Mineral Resources of the Parsnip Peak Wilderness Study Area, Lincoln County, Nevada

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
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BUREAU OF MINES
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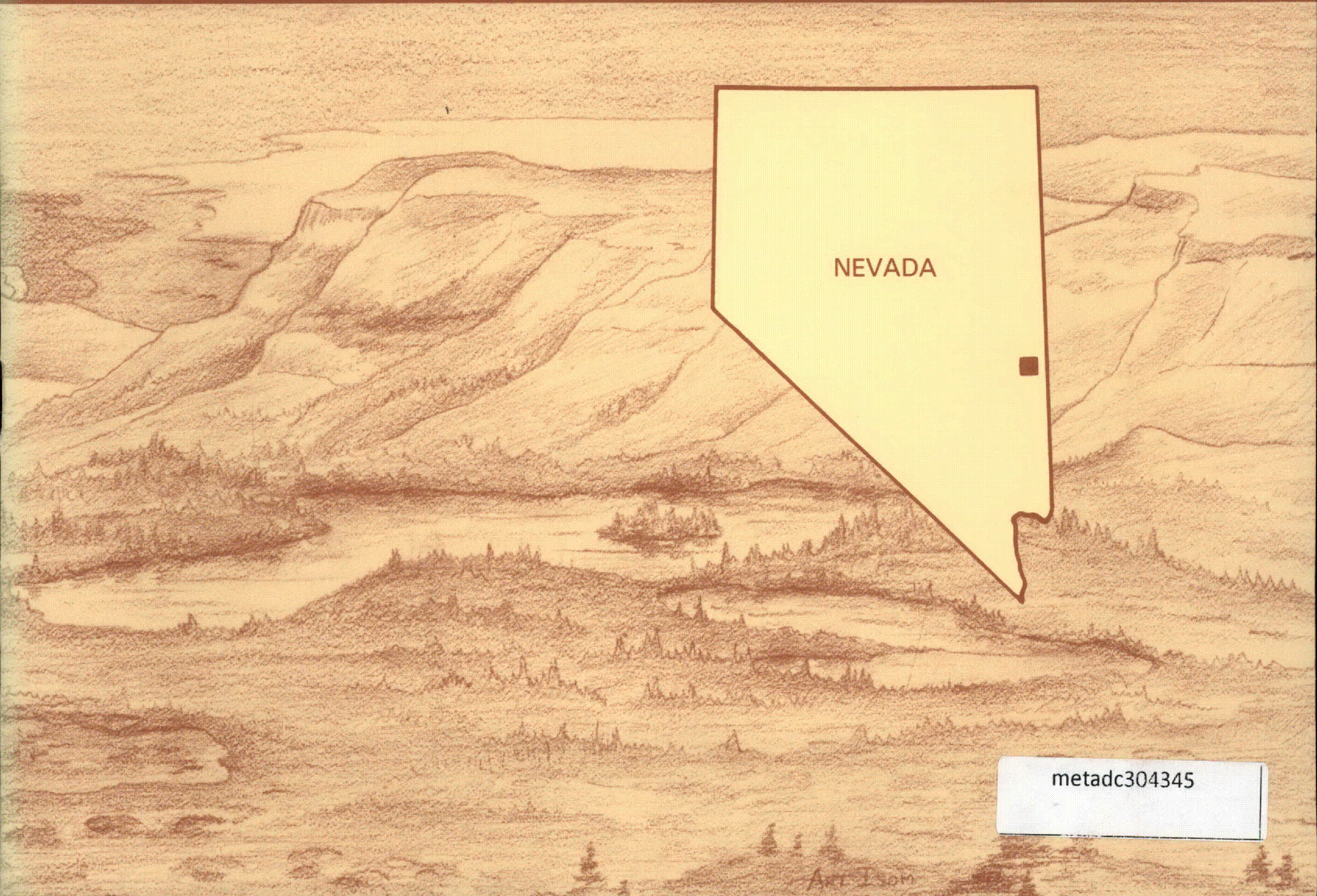
BUREAU OF LAND MANAGEMENT

U.S. GEOLOGICAL SURVEY BULLETIN 1728–D



DEFINITION OF LEVELS OF MINERAL RESOURCE POTENTIAL AND CERTAINTY OF ASSESSMENT

Definitions of Mineral Resource Potential

LOW mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics define a geologic environment in which the existence of resources is unlikely. This broad category embraces areas with dispersed but insignificantly mineralized rock as well as areas with few or no indications of having been mineralized.

MODERATE mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resource occurrence, where interpretations of data indicate a reasonable likelihood of resource accumulation, and (or) where an application of mineral-deposit models indicates favorable ground for the specified type(s) of deposits.

HIGH mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resource occurrence, where interpretations of data indicate a high degree of likelihood for resource accumulation, where data support mineral-deposit models indicating presence of resources, and where evidence indicates that mineral concentration has taken place. Assignment of high resource potential to an area requires some positive knowledge that mineral-forming processes have been active in at least part of the area.

UNKNOWN mineral resource potential is assigned to areas where information is inadequate to assign low, moderate, or high levels of resource potential.

NO mineral resource potential is a category reserved for a specific type of resource in a well-defined area.

