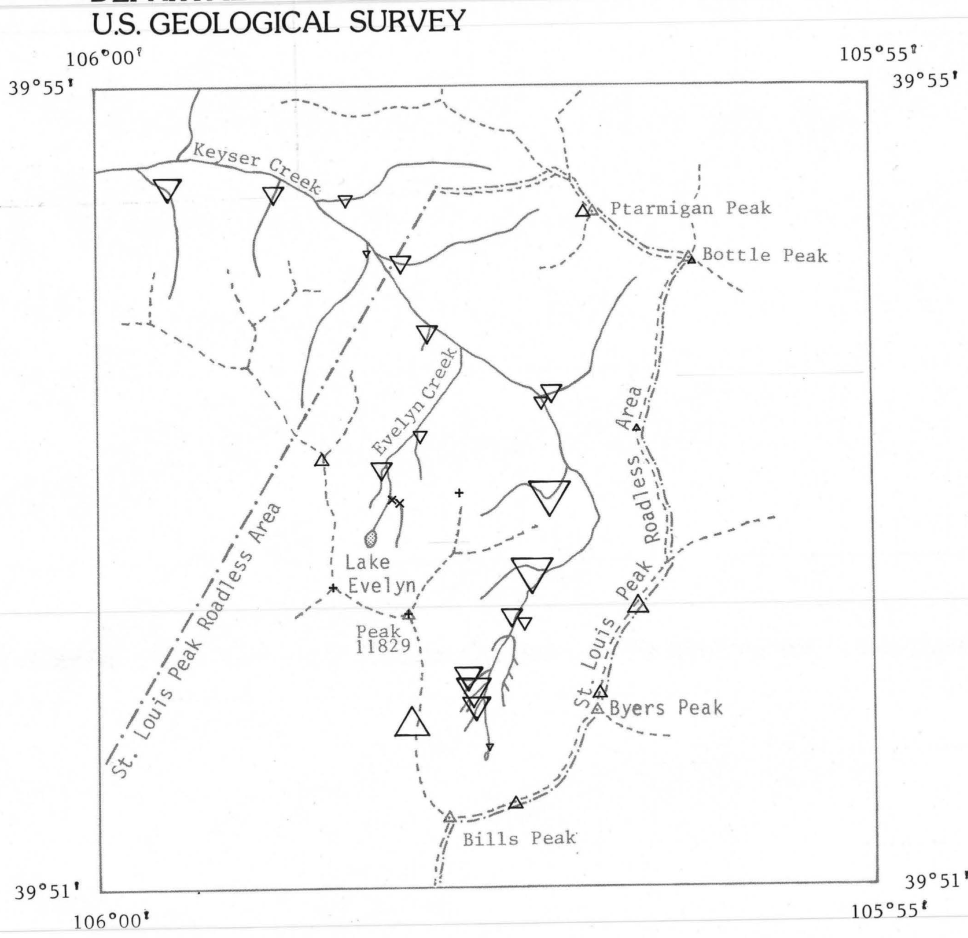


EXPLANATION

CONCENTRATION IN PARTS PER MILLION--N, not detected; L, detected but less than 20; >, greater than

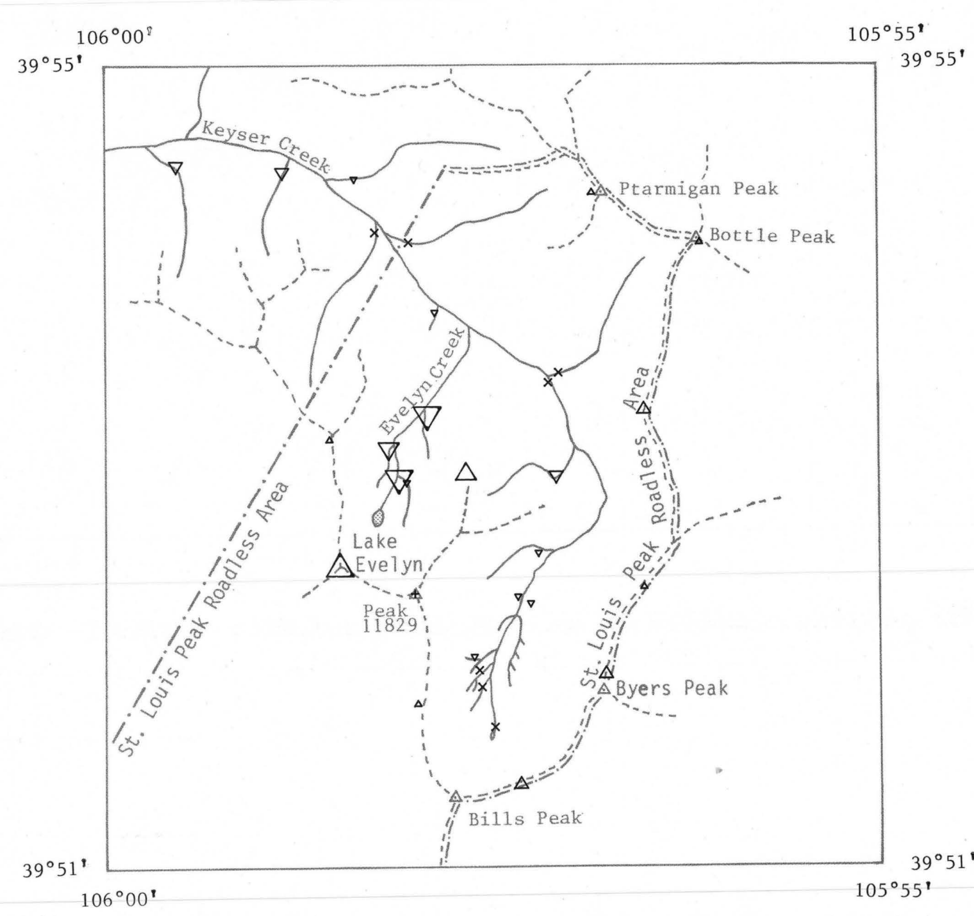
RIDGE: + N;L;20;30 · ▲ 50;100;150 · ▲ 200;300 · △ 500;700 · △ 1000;1500;2000

