DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

TO ACCOMPANY MAP MF-1453-B

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

SUMMARY REPORT

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

STUDIES RELATED TO WILDERNESS

Under the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964) and related acts, the U.S. Geological Survey and the U.S. Bureau of Mines have been conducting mineral surveys of wilderness and primitive areas. Areas officially designated as "wilderness," "wild," or "canoe" when the act was passed were incorporated into the National Wilderness Preservation System, and some of them are presently being studied. The act provided that areas under consideration for wilderness designation should be studied for suitability for incorporation into the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. The act directs that the results of such surveys are to be made available to the public and be submitted to the President and the Congress. This report discusses the results of a mineral survey of the Tioga Lake (5050), Hall Natural Area (5051), Log Cabin-Saddlebag (5052), and Horse Meadows (5049) Roadless Areas, Inyo National Forest, Mono County, California. Tioga Lake, Hall Natural Area, Log Cabin-Saddlebag, and Horse Meadows 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

A survey of mines and prospects together with geologic and geochemical studies of the Tioga Lake, Hall Natural Area, Log Cabin-Saddlebag, and Horse Meadows Roadless Areas (fig. 1) indicate that four sites in the Log Cabin-Saddlebag and two in the Hall Natural Area have indentified low to moderate mineral resource potential. The Log Cabin-Saddlebag area has 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 (fig. 2). A low mineral resource potential for tungsten and gold-silver was identified at two prospects in the Horse Meadows area; however, no evidence for mineral resource potential was found in the Tioga Lake area.

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 area.

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. Elevations in the glaciated and rugged terrain range from 6,815 to 12,588 ft above sea level. California Highway 120 provides access to the areas between Tioga Pass on the west and the mouth of Lee Vining canyon on the east. Two of the areas lie south of this highway and the other two immediately north of it.

The Tioga Lake Roadless Area covers 800 acres and lies adjacent to and northeast of Tioga Pass; it encompasses Tioga Lake and a small area bordering the lake. The Hall Natural Area covers 5,700 acres and extends west from Tioga Lake to the crest of the Sierra Nevada and northward to the upper basin of Saddlebag Lake. The west boundary is along a series of cirques culminating in the peaks of Mount Conness and North Peak. The Log Cabin-Saddlebag Roadless Area, largest of the group with 14,700 acres, extends east from the Hall Natural Area to within a mile of Mono Lake. It is bordered on the south by Lee Vining canyon and on the north by Lundy Canyon and the Hoover Wilderness. Horse Meadows Roadless Area covers 5,700 acres south of Lee Vining canyon. It is covered mostly by glacial moraines and has a less rugged topography compared to the other roadless areas in this group.

GEOLOGY

The geology is dominated by a series of plutons of the Sierra Nevada that enclose roof pendants of metavolcanic and metasedimentary rocks. The larger plutons are of Cretaceous age and form the west margin of the area. They are bordered on the east by a belt of metamorphic rocks 13,000 ft thick whose protolithic ages are Paleozoic, Triassic, and Jurassic. East of this belt of metamorphic rocks, in the area that includes the peaks of Mount Warren and Mono Dome, are six separate plutons of Triassic and Cretaceous ages. These are bordered on the east by a smaller roof pendant composed of Paleozoic metasedimentary rocks. Bedding and foliation throughout the metamorphic rocks follow a northwest trend. Major faults, mostly located in the Saddlebag Lake basin, also follow this trend with the exception of the northeast-trending fault or fault system alined along the course of Lundy Canyon.

All known mineral deposits within the roadless areas are 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. 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

Geochemical analyses

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 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).

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.

All of 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 a six-step semiquantitative emission spectrographic method. All of the rock and stream-sediment samples were also analyzed for five elements (As, Bi, Cd, Sb, and Zn) by wet-chemical methods. Three of the rock samples and 13 of the stream-sediment samples were analyzed for gold by atomic-absorption spectrometry.

For the stream-sediment samples, 12 elements (Ag, As, Au, Bi, Cd, Cu, Mo, Pb, Sb, Sn, W, and Zn) were selected as possible indicators of mineralization; for the concentrate samples, 14 elements (Ag, As, Au, B, Ba, Bi, Cu, Fe, Mn, Mo, Pb, Sn, Sr, and W) were selected for the same reason. Because of the small number of samples in the data set, the analyses for this study were compared to those of the Hoover Wilderness and the nearby Freel-Dardanelles, Raymond Peak, and Carson-Iceberg Roadless Areas. On the basis of analytical distributions of elements in all of these areas, threshold values (highest background values) were selected for the samples evaluated for this report. The concentrations for the elements selected in each sample were weighted (Chaffee, 1983) and the anomalies then plotted on a geologic base map of the region.