Levels of Certainty

<table>
<tr><td rowspan="4">LEVEL OF RESOURCE POTENTIAL →</td><td rowspan="4">U/A
UNKNOWN POTENTIAL</td><td>H/B
HIGH POTENTIAL</td><td>H/C
HIGH POTENTIAL</td><td>H/D
HIGH POTENTIAL</td></tr>
<tr><td>M/B
MODERATE POTENTIAL</td><td>M/C
MODERATE POTENTIAL</td><td>M/D
MODERATE POTENTIAL</td></tr>
<tr><td rowspan="2">L/B
LOW POTENTIAL</td><td rowspan="2">L/C
LOW POTENTIAL</td><td>L/D
LOW POTENTIAL</td></tr>
<tr><td>N/D
NO POTENTIAL</td></tr>
<tr><td></td><td>A</td><td>B</td><td>C</td><td>D</td></tr>
<tr><td></td><td colspan="4">LEVEL OF CERTAINTY →</td></tr>
</table>

A. Available information is not adequate for determination of the level of mineral resource potential.
B. Available information suggests the level of mineral resource potential.
C. Available information gives a good indication of the level of mineral resource potential.
D. Available information clearly defines the level of mineral resource potential.

Abstracted with minor modifications from:

Taylor, R. B., and Steven, T. A., 1983, Definition of mineral resource potential: Economic Geology, v. 78, no. 6, p. 1268–1270.

Taylor, R. B., Stoneman, R. J., and Marsh, S. P., 1984, An assessment of the mineral resource potential of the San Isabel National Forest, south-central Colorado: U.S. Geological Survey Bulletin 1638, p. 40–42.

Goudarzi, G. H., compiler, 1984, Guide to preparation of mineral survey reports on public lands: U.S. Geological Survey Open-File Report 84–0787, p. 7, 8.

Chapter D

Mineral Resources of the Parsnip Peak Wilderness Study Area, Lincoln County, Nevada

By MARGO I. TOTH, REBECCA G. STONEMAN, and
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U.S. Geological Survey

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U.S. GEOLOGICAL SURVEY BULLETIN 1728

MINERAL RESOURCES OF WILDERNESS STUDY AREAS—
EAST-CENTRAL NEVADA AND PART OF ADJACENT BEAVER AND IRON COUNTIES, UTAH

DEPARTMENT OF THE INTERIOR
DONALD PAUL HODEL, Secretary

U.S. GEOLOGICAL SURVEY
Dallas L. Peck, Director

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STUDIES RELATED TO WILDERNESS

Bureau of Land Management Wilderness Study Areas

The Federal Land Policy and Management Act (Public Law 94–579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine the 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 mineral survey of a part of the Parsnip Peak (NV–040–206) Wilderness Study Area, Lincoln County, Nevada.

RESOURCE / RESERVE CLASSIFICATION

	IDENTIFIED RESOURCES			UNDISCOVERED RESOURCES	
	Demonstrated		Inferred	Probability Range (or)	
	Measured	Indicated		Hypothetical	Speculative
ECONOMIC	Reserves		Inferred Reserves		
MARGINALLY ECONOMIC	Marginal Reserves		Inferred Marginal Reserves		
SUB-ECONOMIC	Demonstrated Subeconomic Resources		Inferred Subeconomic Resources		

Major elements of mineral resource classification, excluding reserve base and inferred reserve base. Modified from U. S. Bureau of Mines and U. S. Geological Survey, 1980, Principles of a resource/reserve classification for minerals: U. S. Geological Survey Circular 831, p. 5.

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Mineral Resources of the Parsnip Peak Wilderness Study Area, Lincoln County, Nevada

By Margo I. Toth, Rebecca G. Stoneman, *and* H. R. Blank, Jr.
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SUMMARY

The Parsnip Peak (NV–040–206) Wilderness Study Area in Lincoln County, Nevada, is 10 mi (miles) northeast of the small mining town of Pioche. A mineral resource study of the area was completed in the summers of 1984 and 1985 by the U.S. Geological Survey and U.S. Bureau of Mines. A small area of limestone and dolomite on the western side of the wilderness study area has high mineral resource potential for arsenic, antimony, mercury, and gold. The rest of the Parsnip Peak Wilderness Study Area has low mineral resource potential for metals, oil and gas, coal, and geothermal energy (fig. 1). The Free perlite deposit and three unnamed perlite deposits on the southwestern side of the study area contain identified perlite resources of 3.4 million tons. The mineral resource potential for perlite is moderate in the rhyolite volcanic rock that occurs along the western side of the study area.

The study area is accessible from all sides by unpaved roads. Most of these roads are passable by four-wheel-drive vehicles during the drier months of the year. The study area is characterized by steep, rocky terrain that gives way to the gently sloping alluvial fans on both sides of the area. Pinyon and juniper trees cover the study area; mountain mahogany bushes in the higher elevations severely limit the observation of outcrops in the more densely vegetated areas.

The study area is along the eastern margin of the Basin and Range physiographic province and is within the Blue Ribbon lineament of Rowley and others (1978). A thick section of Miocene (for geologic ages see the geologic time chart on the last page of this report) silicic volcanic rocks underlies the central and western parts of the area; the section consists of the Bauers and Swett Tuff Members of the Condor Canyon Formation, overlain by ash-flow tuffs and rhyolite flows of the Blawn Formation. Lake sediments of the Pliocene Panaca Formation occur along the east side of the study area and consist of flat-lying tuffaceous siltstone, mudstone, and fine-grained sandstone. Extensive colluvial deposits of Quaternary age are developed along the eastern and western flanks of the area. A small outcrop of altered Cambrian limestone and dolomite occurs along a fault on the western margin of the area.

Normal faults cross the study area and trend mostly northwest, although a few north-trending faults are present. Offsets range from a few tens of feet to several hundred feet. None of the faults cut Quaternary deposits.