STREAM: × N;L;20;30;50;70 · ▾ 100;150 · ▿ 200;300 · ▽ 500;700 · ▽ 1000;1500 · ▽ 2000;3000 · ▽ 5000;>5000

Scale 1:50,000 — 0 1 2 3 KILOMETERS; 0 1 2 MILES

RIDGE · STREAM · APPROXIMATE BOUNDARY ST. LOUIS PEAK ROADLESS AREA · PEAK

MAP A. BORON IN HEAVY-MINERAL CONCENTRATES



EXPLANATION

CONCENTRATION IN PARTS PER MILLION--N, not detected; L, detected but less than 20

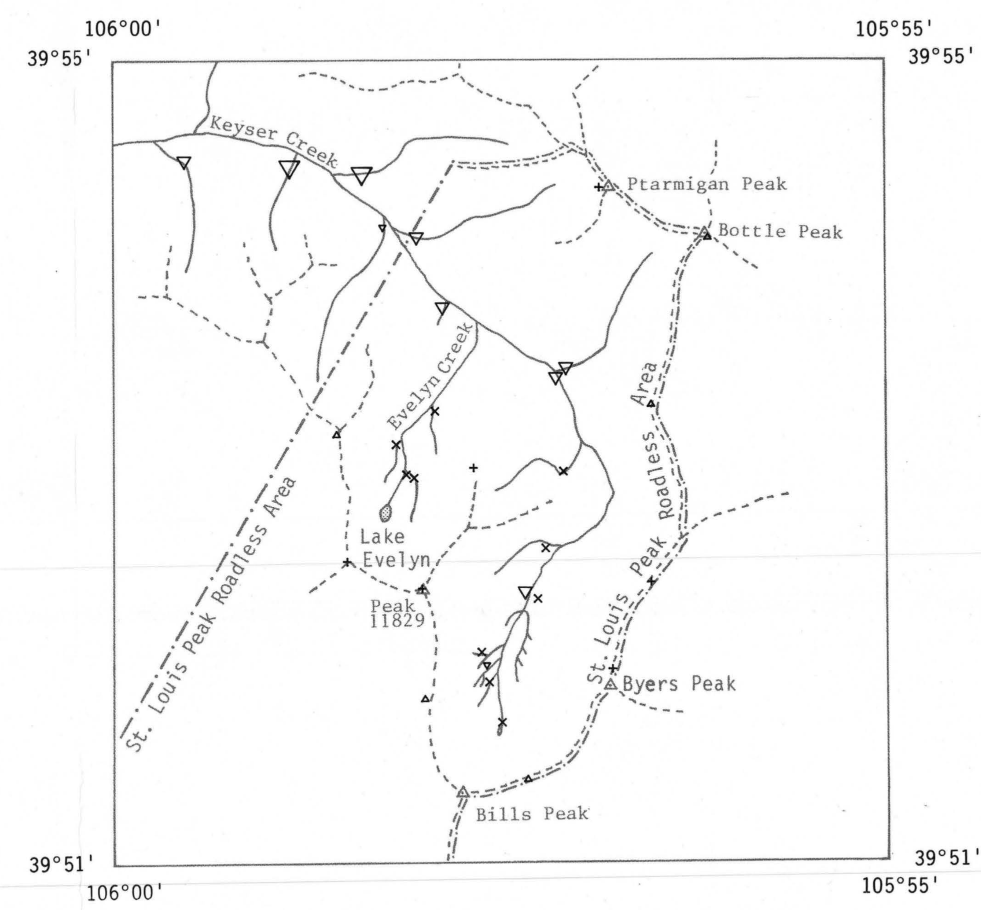
RIDGE: + N;L;20;30 · ▲ 50;100;150 · ▲ 200;300 · △ 500;700 · △ 1000;1500;2000