Geochemical anomalies

Significant geochemical anomalies for both stream sediment and heavy-mineral 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 (fig. 3). The most significant anomalies are those from 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 types 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 at least, the result of contamination from mining activity upstream from the sample sites.

GEOPHYSICS

Magnetic survey

An aeromagnetic survey was flown that covers the four roadless areas. Flight lines were spaced about 0.5 mi apart and flown in an east-west direction at an altitude of approximately 1,000 ft above the ground (U.S. Geological Survey, 1981). These flight specifications were considered adequate to reveal any significant magnetic iron-ore deposits and to delineate areas with chromium and nickel because of their association with highly magnetic mafic intrusions (Oliver, 1982; duBray and others, 1982).

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 ($k\approx0.3\times10^{-3}$ emu/cm^3).

Field measurements of outcrops of the quartz monzonite of Williams Butte indicate that its magnetic susceptibility is quite variable and ranges from 0.1 to 3.7×10^{-3} emu/cm^3, but rock samples 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 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 therefore 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 1 to 4×10^{-3} emu/cm^3 (Oliver, 1982, table 10).

Gravity survey

No gravity surveys were made specifically for this study, but 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).

The gravity survey reveals a gravity high of about 12 mGal associated with the Saddlebag Lake roof pendant that crops out in the eastern part of the Log Cabin-Saddlebag Roadless Area. The mean density of the metamorphic rocks in the pendant is 2.86 g/cm^3, significantly greater than that of the surrounding granitic plutons whose densities range from 2.61 to 2.74 g/cm^3. On the basis of these rock densities, quantitative modeling of the gravity high indicates that the Paleozoic and Mesozoic metamorphic rocks are not

very thick and extend only about 1 mi down into the granitic rocks. An asymmetrical root of the pendant, however, extends eastward under the exposed granitic rocks for a horizontal distance of about two miles at a few thousand feet below the surface.

No evidence of significant mineral deposits is indicated on the basis of the regional gravity data.

MINES AND PROSPECTS

Present studies

The U.S. Bureau of Mines (USBM) conducted a mineral resource appraisal of the Hall Natural Area (5051) in the summer of 1977 and of the Log Cabin-Saddlebag (5052), Horse Meadows (5049), and Tioga Lake (5050) areas in the summer of 1979.

The USBM gathered data concerning mines, prospects, and mineralized areas (table 1). USBM personnel conducted searches of literature and courthouse records and made field examinations to assess the mineral resources and potential of properties within the study areas. A total of 228 samples taken from mines, prospects, and mineralized areas was analyzed by atomic-absorption, chemical, and fire-assay methods. At least one sample from every prospect was analyzed by semiquantitative spectrographic methods to determine the presence of unsuspected elements. Sample analyses are on file at the U.S. Bureau of Mines, Western Field Operations Center, Spokane, Wash.

Mining claims and activity

Mining activity began in this area of the Sierra Nevada in the late 1850's and was followed by the organization of the Tioga mining district in 1859. The Jordan mining district (north of Mono Lake) and the Homer mining district (near Lundy Lake) were organized in 1879.

More than 150 lode claims have been recorded in the roadless areas since 1880. This total includes approximately 100 claims recorded from 1895 to 1915 in the eastern part of the Log Cabin-Saddlebag area.

The Great Sierra mine was located in 1860, and in 1882 was the first property in the study areas to have major development. The Great Sierra, Tip Top, Lake, Summit, Sonora, High Rock, Bevan, Ahwaga, and Atherton claims are in the Hall Natural Area and were patented in 1882. During the 1890's J. P. Hammond began work on the Illinois (Centipede) and Charleston claims in the Log Cabin-Saddlebag area (fig. 2). A five-stamp mill was constructed at the Illinois claim, and minor gold and silver production was recorded from the Charleston claim in 1894 (Eakle, 1917). Gold- and silver-bearing quartz veins were discovered outside the study areas at the Log Cabin and May Lundy mines (fig. 2) during the early 1900's. These mines yielded gold until the late 1930's. Ore from the Log Cabin mine was processed through a 10-stamp amalgamation plant until about 1940 when a 100-ton-per-day mill was completed.