The nearest mining district is 10 mi southwest of the study area. As of July 1984, mining activity within the study area consisted of assessment work on two groups of claims, the Blue Rock placer claims for perlite and the Gold Tower lode claims in faulted jasperoid. No perlite outcrops are present on the parts of the Blue Rock claims that lie within the study area. The Gold Tower claims are in brecciated jasperoid in altered Cambrian limestone and dolomite. Samples from the claims contain high concentrations of antimony, arsenic, and mercury; silver was detected in three samples, and gold was detected in one sample.

The Free perlite deposit in the southern part of the study area contains 250,000 tons of inferred subeconomic resources (see resource/reserve classification chart on p. IV of this report). The deposit is probably too small to be of economic importance. Several miles northwest of the Free perlite deposit, three unnamed perlite deposits contain 700,000 tons, 420,000 tons, and 2 million tons, respectively, of inferred subeconomic re-

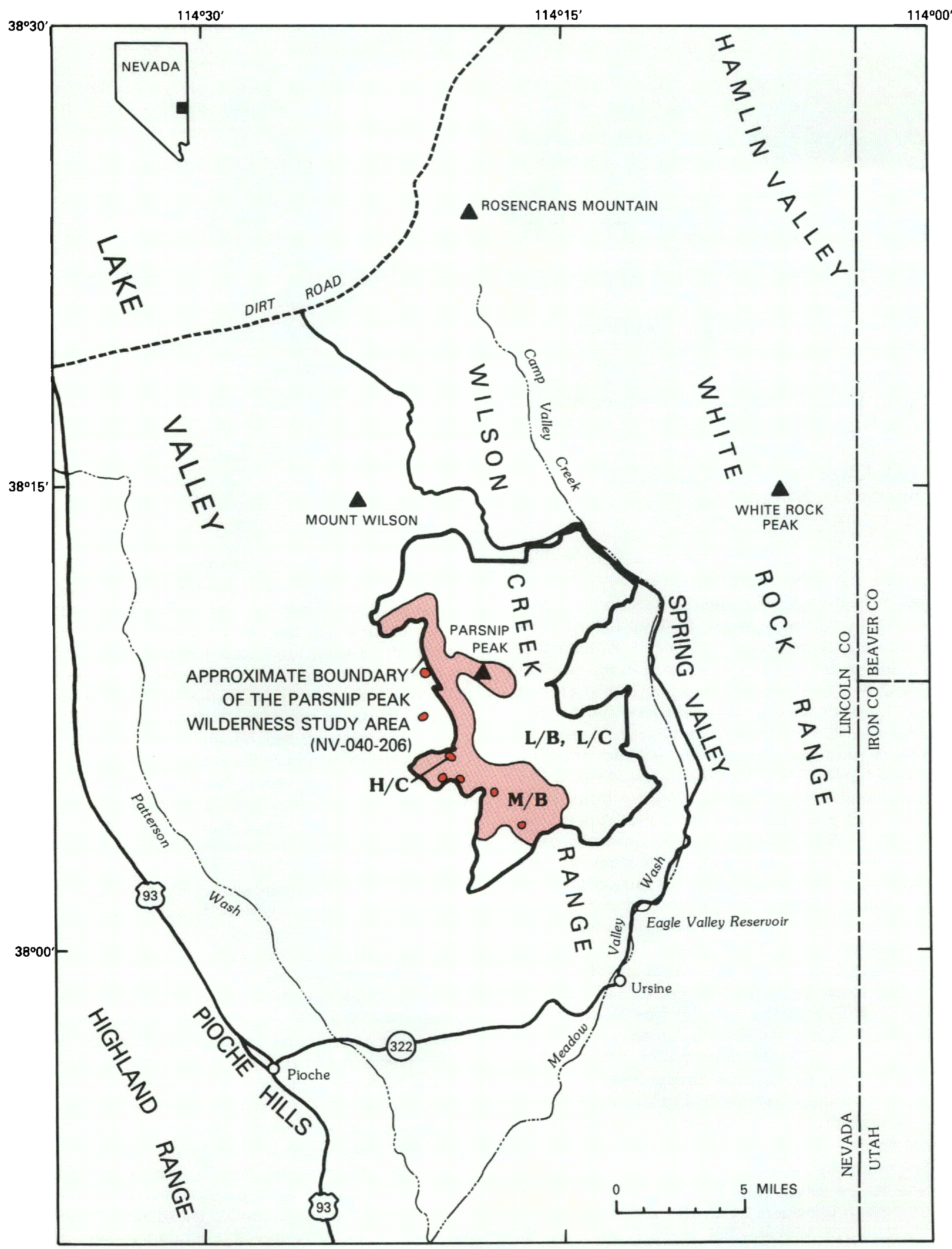


Figure 1 (above and facing page). Map showing location, identified resources, and mineral resource potential of the Parsnip Peak Wilderness Study Area, Lincoln County, Nevada.

EXPLANATION

	Areas of identified resources for perlite
H/C	Geologic terrane having high mineral resource potential for arsenic, antimony, mercury, and gold, with certainty level C
M/B	Geologic terrane having moderate mineral resource potential for perlite, with certainty level B
L/B	Geologic terrane having low mineral resource potential for metals and geothermal energy, with certainty level B—Applies to entire study area
L/C	Geologic terrane having low mineral resource potential for oil, gas, and coal, with certainty level C—Applies to entire study area

sources. The perlite in these deposits is of acceptable quality for plaster and concrete aggregate. About 1 mi west of the study area, the Hollinger perlite deposit had original reserves of 9 million tons of minable perlite; more than 250,000 tons have been extracted by open-pit mining.