STREAM: × N;L;20;30;50 · ▾ 70;100;150 · ▿ 200;300 · ▽ 500;700 · ▽ 1000;1500;2000

Scale 1:50,000 — 0 1 2 3 KILOMETERS; 0 1 2 MILES

RIDGE · STREAM · APPROXIMATE BOUNDARY ST. LOUIS PEAK ROADLESS AREA · PEAK

MAP B. LEAD IN HEAVY-MINERAL CONCENTRATES



EXPLANATION

CONCENTRATION IN PARTS PER MILLION--N, not detected; L, detected but less than 10

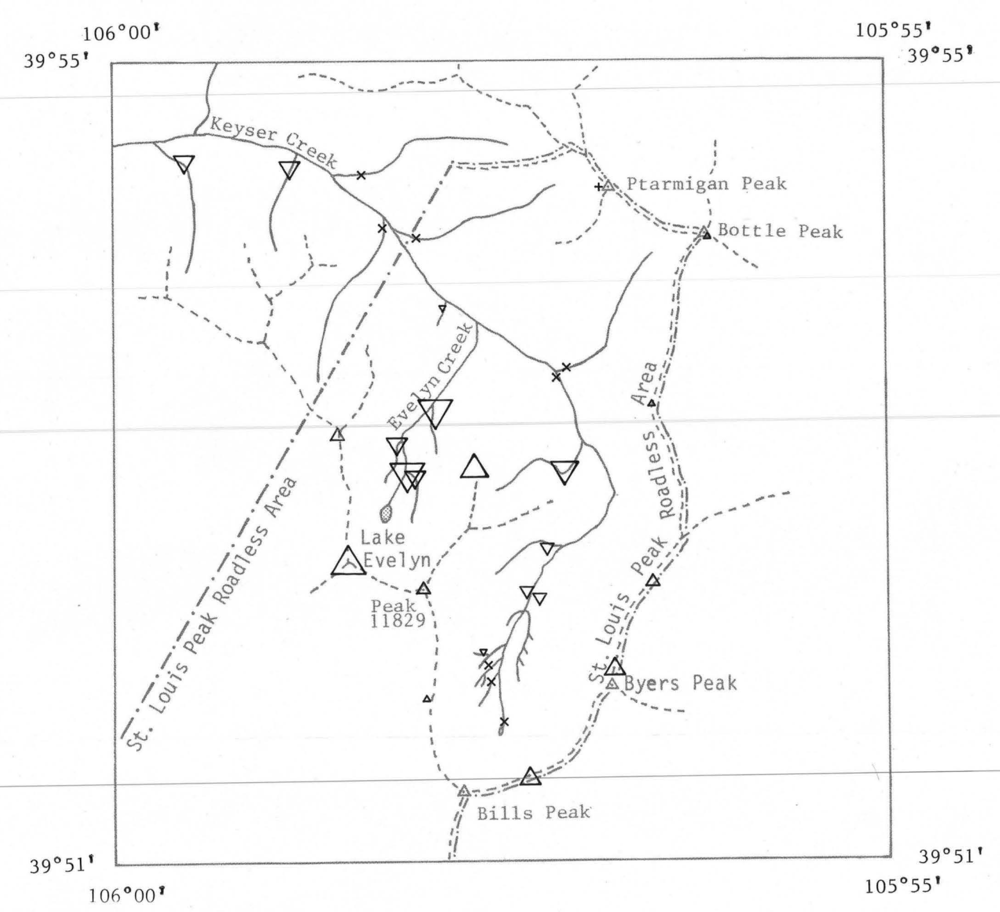
RIDGE: + N;L · ▲ 10;15

STREAM: × N;L;10;15 · ▾ 20 · ▿ 30 · ▽ 50;100;150

Scale 1:50,000 — 0 1 2 3 KILOMETERS; 0 1 2 MILES

RIDGE · STREAM · APPROXIMATE BOUNDARY ST. LOUIS PEAK ROADLESS AREA · PEAK

MAP C. MOLYBDENUM IN HEAVY-MINERAL CONCENTRATES



EXPLANATION

CONCENTRATION IN PARTS PER MILLION--N, not detected; L, detected but less than 200; >, greater than