Traces of tungsten have been found in and near the Hall Natural Area. In the 1940's the Hess mine, less than one mile north of the Hall Natural Area, was explored for tungsten. The mine has yielded small tonnages of ore from mill testing. Within the Hall Natural Area, the September claims were located for tungsten in 1954.

MINERAL RESOURCES AND RESOURCE POTENTIAL

Log Cabin-Saddlebag

The Centipede, North Log Cabin, Saddlebag Lake, and 9991 prospects have an estimated total of 37,000 tons of gold-silver resources averaging 0.04 oz gold per ton and 0.2 oz silver per ton (table 1). Resources are in northerly trending, steeply dipping shear zones that range from 1 to 3 ft thick. Zones at the Centipede, North Log Cabin, and Saddlebag Lake prospects contain limonite-stained metasedimentary rocks and quartz veins with as much as 5 percent disseminated sulfides (mainly pyrite). Zones at the 9991 prospect contain limonite-stained quartz diorite and quartz veins with as much as 3 percent disseminated pyrite. A moderate potential exists for additional gold-silver resources along strike and at depth in the mineralized zones.

Three prospects, the Klondike, Australian, and Golden Fleece, have a moderate potential for gold-silver resources. Twelve selected dump samples at the Klondike prospect (fig. 2) assayed from trace to 0.40 oz gold per ton and as much as 0.5 oz silver per ton. Two dump samples at the Australian claim (fig. 2) had from trace and 0.01 oz gold per ton and 0.2 to 2.1 oz silver per ton. One dump sample from the Golden Fleece prospect (fig. 2) contained 0.04 oz gold per ton and 1.5 oz silver per ton. Resource estimates could not be made for these prospects because the underground workings were caved and mineralized zones were covered with talus.

Hall Natural Area

The Great Sierra mine contains 600,000 tons of inferred subeconomic resources that average 0.01 oz gold per ton and 1.5 oz silver per ton in fault zones in metasedimentary rocks. The two major zones (Sheepherder and Great Sierra) are 6 to 40 ft thick, strike N. 20-30° W., and dip steeply to the northeast. They are traceable for several thousand feet and contain brecciated metasedimentary rocks and quartz veins with arsenopyrite, pyrite, chalcopyrite, and sphalerite. There is a moderate potential for gold and silver resources to the northwest along the strike of the fault zone.

The northern part of the roadless area has a low potential for tungsten and molybdenum resources based on possible extension of the scheelite-bearing tactite zone from the Hess mine. A low potential for these metals in a similar geologic setting also occurs on the September claims in the southern part of the area.

Horse Meadows

Southwest of Williams Butte are two prospects with resource potential; the Tungsten Queen prospect has a low potential for tungsten, and an unnamed prospect has a low potential for gold and silver. The Tungsten Queen (fig. 2) contained values from trace to 0.07 percent tungsten trioxide (WO_3) in eight samples. A select dump sample from the unnamed prospect to the west contained 0.08 oz gold per ton and 0.1 oz silver per ton.

Tioga Lake

The Tioga Lake Roadless Area has no evidence for potential mineral resources.

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, the mineralized zones are generally small and low grade.

At Gilcrest Peak (fig. 3, no. 2), less than one mile from the May Lundy mine, a silver-gold-lead-cadmium-arsenic-tin-boron geochemical anomaly is present.

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 (fig. 3, no. 5), the small magnitude of the anomaly and the 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. 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 resources were not found in the Tioga Lake Roadless Area.

None of the roadless areas has potential for oil, gas, coal, geothermal energy, or radioactive mineral resources.

REFERENCES

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 [abs.], in Program with abstracts: 9th International Geochemical Exploration Symposium, Saskatoon, Saskatchewan, Canada, p. 41-43.

Chaffee, M. A., Banister, C. A., Barnard, J. B., Giusso, J. R., Hill, R. H., Keith, W. J., Seitz, J. F., Speckman, W. S., and Sutley, S. J., 1980, Geochemical analyses of samples of rock, stream-sediment and panned heavy mineral concentrate, Hoover Wilderness and adjacent study areas, California: U.S. Geological Survey Open-File Report 80-79, 39 p.

duBray, E. A., Dellinger, D. A., Oliver, H. W., Diggles, M. F., Johnson, F. L., Thurber, H. K., Morris, R. W., Peters, T. J., Lindsey, D. S., 1982, Mineral resource potential map of the John Muir Wilderness, Fresno, Inyo, Madera, and Mono Counties, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1185-C, scale 1:125,000 [10 p. text].