As a part of this study, stream-sediment and rock samples from the study area were collected for analysis. Panned concentrates of stream-sediment samples had detectable concentrations of barium, cobalt, chromium, copper, lanthanum, molybdenum, niobium, scandium, tin, strontium, vanadium, yttrium, and zirconium, but only tin was present in anomalous amounts; it was detected in all samples and ranged from 20 to 2,000 ppm (parts per million). The outcrop source of the tin was not located. One stream-sediment sample contained anomalous arsenic, thorium, and uranium. Molybdenum (detected in rock samples, see below) was not detected in any of the stream-sediment samples.

Two rock samples contained detectable molybdenum, two other rock samples contained detectable tin, and another sample had 0.5 ppm silver. The outcrops from which these samples were taken were not visibly mineralized.

Geophysical studies show that the geomagnetic field in the vicinity of the study area is highly disturbed, mainly due to the presence of volcanic rocks and of numerous strongly magnetized rocks in the shallow subsurface. Pronounced east-trending anomalies in the valley to the east of the study area suggest that thick tabular or dikelike intrusive igneous bodies may be concealed beneath the sedimentary deposits of the intermontane basins and beneath the volcanic rocks of the Wilson Creek Range. Gravity data indicate that the study area is in a gravity low, interpreted to be the expression of a caldera.

A small area of limestone and dolomite along the western side of the study area has many of the characteristics of sedimentary-hosted disseminated gold deposits, and rock samples from the area yielded anomalous concentrations for arsenic, antimony, mercury, and gold. The potential for these commodities in the sedimentary rock is therefore high, with certainty level C.

The study area lacks host rocks and structures favorable for the occurrence of oil, gas, or coal. The study area may be underlain by Paleozoic sedimentary rocks, but any hydrocarbons associated with these rocks could have been destroyed by the high temperatures associated with the eruption of the Tertiary volcanic rocks. The mineral resource potential of these commodities is therefore low.

Springs are abundant in the study area, especially along faults, but their temperatures are low, ranging from 50 °F to 75 °F. The resource potential for geothermal energy is therefore low.

INTRODUCTION

At the request of the U.S. Bureau of Land Management, 53,650 acres of the Parsnip Peak (NV–040–206) Wilderness Study Area were studied by the U.S. Geological Survey (USGS) and U.S. Bureau of Mines (USBM). In this report the studied area is referred to as "wilderness study area" or simply "study area."

The Parsnip Peak Wilderness Study Area is in east-central Lincoln County, Nevada (fig. 1). Spanning the southern half of the north-trending Wilson Creek Range, the study area is bordered by Lake Valley on the west and Camp Valley Creek and Meadow Valley Wash on the east. Streams flow to the west and east from the central mountainous part of the study area and drain into large alluvial fans on both sides of the study area. Elevations range from about 6,000 ft (feet) on the southeast flank of the Wilson Creek Range to 8,916 ft at Parsnip Peak. Mount Wilson (9,296 ft), the highest peak in the Wilson Creek Range, is just northwest of the study area. The study area is characterized by steep, rocky terrain covered by pinyon and juniper; in the higher elevations mountain mahogany severely limits the observation of outcrop in the more densely vegetated areas.

Pioche, the nearest town, is about 10 mi southwest of the study area, and Caliente, the nearest rail shipping point, is about 15 mi south of Pioche along U.S. Highway 93. Access to the borders of the study area is by improved and unimproved dirt roads; access to the interior is by foot and a few jeep trails.

Prior to the field investigation, USBM personnel reviewed pertinent published and unpublished literature. Files at the U.S. Bureau of Land Management state office in Reno, Nev., were checked for patented and unpatented mining-claim locations, and oil, gas, and geothermal leases and lease applications. Lessees, mining-claim holders, and persons having knowledge of mineral occurrences and mining activities within and near the area were contacted.

Two USBM employees spent 12 days in the field and collected a total of 53 chip, grab, and select samples.

Twenty-three perlite samples were crushed and screened to a 30- to 50-mesh fraction and expanded in a perlite expander. The perlite was tested at the standard settings with no preheat and with preheats of 300 °F and 600 °F. The density of the resulting expanded product determined the suitability of the perlite for various industrial uses. Seventeen samples were fire assayed for gold and silver, and thirteen other samples were analyzed by semiquantitative optical emission spectrographic methods for 40 elements. Results of the perlite tests and the analyses were summarized by Gese (1985).

Complete analytical results for all USBM samples are available for public inspection at the U.S. Bureau of Mines, Intermountain Field Operations Center, Building 20, Denver Federal Center, Denver, CO 80225.

A mineral resource assessment of the study area by the USGS in the summer of 1984 consisted of reconnaissance geologic mapping combined with stream-sediment and rock sampling and subsequent analyses of the samples. Aerial photographs were used extensively to facilitate geologic mapping and to determine regional structures. Areas which showed anomalous geochemistry were field checked and resampled in the summer of 1985. Thin sections of representative rock samples were obtained for petrographic studies. Geophysical studies were done in the fall of 1985. The geologic map of Ekren and others (1977) provided information concerning the regional geology in Nevada. The mineral resource potential of the wilderness study area was classified according to the system of Goudarzi (1984) (see inside front cover of this report).

Acknowledgments.—The USGS authors acknowledge the assistance and cooperation of personnel in the Bureau of Land Management office in Ely, Nev. Discussions with M. G. Best (Brigham Young University) about the stratigraphy of the volcanic rocks in the Wilson Creek Range were extremely helpful.