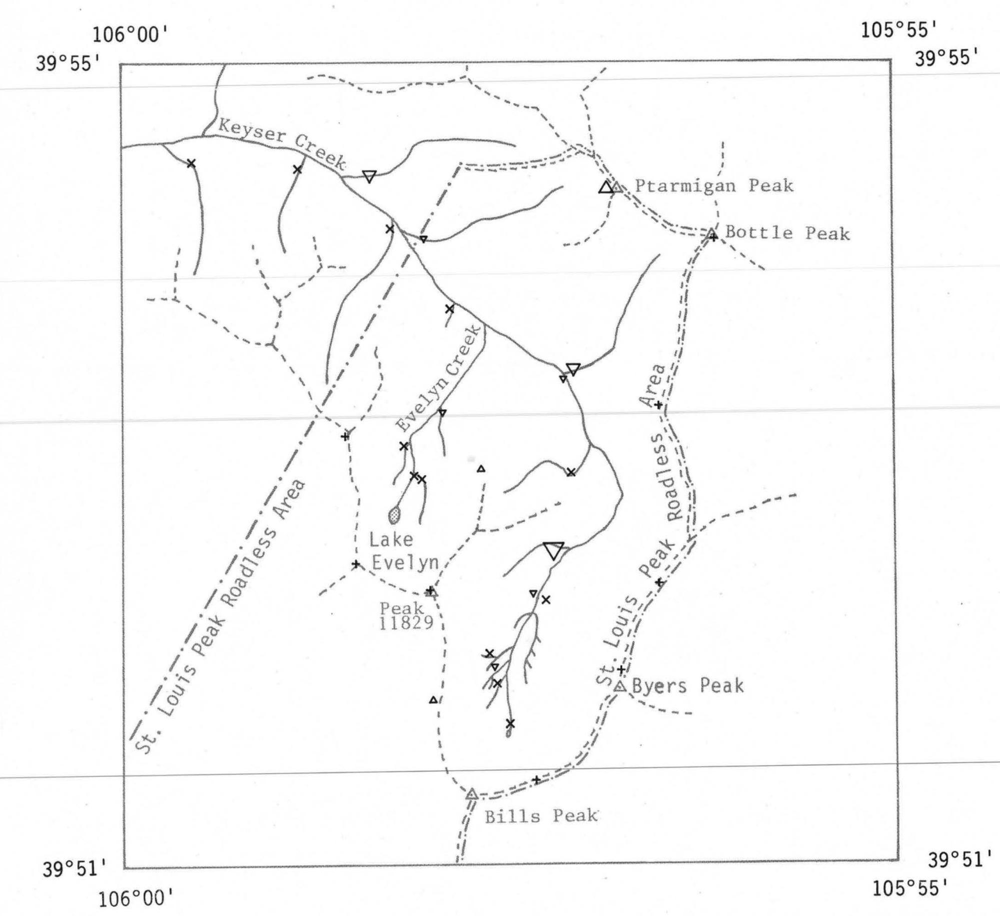
RIDGE: + N;L;200 · ▲ 300 · ▲ 500;700;1000 · △ 1500 · △ 2000;3000 · △ 5000

STREAM: × N;L · ▾ 200;300 · ▿ 500;700;1000 · ▽ 1500 · ▽ 2000;3000 · ▽ 5000;>5000

Scale 1:50,000 — 0 1 2 3 KILOMETERS; 0 1 2 MILES

RIDGE · STREAM · APPROXIMATE BOUNDARY ST. LOUIS PEAK ROADLESS AREA · PEAK

MAP D. THORIUM IN HEAVY-MINERAL CONCENTRATES



EXPLANATION

CONCENTRATION IN PARTS PER MILLION--N, not detected; L, detected but less than 20