Eakle, A. S., and McLaughlin, R. P., 1917, Mono County: California State Mining Bureau Report 15 of the State Mineralogists, p. 135-175.

Federspiel, F. E., Scott, D. F., Cather, E. E., Zilka, N. T., and Leszcykowski, A. M., 1982, Mineral resources of the Log Cabin Saddlebag (5052), Hall Natural Area (5051), Horse Meadows (5049), and Tioga Lake (5050) RARE II study areas, Mono County, California: U.S. Bureau of Mines Mineral Land Assessment MLA 7-82, 16 p.

Huber, N. K., 1979, Regional setting, geology, and geochemical studies of the Minarets Wilderness and adjacent areas, Madera and Mono Counties, California, Chapter A, in Mineral resources of the Minarets Wilderness and adjacent areas, Madera and Mono Counties, California: U.S. Geological Survey Open-File Report 79-1472, 183 p.

Oliver, H. W., 1977, Gravity and magnetic investigations of the Sierra Nevada batholith, California: Geological Society of America Bulletin, v. 88, p. 445-461.

___1982, Geophysical studies of the Minarets Wilderness and adjacent areas, Madera and Mono Counties, California, Chapter B, in Mineral resources of the Minarets Wilderness and adjacent areas, Madera and Mono Counties, California: U.S. Geological Survey Bulletin 1516, p. 49-72.

Oliver, H. W., and Robbins, S. L., 1982, Bouguer gravity map of California, Mariposa sheet: California Division of Mines and Geology, scale 1:250,000.

Seitz, J. F., 1983, Geologic map of the Tioga Lake, Hall Natural Area, Log Cabin-Saddlebag, and Horse Meadows Roadless Areas, Mono County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1453-A, scale 1:62,500.

U.S. Geological Survey, 1981, Aeromagnetic map of Lee Vining Canyon and vicinity, Mono County, California: U.S. Geological Survey Open-File Report 81-432, scale 1:62,500.

Table 1.--Mines, prospects, and mineralized areas with resources or resource potential in the Hall Natural Area (5051), Log Cabin-Saddlebag (5052), and Horse Meadows (5049) Roadless Areas, Mono County, Calif.
[Underlined names refer to properties with mineral resources]

Name (commodity)	Summary	Workings and production	Sample data/resource assessment
		Hall Natural Area (5051)	
Great Sierra mine (Patented claims) (silver)	Four parallel fault zones strike N. 20-30° W. and dip steeply to the northeast in Paleozoic metasedimentary and metavolcanic rocks of the Saddlebag Lake roof pendant. The zones are 6 to 40 ft thick, and contain brecciated metasedimentary rocks and quartz lenses and pods with as much as 8 percent combined arsenopyrite, pyrite, chalcopyrite, and sphalerite.	Twelve shafts, eight pits, and a crosscut reported to be over 1,784 ft in length	Twenty-one samples across the fault zone averaged 0.99 oz silver per ton and trace gold. About 600,000 tons of inferred subeconomic resources averaging 0.01 oz gold per ton and 1.2 oz silver per ton is on the property. A moderate potential for additional gold and silver resources is present to the northwest along the strike of the fault zone.
September claims (tungsten and molybdenum)	Paleozoic metasedimentary rocks intruded by Cretaceous granitic rocks underlie the claims. Locally, disseminated tungsten and molybdenum minerals occur in northwest-trending calc-silicate rocks along a contact with intrusive rocks.	None	A total of 61 samples was taken on the claims; 10 contained trace to as much as 0.01 oz gold per ton; three samples contained 0.02, 0.10, and 0.25 percent tungsten trioxide; and four samples contained 0.007, 0.59, and 2.47 percent molybdenum disulfide. The claim has a low mineral resource potential for molybdenum and tungsten.
		Log Cabin-Saddlebag Roadless Area (5052)	
Golden Fleece prospect (gold-silver)	Alinement of workings and quartz on stockpiles indicates a quartz vein trending northwest in granodiorite. The vein is limonite stained and vuggy with minor pyrite and chrysocolla along fracture planes.	Two short caved adits and one pit about 20 ft in diameter	Four samples were taken; three grab samples of dump material contained 0.01 to 0.02 oz gold per ton and as much as 0.4 oz silver per ton; one grab sample from a stockpile of vein quartz assayed 0.04 oz gold per ton and 1.5 oz silver per ton. This prospect has a moderate potential for gold-silver resources.
9991 prospect (gold-silver)	Two quartz veins containing 1 to 3 percent combined pyrite and arsenopyrite cut quartz diorite. The veins range from 1 to 2 ft thick, trend northwest, and dip steeply southwest.	Three caved shafts, four bulldozer trenches, and four prospect pits	Seven samples were taken; three chip samples across quartz veins averaged 0.1 oz gold per ton and less than 0.2 oz silver per ton. Two stockpile samples averaged 0.41 oz gold per ton and 0.4 oz silver per ton. About 600 tons of inferred marginal gold-silver resources averaging 0.1 oz gold per ton and 0.1 oz silver per ton is in the quartz veins. A moderate potential for additional gold-silver resources may exist along the strike of the veins.
Centipede prospect (silver)	Paleozoic metasedimentary rocks of the Saddlebag Lake roof pendant underlie the prospect. En echelon, northeast-trending shear zones are parallel to a fault that traverses the prospect. These zones contain brown, silicified, biotite-bearing quartzite and quartz and calcite veinlets with about 2 percent disseminated sulfides, mainly pyrite and pyrrhotite.	Two adits totaling 550 ft, two caved adits, a 30-ft inclined shaft, and three prospect pits. Remains of a 5-stamp mill are near the open adits	Thirty samples were taken on the gold prospect. Fifteen samples across shear zones at the surface and underground had as much as 0.06 oz gold per ton and 0.1 oz silver per ton. Four select dump samples of vein quartz contained from trace to 0.2 oz gold per ton and up to 0.5 oz silver per ton. The remaining 11 samples were of metasedimentary rock and contained as much as trace gold and 0.2 oz silver per ton. There is 7,000 tons of inferred subeconomic gold-silver resources containing 0.03 oz gold per ton and 0.1 oz silver per ton on this prospect. Potential is moderate for additional gold-silver resources along the strike of the fault zone.

