DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

Base from U.S. Geological Survey
Mono Craters, 1953; Matterhorn Peak, Tuolumne Meadows, 1956; Bodie, 1958

SCALE 1:62 500

1 ½ 0 1 2 3 4 5 MILES
1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 80 FEET
DOTTED LINES REPRESENT 40-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Geology from Seitz (1983)

MINERAL RESOURCE POTENTIAL MAP OF THE TIOGA LAKE, HALL NATURAL AREA, LOG CABIN-SADDLEBAG, AND HORSE MEADOWS ROADLESS AREAS, MONO COUNTY, CALIFORNIA

By

James F. Seitz, Maurice A. Chaffee, and Howard W. Oliver
U.S. Geological Survey
and
Frank E. Federspiel, Douglas F. Scott, Eric E. Cather,
Nicholas T. Zilka, and Andrew M. Leszcykowski
U.S. Bureau of Mines

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EXPLANATION

AREA WITH RESOURCE POTENTIAL FOR GOLD AND SILVER

- Moderate
- Low

AREA WITH LOW RESOURCE POTENTIAL FOR TUNGSTEN AND MOLYBDENUM

AREA WITH GEOCHEMICAL ANOMALY—Ag, silver; As, arsenic; Au, gold; B, boron; Cd, cadmium; Mn, manganese; Pb, lead; Sn, tin

MINE OR PROSPECT—See table 1 of accompanying pamphlet

- Mine
- Prospect

CORRELATION OF MAP UNITS

SURFICIAL DEPOSITS				
Qal	Qt	Qg		QUATERNARY
	Qm			
VOLCANIC ROCKS				
Trp				TERTIARY
PLUTONIC ROCKS Relative ages uncertain			METAMORPHOSED VOLCANIC ROCKS	METAMORPHOSED SEDIMENTARY ROCKS	
Kcp			Kdp	Kph	CRETACEOUS
Khd			Kft	Kcs	
Kk			Kmft	Kg	
Kt			Kft		
Kwb					
Kgu					
Ke					
Kmw					
Kaw					
Kab					
K'b md					CRETACEOUS AND TRIASSIC
			Jsl	Jhc	JURASSIC
Trlv					TRIASSIC
Trml					
TrPcl			TrPbm		TRIASSIC AND PERMIAN (?)
			TrPcl		
			TrPvl	TrPel	
			TrPms		
			TrPgl		
			SOaq		SILURIAN (?) AND ORDOVICIAN (?)
			SOm		
Upper Paleozoic			Pzdp		PALEOZOIC
Lower Paleozoic			Pztc		

—?— CONTACT—Dashed and queried where uncertain; dotted where concealed

—?— FAULT—Dashed and queried where uncertain; dotted where concealed

APPROXIMATE BOUNDARY OF ROADLESS AREA

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qal ALLUVIUM (QUATERNARY)—Locally includes landslide debris and glacial outwash

Qt TALUS AND SLOPE WASH (QUATERNARY)

Qg GLACIERS (QUATERNARY)—Consists of both rock and ice glaciers

Qm MORAINES (QUATERNARY)—Glacial moraines

VOLCANIC ROCKS

Trp RHYOLITE PLUG (TERTIARY)—Fine-grained rhyolite with visible biotite and abundant quartz

PLUTONIC ROCKS

Kcp CATHEDRAL PEAK GRANODIORITE (CRETACEOUS)—Gray granodiorite, generally coarsely porphyritic but locally granular

Khd HALF DOME GRANODIORITE (CRETACEOUS)—Coarse-grained granitic rock with as much as 25 percent hornblende as stubby phenocrysts

Kk GRANODIORITE OF KUNA CREST (CRETACEOUS)—Dark medium-grained biotite-hornblende granodiorite

Kt GRANODIORITE OF TIOGA LAKE (CRETACEOUS)—Coarse-grained granodiorite with large hornblende phenocrysts and abundant biotite

Kwb QUARTZ MONZONITE OF WILLIAMS BUTTE (CRETACEOUS)—Medium-grained granitic rock with abundant quartz and minor biotite

Kgu GRANITIC ROCKS, UNDIFFERENTIATED (CRETACEOUS)—Medium-grained granitic rock with some angular mafic autoliths

Ke QUARTZ MONZONITE OF ELLERY LAKE (CRETACEOUS)—Medium-grained quartz monzonite with considerable biotite and lesser amounts of chlorite and hornblende

Kmw GABBRO OF MOUNT WARREN (CRETACEOUS)—Medium- to coarse-grained; composed of plagioclase, hypersthene, olivine, augite, quartz, biotite, and hornblende

Kaw ALASKITE OF WILLIAMS BUTTE (CRETACEOUS)—Leucocratic granite with about 1 percent mafic minerals

