu	N(10)-30	99	150	1
Mo	N(10)-50	93	70-200	7
Pb	N(20)-70	89	100-500	11
Sn	N(20)-100	96	150-1,000	4
Th	N(200)-5,000	92	>5,000	8
W	N(100)-300	83	500-2,000	17

Table 2.--Anomaly scores for 8 selected elements in samples of minus-60-mesh stream sediment, Pyramid Roadless Area, California

[Concentration value or range in parts per million. Leaders (--) indicate no data]

Element	Score=1 (weak): Value or range	Score=1 (weak): Percent of samples	Score=2 (moderate): Value or range	Score=2 (moderate): Percent of samples	Score=3 (strong): Value or range	Score=3 (strong): Percent of samples
As	--	--	20-30	4	50-70	2
B	150	3	200	7	--	--
Cd	0.30	1	0.40-0.60	2	0.70-0.80	2
Cu	50	2	70	3	--	--
Mo	7	2	--	--	15	1
Sb	--	--	--	--	7-40	2
U	16-20	4	22-32	4	43-120	6
Zn	120-140	4	190	1	--	--

Table 3.--Anomaly scores for 12 elements in samples of nonmagnetic heavy-mineral concentrate, Pyramid Roadless Area, California

[Concentration value or range in parts per million. <, 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): Percent of samples	Score=2 (moderate): Value or range	Score=2 (moderate): Percent of samples	Score=3 (strong): Value or range	Score=3 (strong): Percent of samples
Ag	--	--	2-5	4	7-500	8
As	--	--	<500	2	500-700	2
Au	--	--	<20	2	20->1,000	8
B	100-150	8	200	2	--	--
Bi	--	--	30	1	100-2,000	6
Co	50	4	70	2	--	--
Cu	--	--	--	--	150	1
Mo	70-100	2	150	4	200	1
Pb	100-150	6	200	4	500	1
Sn	150	3	--	--	1,000	1
Th	>5,000	8	--	--	--	--
W	500	8	700	6	1,000-2,000	3

SUMMARY GEOCHEMICAL MAPS FOR SAMPLES OF ROCK, STREAM SEDIMENT, AND NONMAGNETIC HEAVY-MINERAL CONCENTRATE, PYRAMID ROADLESS AREA, EL DORADO COUNTY, CALIFORNIA

By

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