Table 1--Continued

Name (commodity)	Summary	Workings and production	Sample data/resource assessment
North Log Cabin prospect (gold-silver)	A north-trending quartz vein about 2 ft thick is in Paleozoic hornfels. The quartz is vuggy, coarsely crystalline, limonite stained, and contains as much as 5 percent pyrite.	Three trenches averaging 35 ft long and wide	Of six samples collected, three select samples of stockpiled vein quartz ranged from 0.05 to 0.19 oz gold per ton and 0.1 to 0.8 oz silver per ton. Three select dump samples of vein quartz had as much as 0.01 oz gold per ton and 0.9 oz silver per ton. About 10,000 tons of inferred subeconomic resources containing 0.06 oz gold per ton and 0.3 oz silver per ton is on the prospect. A moderate potential for additional gold-silver resources exists along the strike of the vein.
Klondike prospect (gold-silver)	Mineralized shear zones are in Paleozoic hornfels and quartzites that have been intruded by Cretaceous granitic rocks. The principal structure is a 14-ft-thick zone, striking N. 60° W. and dipping 49° NE., containing a 10-ft-thick massive limonite-stained quartz vein. Other northeast- and northwest-trending shear zones are exposed locally but most are covered by talus.	Fifteen caved adits representing an estimated 8,000 ft of underground workings, one caved shaft, and several prospect pits and trenches	Twenty-seven samples were taken on the prospect. Two chip samples across the principal zone contained from trace to 0.01 oz gold per ton and 0.1 oz silver per ton. Twelve select samples of vein quartz from the dumps had values from trace to 0.40 oz gold per ton and as much as 0.50 oz silver per ton. Thirteen samples representing average dump rock contained from nil to 0.08 oz gold per ton and up to 0.1 oz silver per ton. Potential is moderate for gold-silver resources along the strike and at depth in the shear zone.
Saddlebag Lake prospect (gold-silver)	Paleozoic metasedimentary rocks of the Saddlebag Lake roof pendant underlie the prospect. A shear zone averaging 3 ft thick strikes N. 14°-19° W. and dips 45° NE.; it is exposed for 600 ft along strike in gray hornfels. The zone contains silicified hornfels and a 2-ft-thick massive limonite-stained quartz vein.	Three small prospect pits	Nine chip samples were taken; seven samples across the quartz vein contained as much as 0.03 oz gold per ton. Two samples across the shear zone contained no gold or silver. About 20,000 tons of inferred subeconomic resources averaging 0.03 oz gold per ton and 0.1 oz silver per ton is on the prospect. A moderate potential for additional gold-silver resources lies to the southwest along the strike and at depth in the shear zone.
Australian claim (patented) (silver)	Northwest-trending Paleozoic quartzite and hornfels of the Saddlebag Lake roof pendant underlie the claim. A 4-ft-thick shear zone strikes N. 18° W., dips 80° NE., and is exposed only in the shaft. The zone contains silicified hornfels and quartz stringers with about 5 percent disseminated sulfides, mainly arsenopyrite and pyrite.	A 20-ft-deep partially caved shaft, one caved adit, and one trench	Four samples were taken; two chip samples across the zone contained as much as trace gold and 0.6 oz silver per ton. Two select samples of sulfide-bearing quartz stringers had trace and 0.01 oz gold per ton and 0.2 to 2.1 oz silver per ton. The claim has a moderate potential for low-grade gold-silver resources.
	Horse Meadows Roadless Area (5049)		
Unnamed prospect (gold-silver)	Paleozoic quartzite has been intruded by an intrusive stock composed mainly of alaskite. Narrow quartz stringers in the quartzite contain finely disseminated pyrite.	One small sloughed prospect pit	One select sample of the quartz stringers assayed 0.08 oz gold per ton and 0.1 oz silver per ton. A low potential for gold-silver resources exists at this prospect.
Tungsten Queen No. 1 claim (tungsten)	Paleozoic metasedimentary rocks of the Saddlebag Lake roof pendant are intruded by Cretaceous granitic rocks. Pods up to 40 ft thick occur along intrusive rock contacts; pods are composed of hornfels and tactite and contain epidote, garnet, quartz, and, locally, scheelite.	Two bulldozer cuts and two shallow prospect pits	Eight samples across tactite pods contained from trace to 0.07 percent WO_3 and trace gold and silver. The claim has a low potential for tungsten.