Kab QUARTZ MONZONITE OF AEOLIAN BUTTE (CRETACEOUS)—Fine-grained leucocratic quartz monzonite with no visible mafic minerals

K'b md GRANODIORITE OF MONO DOME (CRETACEOUS AND TRIASSIC)—Medium-grained granodiorite with abundant biotite

Trlv QUARTZ MONZONITE OF LEE VINING CANYON (TRIASSIC)—Contains abundant mafic autoliths

Trml QUARTZ MONZONITE OF MONO LAKE (TRIASSIC)—Medium- to coarse-grained granitic rock with abundant biotite

TrPol QUARTZ DIORITE OF ODELL LAKE (TRIASSIC AND PERMIAN)—Predominantly quartz diorite but characterized by variety of lithologies and textures incorporated within unit

METAMORPHOSED VOLCANIC ROCKS

Kdp DACITE PORPHYRY (CRETACEOUS)—Fine-grained quartz-feldspar groundmass with fragments and irregular phenocrysts of plagioclase, quartz, and biotite

Kft FELSIC TUFF (CRETACEOUS)—Foliated metatuff with fine quartz-feldspar groundmass

Kmft MAFIC AND FELSIC TUFF (CRETACEOUS)—Foliated tuff with quartz-feldspar groundmass and quartz and plagioclase phenocrysts

Ktf VOLCANIC TUFFS AND FLOWS, SHALES, AND CALC-SILICATE HORNFELS (CRETACEOUS)—Foliated metatuff, well bedded in places. Includes porphyritic basalt with abundant rounded phenocrysts of feldspar, and intercalated beds of calc-silicate hornfels

Jsl METARHYODACITE OF STEELHEAD LAKE (JURASSIC)—Massive metatuff bed that contains abundant rounded feldspar phenocrysts

TrPbm METAVOLCANIC BRECCIA OF BLACK MOUNTAIN (TRIASSIC AND PERMIAN)—Sequence of predominantly metavolcanic rocks with lesser amounts of interbedded metasedimentary rocks

TrPcl METARHYODACITE OF COONEY LAKE (TRIASSIC AND PERMIAN?)—A medium- to coarse-grained metamorphosed tuff that contains abundant quartz grains and rounded blebs of feldspar

TrPvl METARHYODACITE OF VIRGINIA LAKES (TRIASSIC AND PERMIAN?)—Light-colored medium-grained metamorphosed tuff that underlies the metaconglomerate of Cooney Lake

TrPms META-ANDESITE OF MOUNT SCOWDEN (TRIASSIC AND PERMIAN?)—Composed largely of metavolcanic rocks

TrPgl METARHYODACITE OF GREENSTONE LAKE (TRIASSIC AND PERMIAN?)—Massive medium-grained metavolcanic rock unit

METAMORPHOSED SEDIMENTARY ROCKS

Kph PELITIC HORNFELS (CRETACEOUS)—Fine matrix of quartz, feldspar, biotite, and magnetite with small grains of plagioclase, quartz, and pyroxene

Kcs MARBLE AND CALC-SILICATE HORNFELS (CRETACEOUS)—Bedded sandstone, calc-silicate hornfels, and marble

Kg GRAYWACKE, VOLCANIC FLOWS AND TUFF, AND CROSSBEDDED SANDSTONE (CRETACEOUS)—Well-bedded fine-grained greenish sandstone with interbedded graywacke, metatuff, and basalt flows

Jhc CALC-SILICATE SEQUENCE OF HORSE CREEK (JURASSIC)—Calc-silicate hornfels and metavolcanic tuff intercalated with several marble beds

TrPel METACONGLOMERATE OF EAST LAKE (TRIASSIC AND PERMIAN?)—Sequence of metaconglomerate, hornfels, quartzite, and metavolcanic rocks that forms a key stratigraphic unit in this area

SOaq ANDALUSITE HORNFELS AND BIOTITE-BEARING QUARTZITE (ORDOVICIAN? AND SILURIAN?)—Black hornfels with andalusite, and massive to well-bedded quartzite containing abundant fine biotite

SOm MARBLE AND CALC-SILICATE HORNFELS (ORDOVICIAN? AND SILURIAN?)—Interbedded marble, white quartzite, and calc-silicate hornfels

Pzdp METASEDIMENTARY ROCKS OF DUNDERBERG PEAK (PALEOZOIC)—Quartzite, hornfels, argillite, metasiltstone, and slate with a minor amount of marble

Pztc METASEDIMENTARY ROCKS OF TIOGA CREST (PALEOZOIC)—Predominantly of slate and quartzite, with some beds of highly deformed metaconglomerate