APPRAISAL OF IDENTIFIED RESOURCES

By Diann D. Gese
U.S. Bureau of Mines

Mining and Mineral-Exploration History

The Parsnip Peak Wilderness Study Area is not in any mining district but is 10 mi northeast of the Pioche (Ely) mining district, 15 mi southeast of the Bristol (Jackrabbit) district, and 25 mi south of the Atlanta (Silver Park and Silver Springs) district. Silver deposits in the Pioche and Bristol districts and gold and silver deposits in the Atlanta district were discovered in the late 1860's.

As of July 1984, mining activity within the study area consisted of assessment work on two groups of claims, the Blue Rock placer claims and the Gold Tower lode claims. Oil and gas leases cover parts of the study area (fig. 2); however, as of March 1984, no oil or gas wells had been drilled on these leases (Weimer–McMillion, 1984). Perlite occurrences have been found within and near the study area.

Perlite

Perlite was produced from the late 1940's until the early 1970's from the Hollinger pit, 1 mi west of the study area. Four perlite deposits within the study area, the Free deposit and three unnamed deposits, were examined. The inferred subeconomic perlite resource within the study area is approximately 3.4 million tons.

Tonnages for perlite deposits that occur within the area studied were calculated by multiplying the area of a deposit in square feet times its thickness in feet, and dividing the resulting volumes by a tonnage factor of 13.9 (density assumed for perlite was about 144 lb/ft^3 or pounds per cubic foot). The area of perlite outcrop mapped in the field was estimated by using a planimeter; the thickness was measured in the field. Areas and thicknesses used to calculate the perlite resources at various deposits in the study area are in Gese (1985).

Free Perlite Deposit

The Free perlite deposit is within the study area in secs. 5 and 6, T. 2 N., R. 69 E. The deposit is intruded and capped by dacite. The average density of the expanded perlite is 4.7 lb/ft^3 (Gese, 1985). When expanded in a laboratory furnace, one sample from the deposit shattered and smoked, possibly due to an excessive amount of combined water in the sample (Kadey, 1983). Perlite of this density may produce an acceptable concrete or plaster aggregate.

Inferred perlite resources of the Free deposit are estimated to be 250,000 tons. At the present time, there is no road to the Free perlite deposit, and the deposit is probably too small to be of economic importance.

Unnamed Perlite Deposits

Three unnamed perlite deposits occur within the study area in secs. 25–27, T. 3 N., R. 68 E. Two samples were taken from a perlite deposit in the SE¼ sec. 27, T. 3 N., R. 68 E. Densities of expanded perlite ranged from 5.7 to 8.2 lb/ft^3. Perlite of this density could be used as plaster and concrete aggregates. Inferred subeconomic resources of this deposit are estimated to be 700,000 tons.

Densities of expanded samples from a perlite deposit in the SW¼ sec. 25, T. 3 N., R. 68 E., ranged from 3.9 to 5.6 lb/ft^3 (Gese, 1985). Perlite of this density may produce an acceptable plaster and concrete aggregate.