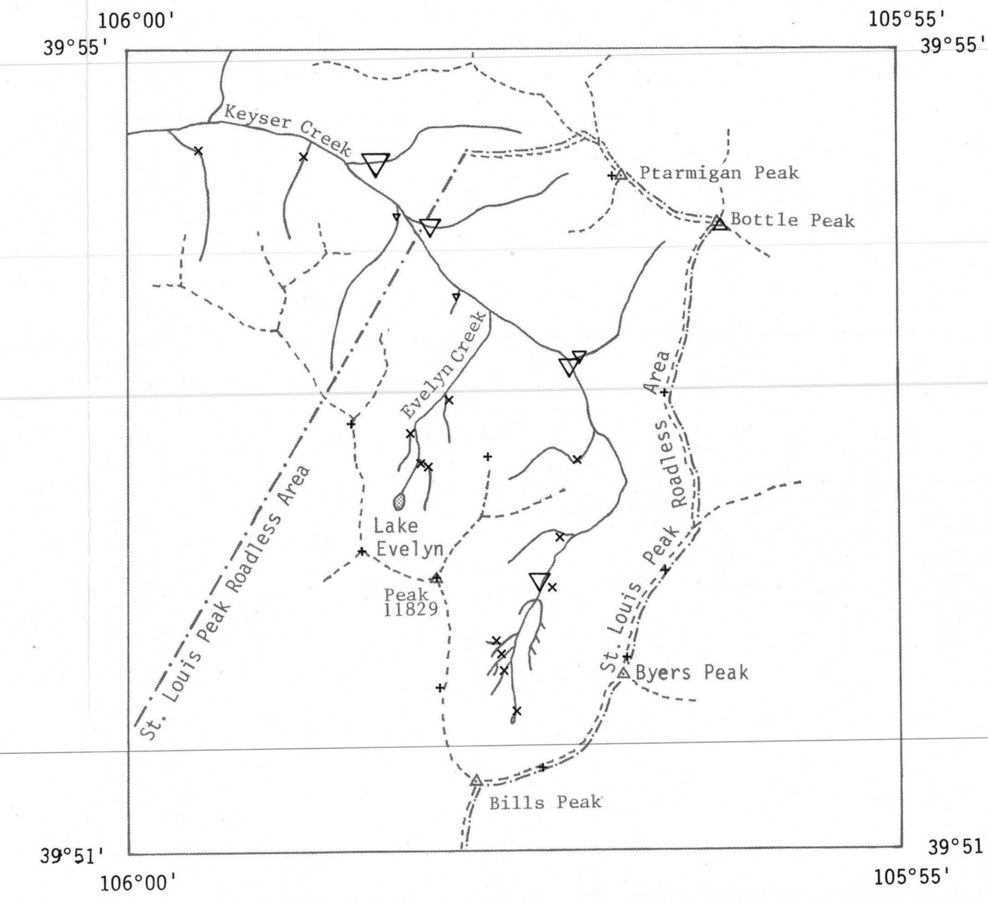
RIDGE: + N;L;20 · ▲ 30 · △ 50

STREAM: × N;L · ▾ 20 · ▿ 30 · ▽ 50

Scale 1:50,000 — 0 1 2 3 KILOMETERS; 0 1 2 MILES

RIDGE · STREAM · APPROXIMATE BOUNDARY ST. LOUIS PEAK ROADLESS AREA · PEAK

MAP E. TIN IN HEAVY-MINERAL CONCENTRATES



EXPLANATION

CONCENTRATION IN PARTS PER MILLION--N, not detected; L, detected but less than 100

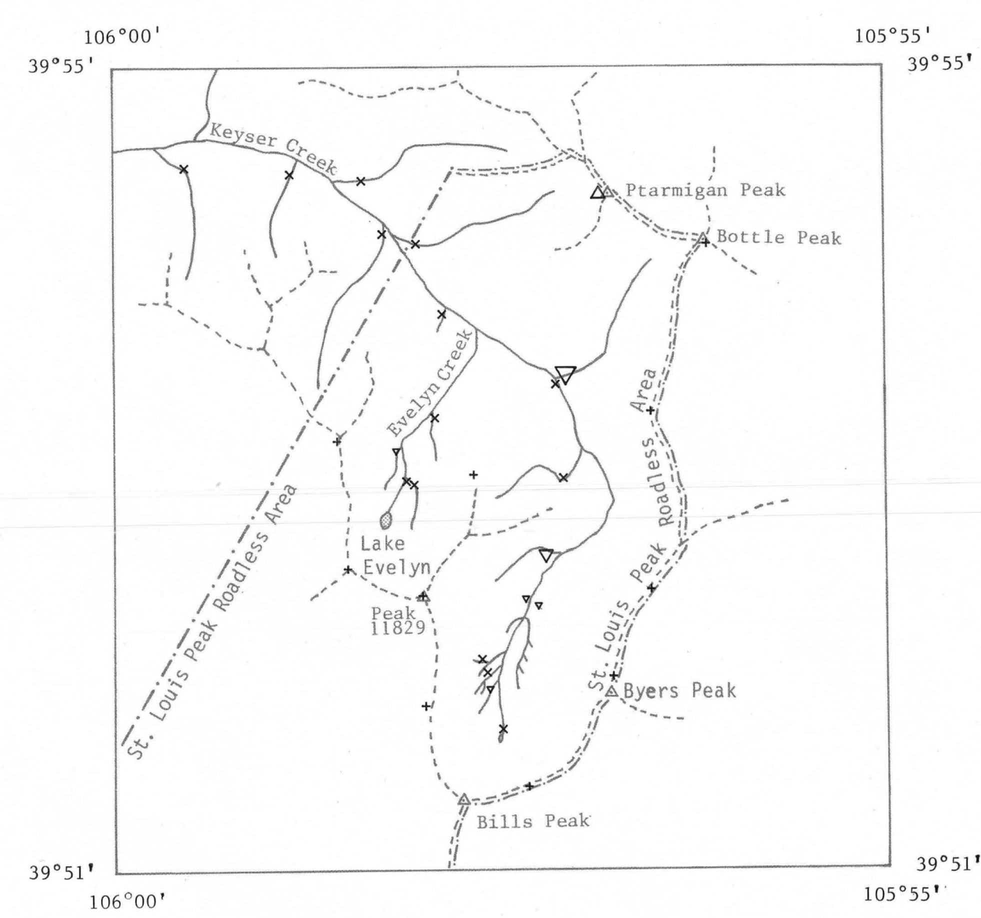
RIDGE: + N;L;100 · △ 150

STREAM: × N;L;100;150 · ▾ 200;300 · ▿ 500 · ▽ 700 · ▽ 1000;1500;2000

Scale 1:50,000 — 0 1 2 3 KILOMETERS; 0 1 2 MILES

RIDGE · STREAM · APPROXIMATE BOUNDARY ST. LOUIS PEAK ROADLESS AREA · PEAK

MAP F. TUNGSTEN IN HEAVY-MINERAL CONCENTRATES



EXPLANATION

CONCENTRATION IN PARTS PER MILLION--N, not detected; L, detected but less than 500