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 resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral resource potential survey of the Tioga Lake, Hall Natural Area, Log Cabin-Saddlebag, and Horse Meadows Roadless Areas in the Inyo National Forest, Mono County, California. Tioga Lake (5050), Hall Natural Area (5051), Log Cabin-Saddlebag (5052), and Horse Meadows (5049) Roadless Areas were classified as further planning areas during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

SUMMARY

Mineral resource surveys of the Hall Natural Area and the Log Cabin-Saddlebag Roadless Areas indicate that four prospects in the Log Cabin-Saddlebag area and one mine in the Hall Natural Area contain mineral resources. The Log Cabin-Saddlebag areahas a moderate potential for gold and silver resources at four sites, and the Hall Natural Area has a moderate potential for gold and silver resources at one site and a low potential for tungsten and molybdenum at two sites. Similar studies of the Tioga Lake and Horse Meadows Roadless Areas indicate no mineral resources in the two areas; however, two prospects in the Horse Meadows area have a low potential for tungsten and gold-silver resources.

Approximately 37,000 tons of inferred subeconomic and about 600 tons of inferred marginal gold-silver resources were identified in the Log Cabin-Saddlebag area. About 600,000 tons of inferred subeconomic gold-silver resources was estimated in the Hall Natural Area. These resources are in steeply dipping quartz-bearing fissure veins. A moderate potential for additional gold-silver resources exists beneath talus or at depth along known structures in the study areas.

No evidence of a potential for resources of oil, gas, coal, geothermal energy, or uranium was found in the areas.

INTRODUCTION

The Tioga Lake, Hall Natural Area, Log Cabin-Saddlebag, and Horse Meadows Roadless Areas are located in the eastern part of the Sierra Nevada range, Mono County, Calif. The roadless areas form a contiguous group that lies immediately east of Yosemite National Park and extends from the crest of the Sierra Nevada east to within 1 mi of Mono Lake.

GEOLOGY

Mineral deposits within the roadless areas are mostly found in metamorphic rocks of the roof pendants or along the contacts between roof pendants and intrusive rock bodies (Seitz, 1983). Sulfide-bearing quartz veins occur along fault, shear, and fracture zones in slate and quartzite. The veins range from massive, such as at the Great Sierra mine, to networks of thin veins, such as on Mount Scowden. Exposed veins are not highly mineralized.

Mineralized sites consist principally of hydrothermally altered fracture and shear zones within the metasedimentary rocks of the roof pendants which have quartz veins and pods that contain gold and silver minerals, disseminated pyrite, and other sulfides. The most extensive alteration is exposed in Lundy Canyon where alteration zones are hundreds of feet thick. Similar sites, though on a much smaller scale, extend through other parts of the area.

Tungsten minerals occur in the Hall Natural Area in skarn near contacts of metamorphic and intrusive rocks. The small size and low grade of these occurrences indicate a low resource potential. An extensive zone containing garnet, epidote, calcite, and wollastonite occurs along the contact of metasedimentary and intrusive rocks on the west flank of Mount Warren. Samples from the zone contained no tungsten.

GEOCHEMISTRY

Within the four roadless areas, 27 rock samples, 47 minus-60-mesh stream-sediment samples, and bulk sediment for 33 nonmagnetic heavy-mineral-concentrate samples were collected and analyzed by geochemical methods. These samples include those collected specifically for this report as well as some of the samples collected for the mineral resource assessment of the Hoover Wilderness to the north (Chaffee and others, 1980) and the Minarets Wilderness to the south (Huber, 1979). The rock samples were collected primarily to provide information on the normal, or background, chemical abundances in the rock units present in the roadless areas; consequently, only the stream-sediment and concentrate analyses are discussed here.

Significant geochemical anomalies for both stream sediment and concentrate are present in samples collected from several parts of the Log Cabin-Saddlebag Roadless Area and in samples collected from the southern part of the Hall Natural Area. The most significant anomalies are in drainage basins that originate in the Hoover Wilderness and continue into the Log Cabin-Saddlebag Roadless Area. All of the elements selected in each of the two sample sets are present in different combinations at different anomalous sites. These suites of elements are commonly associated with contact-metasomatic sulfide deposits that may contain base- and precious-metal deposits and (or) tungsten deposits. Some of the anomalies may be in part the result of contamination from mining activity upstream from the sample sites.

GEOPHYSICS

Magnetic survey

The only significant magnetic anomaly within the study area is an elongate magnetic high of about 1,000 gammas located along the south flank of the ridge connecting Mono Dome and Lee Vining Peak in the Log Cabin-Saddlebag Roadless Area. The magnetic high is primarily correlative with two igneous plutons, the granodiorite of Mono Dome and the quartz monzonite of Williams Butte, but also extends northeastward into the Hoover Wilderness where it terminates over a small body of gabbro about 1 mi west of Lee Vining Peak (Seitz, 1983).