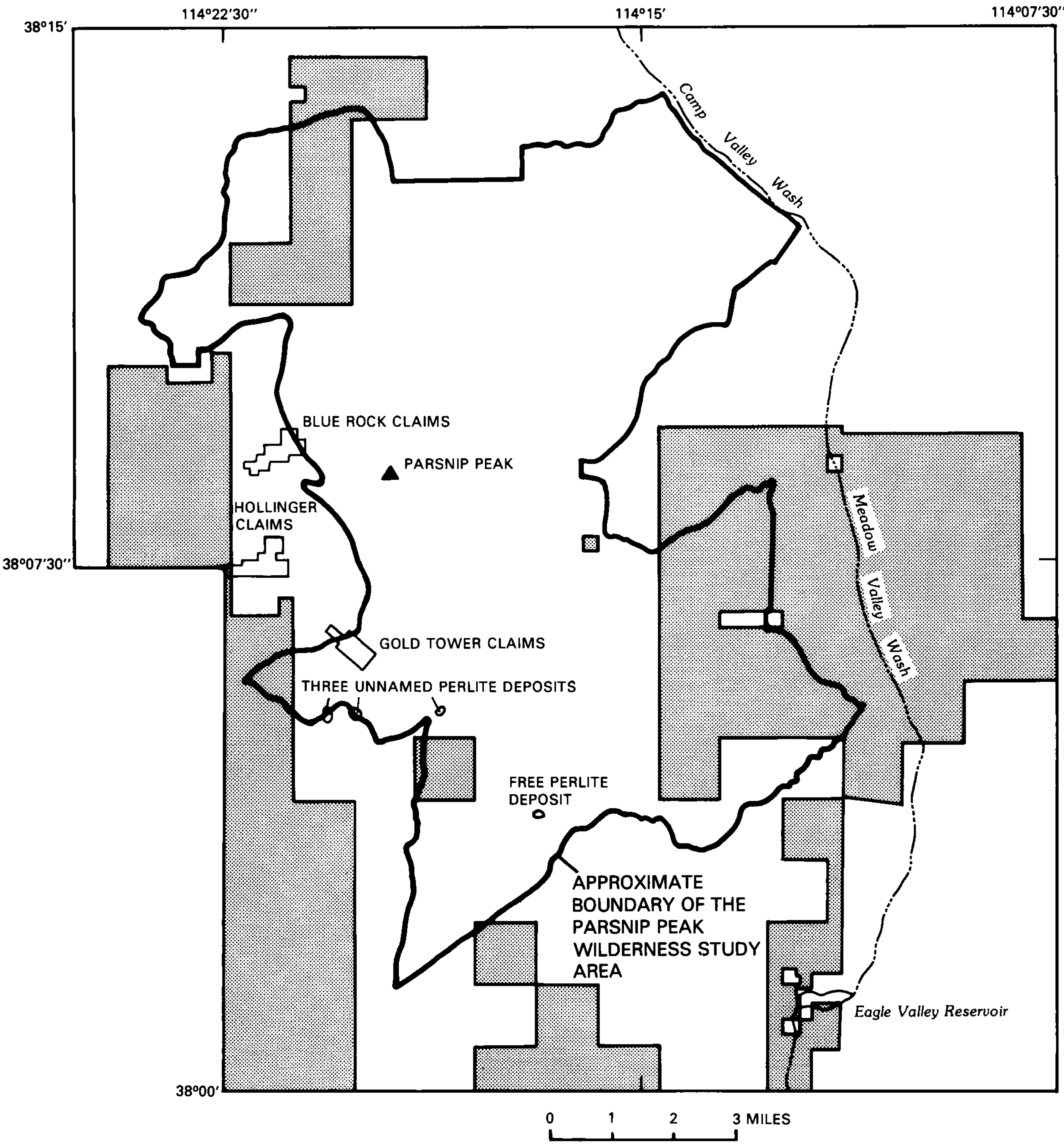


Figure 2. Map showing mining claims and oil and gas leases (shaded) within and near the Parsnip Peak Wilderness Study Area, Nevada.

Inferred subeconomic perlite resources of this deposit are estimated to be 2 million tons.

The average density of expanded samples from a perlite deposit in SW¼ sec. 25, T. 3 N., R. 68 E., was about 4 lb/ft^3 (Gese, 1985). This deposit would produce perlite acceptable as a plaster and concrete aggregate. Inferred resources of this perlite deposit are estimated to be 420,000 tons.

Blue Rock Claims Area

The Blue Rock claims consist of three placer claims located for perlite in secs. 3 and 4, T. 3 N., R. 68 E.

These claims extend into the study area, but no perlite outcrops were found on the claims within the study area. The claims have been active since 1949. Perlite crops out at the study-area boundary and as far as 0.75 mi west of the study area. The deposit appears to be free of contaminants except for minor jasper at the top and bottom of one exposed section.

Four perlite samples were taken on the Blue Rock claims. One sample was taken from a pit in the perlite, and the rest were taken from perlite outcrops. Density of expanded perlite samples ranged from 2.50 to 5.37 lb/ft^3. Perlite sampled in 1983 expanded 14 times at 1,250 °F (K. R. Olinghouse, claim holder, oral commun., 1984). Perlite of this density would probably be suitable for plaster and concrete aggregate.

To determine whether the perlite extends into the subsurface of the study area, a drilling program would be necessary. Mining the exposed perlite by open-pit methods is feasible, although there has been no known production from the Blue Rock claims. The deposit is about 2 mi by jeep trail to a well-maintained dirt road that provides direct access to U.S. Highway 93.

Hollinger Perlite Deposit

The Hollinger perlite deposit, or Hollinger pit, NE¼ sec. 16, T. 3 N., R. 68 E., is the only known perlite producer near the study area. Literature dating back to August 1951 has incorrectly located the deposit in secs. 3 and 10, T. 3 N., R. 68 E. (Union Pacific Railroad, unpub. data, 1951). Placer claims held by Kerr–McGee now cover the Hollinger perlite deposit, including the Hollinger pit. The mine was developed by quarry methods in the late 1940's by the Combined Metals Production Co., which produced perlite until about 1971 (Union Pacific Railroad, unpub. data, 1951; Cammarota, 1970). Ore was crushed and sized at the company's grinding plant at Caselton, Nev., and hauled by railroad to various expanding plants throughout the country. Most of the perlite from the Hollinger pit was used for the production of lightweight plaster aggregate. Original reserves of minable perlite were 9 million tons, of which more than 250,000 tons have been extracted by open-pit mining (Union Pacific Railroad, unpub. data, 1951; Tschanz and Pampeyan, 1970).

In July 1984, the quarry consisted of three benches that open up a face of high-quality perlite about 90 ft thick. Twenty-three samples were taken in the Hollinger pit area. Ten of these samples were expanded in a laboratory furnace, and densities of the resulting materials ranged from 2.55 to 4.56 lb/ft^3. Expanded perlite of this density would probably be satisfactory for plaster and concrete aggregate, as a filter aid, in wallboard construction, and as an insulating material. A well-maintained dirt road provides access directly from the mine to U.S. Highway 93.

Gold Tower Claims

The Gold Tower claims consist of seven lode claims in Cambrian limestones and dolomites in secs. 22 and 23, T. 3 N., R. 68 E., within the study area (pl. 1). The claims were located by the C and C Mining Co. in January 1981 on jasperoid outcrops (J. W. Cole, C and C Mining Co., written commun., March 1984). Two shafts (19.5 and 60 ft deep, respectively) and two prospect pits are on brecciated jasperoid in altered carbonate rocks. The shafts are about 400 ft apart and along the strike of the same 10-ft-wide brecciated jasperoid body. The jasperoid contains limonite, hematite, goethite, cinnabar, orpiment, and realgar. One of six samples taken in the area of the two shafts contained silver; none of the samples contained detectable gold. Five of the samples contained 3–7 ppm thallium.

Seventeen samples were taken on the Gold Tower claims; 12 samples were taken from jasperoids, both massive and brecciated, and 5 were taken from silicified limestones and dolomites. One sample contained a trace of gold (0.010 ppm), and two samples contained a trace of silver (0.360 ppm). Sixteen of the 17 samples contained arsenic above the detection limit of 2 ppm; the average arsenic content of the 16 samples is 170 ppm. Ten of the samples contained antimony above the detection limit of 2 ppm; the average antimony content of the 10 samples is 23 ppm. Six of the samples contained thallium above the detection limit of 2 ppm; the average thallium content of the six samples is 4 ppm. Two of the samples contained mercury. High amounts of antimony, arsenic, and mercury in jasperoid and carbonate rocks can indicate disseminated gold and silver deposits typified by the deposit at Carlin, Nev.; however, no near-surface gold or silver resource was identified on the Gold Tower claims based on preliminary surface sampling.