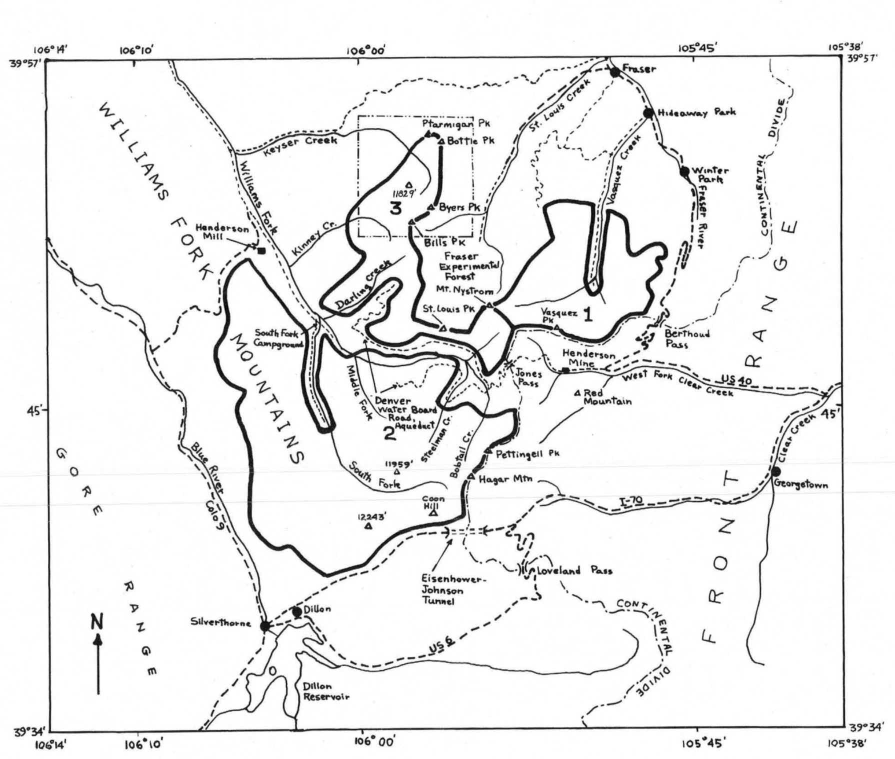
RIDGE: + N;L;500 · △ 700

STREAM: × N;L · ▾ 500;700 · ▿ 1000;2000 · ▽ 3000

Scale 1:50,000 — 0 1 2 3 KILOMETERS; 0 1 2 MILES

RIDGE · STREAM · APPROXIMATE BOUNDARY ST. LOUIS PEAK ROADLESS AREA · PEAK

MAP G. ZINC IN HEAVY-MINERAL CONCENTRATES



EXPLANATION

- Keyser basin geochemical map area
- Paved road
- Dirt road
- Approximate boundary of :
  1. Vasquez Peak Wilderness Area
  2. Williams Fork Roadless Area
  3. St. Louis Peak Roadless Area

0 5 10 KILOMETERS; 0 5 MILES

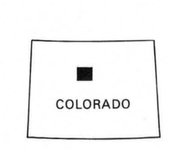
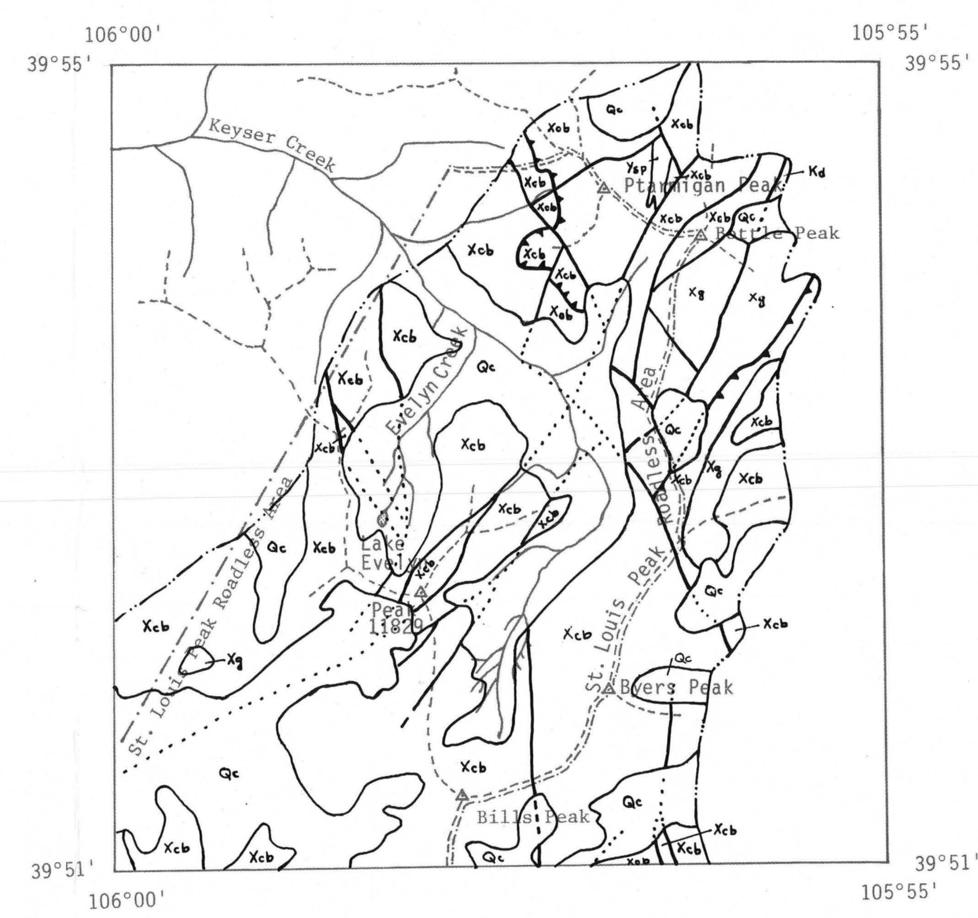