Ground-magnetic-intensity and rock-susceptibility measurements were made along several transects across the aeromagnetic high to search for the source of the anomaly. The results indicate that the rock in the southern part of the granodiorite of Mono Dome is highly magnetic, with susceptibilities in the range of $0.9\text{-}3.4\times10^{-3}$ emu/cm^3 which is sufficient to cause the magnetic high. However, a northern facies of this granodiorite located between Mount Warren and Lee Vining Peak was found to be nonmagnetic ($k<0.3\times10^{-3}$ emu/cm^3).

Field measurements of outcrops of the quartz monzonite of Williams Butte indicate its magnetic susceptibility is quite variable having a range of 0.1 to 3.7×10^{-3} emu/cm^3, but rock samples collected in the area of the observed aeromagnetic anomaly have magnetic susceptibilities greater than 3 emu/cm^3 indicating that this pluton also contributes to the magnetic anomaly. Magnetic susceptibility measurements were made of samples from five other plutons, and metamorphic rock units in the general vicinity of the magnetic anomaly were all less than 1×10^{-3} emu/cm^3. The magnetic high of 1,000 gammas is interpreted as being caused by the exposed plutons that are directly under the measured anomaly rather than by the presence of buried magnetic iron-rich minerals.

A smaller magnetic high of about 500 gammas is associated with the topographic crest of the Sierra Nevada where it borders the Hall Natural Area on the west. The Sierran crest in this area is composed chiefly of the granodiorite of Kuna Crest, a pluton known to have high magnetic susceptibilities in the range of $1\text{ to }4\times10^{-3}$ emu/cm^3 (Oliver, 1982, table 10).

Gravity survey

No gravity survey was made for this study. A regional gravity map with a 5-mGal contour interval that includes the study area was recently published (Oliver and Robbins, 1982), and a two-dimensional computer interpretation of these data has been made (Oliver, 1977, fig. 5).No significant mineral deposits are indicated on the basis of the regional gravity data.

MISCELLANEOUS FIELD STUDIES MAP MF-1453-B

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Log Cabin-Saddlebag

A moderate potential for gold and silver resources is identified for the area north of the Log Cabin mine where a silver-cadmium-gold-lead geochemical anomaly is associated with gold- and silver-bearing quartz veins. However, the mineralized zones are generally small and low grade.

The region adjacent to Lundy Canyon has a low potential for gold-silver resources because of its proximity to the Lundy Canyon fault zone, which may have provided channels for metal-bearing fluids, and because of the presence of gold and silver minerals in a fissure vein at the Golden Fleece prospect.

A geochemical anomaly at Gilcrest Peak, less than 1 mi from the May Lundy mine, may indicate a low potential for gold and silver resources.

Two properties with gold-silver resource potential in the western part of the area (the Saddlebag Lake and Australian claims) are on each side of a silver-gold-cadmium geochemical anomaly. The small magnitude of the anomaly and sparsely mineralized veins suggest a moderate mineral resource potential.

Hall Natural Area

A moderate potential for gold and silver resources is estimated for the area near the Great Sierra mine (table 1). A low-magnitude silver anomaly includes a large area surrounding the mine, with the highest resource potential localized along the northwest-trending Sheepherder and Great Sierra mineralized faults. However, metallurgical difficulties due to relatively abundant arsenopyrite will probably be detrimental to silver recovery.

A manganese-boron anomaly at the extreme north end of this roadless area may indicate that tungsten-bearing zones at the Hess mine extend at depth into the study area. The small size of ore pockets mined from these zones in the past suggests that potential for substantial tungsten resources is low. A low potential for tungsten also exists at the September claims in the southern part of the area.

Horse Meadows

There is low tungsten and gold-silver resource potential in and around two prospects in the area. The Tungsten Queen No. 1 claim has a low potential for tungsten resources, and an unnamed prospect has a low potential for gold-silver resources.

Tioga Lake

Mineralized zones and (or) geochemical anomalies indicative of a potential for metallic mineral resource were not found in the Tioga Lake Roadless Area.

No evidence of a potential for oil, gas, coal, geothermal energy, or radioactive mineral resources was found in any of the four roadless areas.

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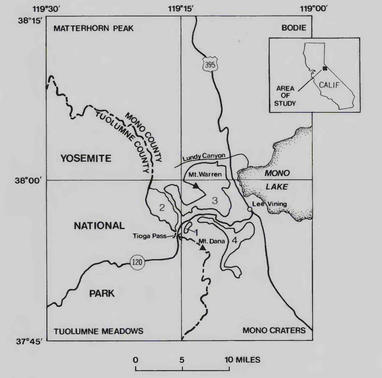

INDEX MAP OF STUDY AREA SHOWING LOCATIONS OF 15-MINUTE QUADRANGLES AND ROADLESS AREAS

Explanatory pamphlet accompanies map

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