Oil and Gas

Oil and gas leases cover about 8,000 acres within the study area (fig. 2). As of March 1984, the only known oil and gas well drilled in the region was May Petroleum, Inc.'s Federal N3258, approximately 12 mi west of the study area (Weimer–McMillion, 1984).

ASSESSMENT OF POTENTIAL FOR UNDISCOVERED RESOURCES

By Margo I. Toth, Rebecca G. Stoneman, and H. R. Blank, Jr.
U.S. Geological Survey

Geology

Geologic Setting

The geology of the region directly east of the study area in Utah is described in detail by Best and Grant (in press), Best and others (in press), and Rowley and others (1978), and is comparable to the geology of the study area. Widespread silicic volcanic rocks erupted in Oligocene time and are present in the ranges adjacent to the study area. The volcanics unconformably overlie thrust-faulted, warped, and folded Paleozoic and Mesozoic sedimentary rocks, which were deformed during the Late Cretaceous Sevier orogeny. Although some highly silicic volcanic rocks are present, the largest volumes of volcanic rock are dacitic ash-flow tuffs and andesitic lavas. Large collapse-type calderas resulted from many of these volcanic eruptions. The study area lies in the center of one of these calderas, the Wilson caldera of Best and Grant (in press). In Miocene time, a bimodal suite of low-silica and high-silica volcanic rocks was erupted.

The Parsnip Peak Wilderness Study Area lies along the eastern margin of the Basin and Range province and within the Blue Ribbon lineament of Rowley and others (1978). The lineament is an east-trending zone of Tertiary rhyolite bodies which contain deposits of fluorspar, uranium, and tin.

In the vicinity of the study area, Basin and Range faulting began about 21 to 22 m.y. (million years) ago (Rowley and others, 1978), typified by northeast-trending normal faults resulting from northwest-southeast extension. Some of the northeast-trending faults have vertical displacements as great as 3,200 ft (Best and others, in press).

Description of Rock Units and Structure

The Parsnip Peak Wilderness Study Area contains a thick section of Miocene silicic volcanic rocks, flanked on the eastern side by Tertiary lake sediments of the Panaca Formation and on the western and eastern sides by extensive colluvial deposits (pl. 1). The volcanic rocks consist of the Bauers and Swett Tuff Members of the Condor Canyon Formation, overlain by ash-flow tuffs and rhyolite flows of the Blawn Formation. On plate 1, rhyolite flows of the Blawn Formation are shown as unit Tr; ash-flow tuffs and sedimentary rocks of the Blawn are combined with the underlying Bauers and Swett Tuff Members as unit Tt.

A small outcrop of Cambrian limestone and dolomite occurs along a fault on the western side of the study area. Much of the rock is brecciated, and jasper and iron oxide alteration is abundant. No metallic minerals were observed in hand specimen. Two shafts and prospect pits are in the outcrop (Gese, 1985) in a jasperoid body.

The Bauers Tuff Member (22.3 m.y., Best and others, in press) was observed in only a few places along the eastern side of the study area. Where it crops out, the member is densely welded and light pink, and contains 8–10 percent of small (less than 1/16 inch) phenocrysts of plagioclase, sanidine, and biotite, and 5–15 percent pink pumice fragments. The Swett Tuff Member (20–30 ft thick) overlies the Bauers and crops out along the eastern side of the study area as a prominent cliff. The member contains a crystal-poor black basal vitrophyre (glassy rock) about 10 ft thick. The Swett Tuff Member is commonly dark red to purple and contains 10 percent phenocrysts of euhedral biotite and plagioclase; some crystals of biotite are as large as ¼ inch across.

Ash-flow tuffs of the Blawn Formation (23 to 18 m.y., Best and others, in press) overlie the Swett Tuff Member in sharp contact. Springs commonly occur at the base of the formation in the highly porous tuffs. The Blawn Formation may correlate with the formation of Rosencrans Knolls (Willis, 1985). The volcanic rocks of the Blawn were erupted from local volcanic centers, possibly at Parsnip Peak and Wilson Peak (Ekren and others, 1977). The ash-flow tuffs of the Blawn Formation are white, light pink or lilac, and salmon pink, and contain 15–20 percent phenocrysts of dark-gray euhedral quartz, plagioclase, biotite, and sanidine; 10–15 percent pumice fragments; and 15–20 percent rock fragments. In the northeast part of the study area near Buck Wash Wells the basal part of the Blawn Formation contains a layer of interbedded tuffaceous sandstone and conglomerate about 2–5 ft thick.

Rhyolite flows of the Blawn Formation overlie the ash-flow tuffs and occur mostly in the higher elevations and in the western part of the study area. The flows are generally layered, are gray, pink, or lilac, and contain 15 percent (range 5–35 percent) phenocrysts of sanidine, smoky quartz, plagioclase, and minor biotite. Perlite was commonly observed in many of the exposures.

Pliocene lake sediments of the Panaca Formation (pl. 1, unit Tp) crop out on the eastern side of the study area and consist of varicolored flat-lying tuffaceous siltstone, mudstone, and fine-grained sandstone. A small outcrop of Cambrian carbonate rocks (pl. 1, unit Ꞓs) occurs along the southwestern edge of the study area.