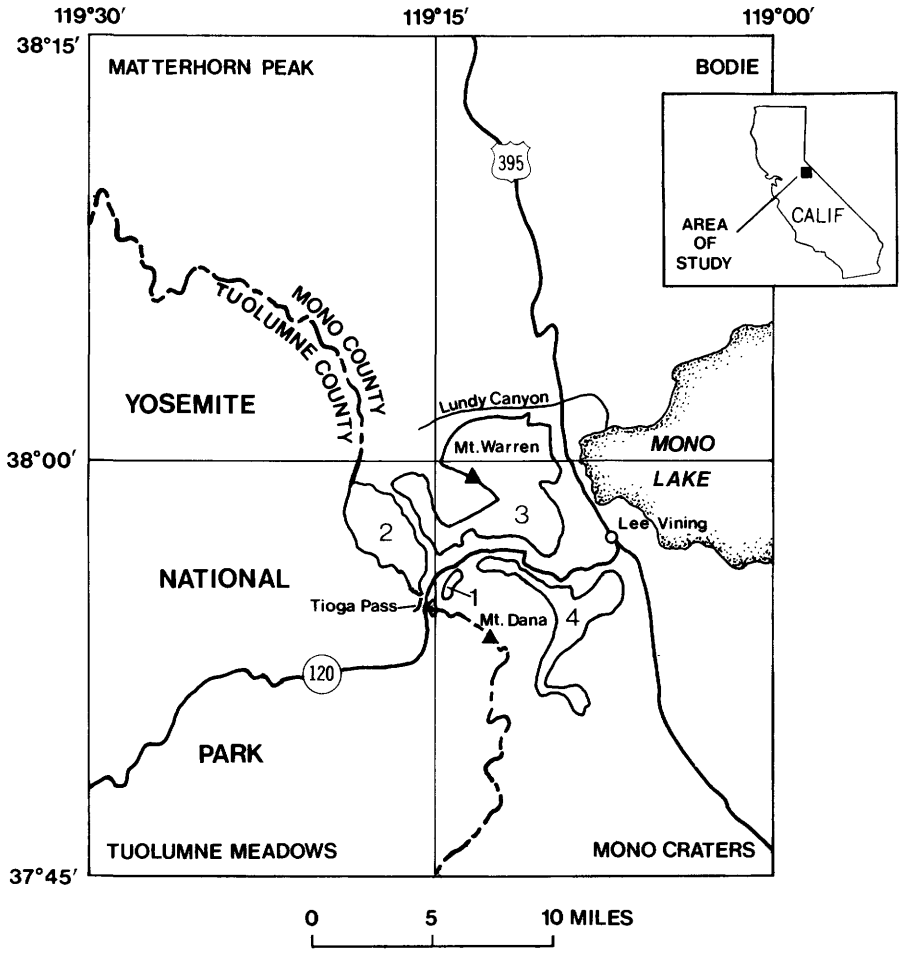

Figure 1.--Index map of study area showing locations of 15-minute quadrangles and roadless areas:

1. Tioga Lake (5050)
2. Hall Natural Area (5051)
3. Log Cabin-Saddlebag (5052)
4. Horse Meadows (5049)

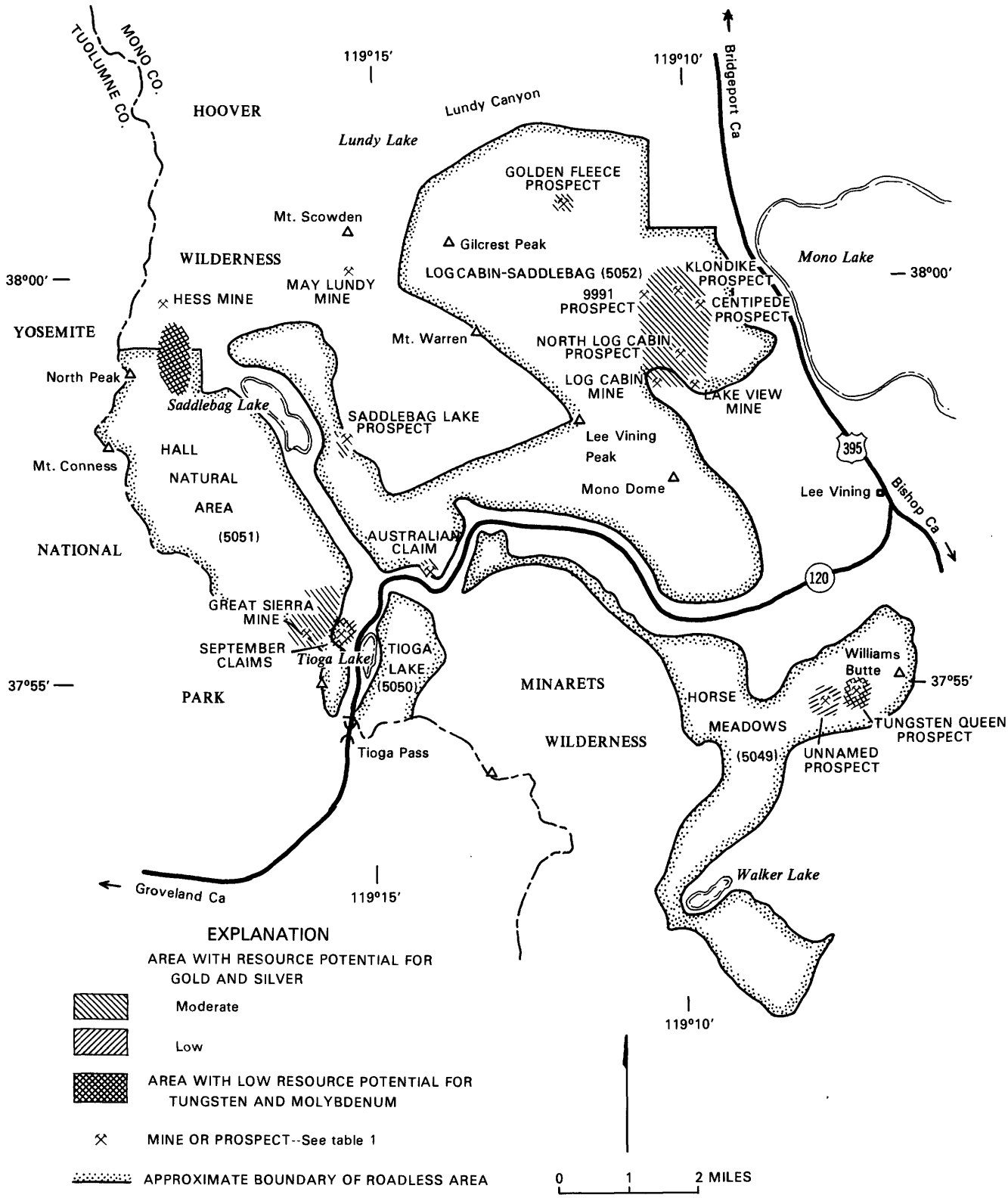

Figure 2.--Mines, prospects, and areas with mineral resource potential in the Tioga Lake (5050), Hall Natural Area (5051), Log Cabin-Saddlebag (5052), and Horse Meadows (5049) Roadless Areas.