Figure 1.--Map showing location of roadless areas, wilderness study area, and Keyser Basin geochemical map area, Grand County, Colo.



Scale 1:50,000 — 0 1 2 3 KILOMETERS; 0 1 2 MILES

Figure 2.--Geologic map of the Keyser Basin, Colo. Simplified from Eppinger, Theobald, and Carlson (1985).

CORRELATION OF MAP UNITS

Qc	Holocene and Pleistocene	QUATERNARY
Unconformity		
Kd	Lower Cretaceous	CRETACEOUS
Unconformity		
Ysp		MIDDLE PROTEROZOIC
Xg		EARLY PROTEROZOIC
Xcb		EARLY PROTEROZOIC

DESCRIPTION OF MAP UNITS

Qc SURFICIAL DEPOSITS (HOLOCENE AND PLEISTOCENE)--Undifferentiated glacial drift, alluvium and alluvial-fan deposits, colluvium, landslide deposits, and slumped ground. Includes deposits of suspected Tertiary age reworked by periglacial processes

Kd DAKOTA SANDSTONE (LOWER CRETACEOUS)--Grayish-white, medium-grained sandstone at top and bottom and intervening dark-gray, carbonaceous shale, sandy mudstone, and siltstone

Ysp SILVER PLUME GRANITE (MIDDLE PROTEROZOIC)--Two-mica quartz monozonite having trachytic texture formed by microcline phenocrysts, but locally equigranular. About 1.4 b.y. old

Xg BOULDER CREEK GRANODIORITE (EARLY PROTEROZOIC)--Ranges from gneissic biotite-quartz monzonite to quartz diorite. About 1.7 b.y. old

Xcb CALCIUM-RICH GNEISSES (EARLY PROTEROZOIC)--Ranges from hornblende gneiss to calc-silicate gneiss, interlayered with biotite gneiss. The hornblende and calc-silicate gneisses range from plagioclase-quartz-hornblende gneiss through diopside-rich gneiss to marble with layering generally more conspicuous than foliation. The biotite gneiss is a fine-grained, well-foliated, plagioclase-quartz-biotite gneiss containing subordinate, fine-grained, disseminated sillimanite. Probably derived from interbedded sediments

CONTACT

FAULT--Dotted where concealed

THRUST FAULT--Sawteeth on upper plate

GEOLOGIC MAP BOUNDARY

RIDGE

STREAM

APPROXIMATE BOUNDARY ST. LOUIS PEAK ROADLESS AREA

PEAK

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 St. Louis Peak Roadless Area (F2361), in the Arapaho National Forest, Clear Creek, Grand, and Summit Counties, Colorado. The 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

Presented herein are geochemical maps showing the distribution and abundance of seven elements (boron, lead, molybdenum, thorium, tin, tungsten, and zinc) in the nonmagnetic fraction of the heavy-mineral concentrates from both stream sediments (herein referred to as stream-sediment concentrates) and from ridgetop soils (herein referred to as ridgetop-soil concentrates), collected in the upper Keyser Creek basin in the St. Louis Peak Roadless Area.

Geologic, geochemical, and geophysical investigations were made of three contiguous areas by the U.S. Geological Survey and the U.S. Bureau of Mines to determine their mineral resource potential (Theobald and others, 1983). These areas were: Williams Fork Roadless Area, St. Louis Peak Roadless Area, and Vasquez Peak Wilderness Study Area (fig. 1). This report presents the results of a follow-up geochemical study made in the upper Keyser Creek basin, one of several anomalous areas delineated by a preliminary geochemical survey (Barton, 1985). The geochemical data on which both these reports are based has been published in tabular form in Barton and Turner (1984), which gives sample location (latitude and longitude), the analyses for 31 elements by emission spectroscopy, a detailed description of sample media selection, and sample collection, preparation, and analysis techniques.

The geology of the area is summarized by Eppinger, Theobald, and Carlson (1985). The Keyser Creek basin is largely underlain by a sequence of Precambrian calcic metamorphic rocks consisting of interlayered hornblende gneisses, calc-silicate gneisses, and biotite gneisses (fig. 2). An area south of Bottle Peak is underlain by Precambrian Boulder Creek Granodiorite. Valley floors of Keyser Creek and Evelyn Creek are filled with a Quaternary cover unit. Small massive-sulfide pods have been seen at many places in the calcic metamorphic sequence of rocks, and prospects on massive-sulfide deposits have been worked in the Byers Peak (St. Louis Lake) and Iron Creek Mining Districts to the southeast of the Keyser Creek basin (Bielski and others, 1983). Geochemically anomalous values for silver, molybdenum, lead, and zinc were found in altered rocks from the area of calcic gneisses (Eppinger and others, 1983), and scheelite, powellite, gahnite, pyrite, and tourmaline were identified in heavy-mineral concentrates from stream sediments in the calcic metamorphic terrane (Eppinger, Theobald, and Sutley, 1985).

Anomalous values in this limited study (11 ridgetop-soil concentrates and 20 stream-sediment concentrates) are defined intuitively and are based on the distribution of values in the Keyser basin area, as well as throughout the entire study area, rather than by a rigorous statistical definition.

RESULTS AND DISCUSSION

Boron

Boron is anomalously high throughout most of the Keyser Creek basin as shown by the analyses from both stream-sediment and ridgetop-soil concentrates (map A). The greatest concentration of high values is in the upper part of the Keyser Creek basin. Although boron is enriched in both sample media, the highest boron values occur in the stream-sediment concentrates. Eppinger and others (1983) report finding tourmaline (mostly dravite) in stream-sediment concentrates. The basin of Evelyn Creek, a tributary to Keyser Creek on the south, is notable for its lack of boron in both sample media.

Lead

Lead is anomalously high in the Lake Evelyn basin in both sample media (map B).

Molybdenum

Molybdenum is anomalously high in stream-sediment concentrates from the lower and middle sections of the Keyser Creek basin and in an isolated sample from the upper part of the basin (map C). Sporadic molybdenum occurrences in ridgetop-soil concentrates are only slightly enriched.

Thorium

Thorium is anomalously high in the Lake Evelyn basin in both sample media (map D). Eppinger and others (1983) report finding monazite in stream-sediment concentrates.

Tin

Tin is slightly anomalous in stream-sediment concentrates from the lower and middle sections of the Keyser Creek basin and in a single ridgetop-soil concentrate from Ptarmigan Peak (map E).

Tungsten

Tungsten is anomalously high in stream-sediment concentrates from the lower and middle sections of the Keyser Creek basin and in an isolated sample from the upper basin (map F). A single ridgetop-soil concentrate sample near Bottle Peak is also anomalous in tungsten.

Zinc

Only a few zinc values are anomalous (map G). The highest values for both stream-sediment concentrates and ridgetop-soil concentrates are from the vicinity of Ptarmigan and Bottle Peaks. A group of modestly anomalous stream-sediment concentrate values are from the upper Keyser Creek basin. Eppinger and others (1983) report finding sporadic gahnite in stream-sediment concentrates.

SUMMARY

Lead and thorium distributions are similar in both ridgetop-soil concentrates and stream-sediment concentrates, and identify the Lake Evelyn basin as anomalous. The correlation of lead with thorium suggests that lead in these samples is a radiogenic product of thorium.

The distributions of molybdenum, tungsten, and tin are similar with anomalous values in the lower part of Keyser Creek basin. The data for ridgetop-soil concentrates add little to the data for stream-sediment concentrates except for one high tungsten value from a site on Bottle Peak. This value supports the stream-sediment-concentrate data from below this site. The high association between molybdenum and tungsten and identification of scheelite and powellite by Eppinger and others (1983) suggests molybdenum and tungsten are present as a solid-solution series.

Boron is anomalously high throughout the entire basin, with few exceptions. Eppinger and others (1983) have reported finding tourmaline in stream-sediment concentrates.

Favorable indications for skarn-type deposits are the assemblage of boron, molybdenum, lead, thorium, tin, tungsten, and zinc found in the calcic metamorphic rocks of the basin. Additionally, tungsten and lesser amounts of molybdenum in a scheelite-powellite solid solution is evidence for skarn-type mineralization.

Massive-sulfide deposits in the calcic metamorphic rocks are indicated as possible by the occurrence of boron in tourmaline (dravite) (Slack, 1980; 1982) and zinc in gahnite (Sundblad, 1982).

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GEOCHEMICAL MAPS SHOWING THE DISTRIBUTION AND ABUNDANCE OF SELECTED ELEMENTS IN HEAVY-MINERAL CONCENTRATES DERIVED FROM STREAM SEDIMENTS AND RIDGETOP SOILS FROM THE UPPER KEYSER CREEK BASIN IN THE ST. LOUIS PEAK ROADLESS AREA, GRAND COUNTY, COLORADO

By
H. N. Barton

1985

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