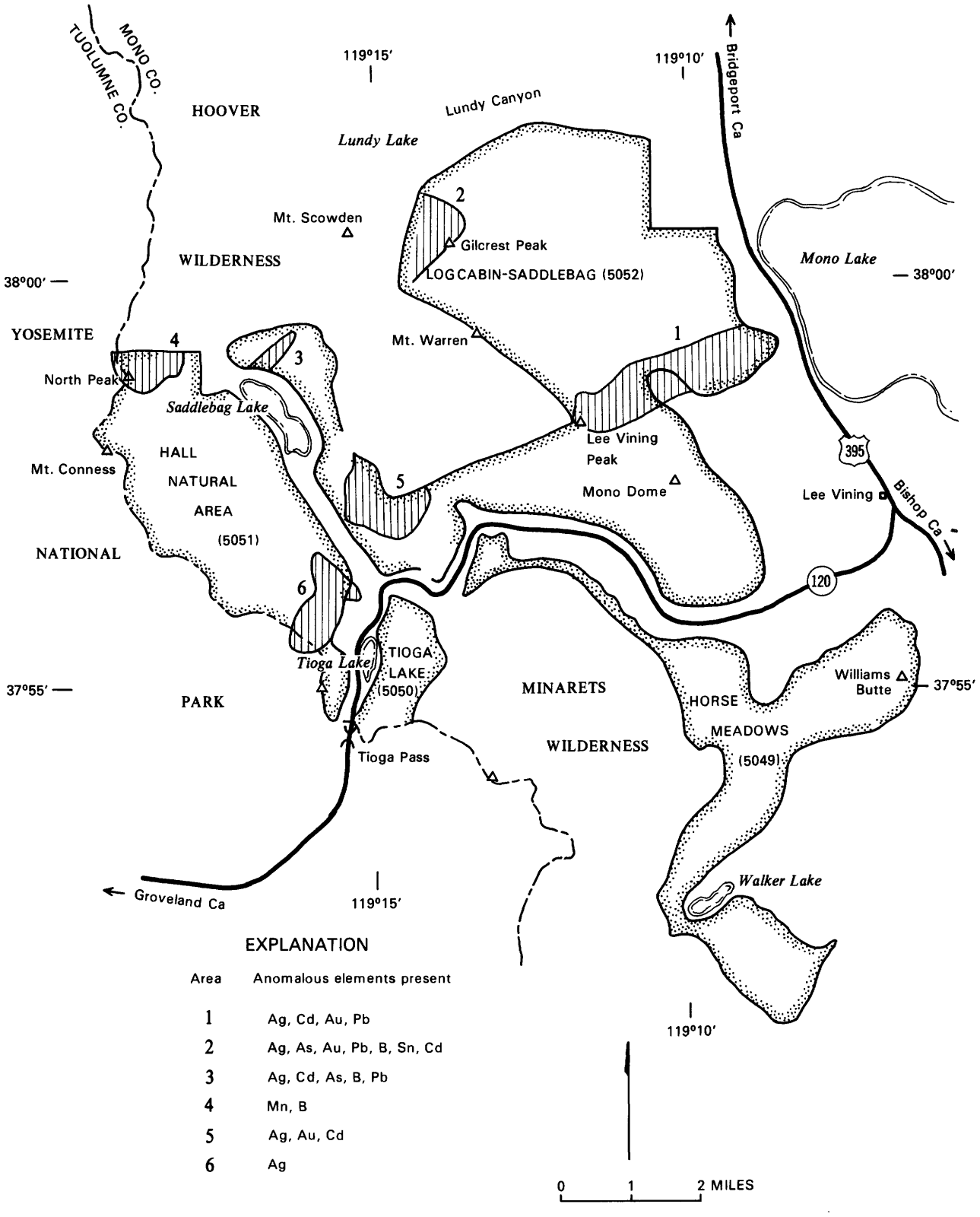

Figure 3.--Areas delineated by geochemical sampling as having anomalous mineral concentrations.