Normal faults cross the study area, but only the more prominent of these faults are shown on plate 1. The faults trend mostly northwest, although a few north-trending faults are present. Offsets range from a few tens of feet to several hundred feet. Many of the springs in the study area occur along faults or at the intersections of faults. None of the faults were observed to cut Quaternary deposits.

Geochemistry

Methods

The geochemical survey of the study area consisted of the sampling and analysis of stream sediments and rocks; sample localities are shown on plate 1. One hundred thirteen samples of stream sediments were collected from streams which drained areas of 1–2 square miles. Two types of samples were collected at each locality. Panned-concentrate samples were collected to analyze for metallic elements such as copper, lead, zinc, and gold which might be in heavy minerals, and a fine fraction of mud and clay was collected to analyze for metals such as molybdenum, uranium, thorium, and arsenic which typically adhere to clay minerals. Analytical data are available upon request from M. I. Toth at the U.S. Geological Survey, M.S. 922, Denver Federal Center, Box 25046, Denver, CO 80225.

Panned-concentrate samples were obtained from sediment collected from several different places in the active streambed where heavy minerals typically accumulate. Samples were panned to a heavy-mineral concentrate weighing about 0.25 ounce, and after processing, they were analyzed for 31 elements by semiquantitative emission spectrography, according to the techniques outlined by Grimes and Marranzino (1968) (half of the sample was retained for optical identification of the minerals). A fine-fraction sample of mud, clay, and silt was collected from within the active stream channel, commonly along point bars. Samples were analyzed for 31 elements by semiquantitative emission spectrography, and for arsenic, molybdenum, uranium, and thorium according to the induction coupled plasma spectroscopy techniques of Taggart and others (1981).

The various rock units were sampled to establish the background values of mineralizing elements and to search for any trends or values that might suggest the presence of mineralized rock. Ninety-three rock samples were analyzed. Altered rock was also sampled wherever observed. Samples were analyzed by semiquantitative emission spectrography for 31 elements and for arsenic, bismuth, cadmium, antimony, and zinc by flame atomic absorption.

G. W. Day, D. E. Detra, P. H. Briggs, R. B. Vaughn, L. A. Bradley, and N. M. Conklin of the U.S. Geological Survey performed all analyses.

Results

Panned-concentrate samples had detectable concentrations of barium, cobalt, chromium, copper, lanthanum, molybdenum, niobium, scandium, tin, strontium, vanadium, yttrium, and zirconium. Of these elements, molybdenum, lead, copper, and tin are common indicators of base-metal mineralization, but only tin was present in anomalous concentrations. Molybdenum was detected in one sample (detection limit 10 ppm), at 15 ppm. Lead (detection limit 20 ppm) was present in 10 samples in concentrations which ranged from 20 to 150 ppm. Copper (detection limit 10 ppm) was present in 15 samples in amounts ranging from 10 to 15 ppm.

Tin was detected in seventy-two samples and ranged from 20 ppm to greater than 2,000 ppm. Samples with the highest concentrations of tin occurred along the southwestern (sample PLJ044) and southeastern (sample PLJ023) boundaries of the study area, but most of the anomalous samples are from the northeastern part of the study area (samples PLJ025, PLJ027, PLJ031, PLJ036, PLJ039, and PLJ042). In the northeastern area, the streams which contained the highest tin concentrations were resampled at various intervals to try to locate the tin anomalies more closely; however, samples from all of the resampled sites contained low tin concentrations. Outcrops near anomalous sample sites were carefully examined for any evidence of mineralization and also were sampled. No mineralized rock was seen, and none of the sampled rocks had detectable tin.

Cassiterite (wood tin) was optically identified in some of the panned-concentrate samples with the highest tin content. The source of the cassiterite is unknown. Because no mineralized rock was observed in outcrop and tin was not detected in any of the rock samples, it is likely that the tin is dispersed in the rocks, possibly as vug fillings or in microfractures.

With the exception of one sample, the fine fraction (less than 100 mesh) of the mud and clay samples contained 9.1–52.1 ppm thorium and 2.5–8.9 ppm uranium. Sample PLJ043 contained anomalous concentrations of both thorium (103 ppm) and uranium (18.2 ppm). Arsenic was detected only in sample PJS003 (11 ppm, detection limit 10 ppm), and molybdenum was not detected in any sample (detection limit 2 ppm).

Only five rock samples had anomalous concentrations of elements commonly associated with base or precious-metal mineralization. None of the samples from the altered jasperoid body had anomalous concentrations of any elements. Samples PMT002A and PMT009A contained 5 ppm molybdenum. Samples PMT029A and PJS056A contained 10 and 15 ppm tin, respectively. Sample PMT060A contained 0.5 ppm silver. No mineralized rock was observed in the outcrops from which these samples were taken. Boron, barium, beryllium, cobalt, chromium, copper, lanthanum, lead, nickel, niobium, strontium, vanadium, yttrium, and zirconium were detected in many of the rock samples, but none of these elements were present in anomalous concentrations.

A hydrogeochemical survey of the Wilson Creek Range by McHugh and others (1983) revealed no anomalous concentrations of metallic elements in spring water from the study area. Five water samples had temperatures which ranged from 50 °F to 54 °F, and one water sample from the southwestern side of the study area had a temperature of 75 °F.

Geophysics

Reconnaissance geophysical data on the Parsnip Peak Wilderness Study Area and vicinity is provided by regional aeromagnetic surveys (U.S. Geological Survey, 1973, 1978), by Bouguer gravity anomaly maps of the Lund and Caliente quadrangles (Snyder and others, 1984; Healey and others, 1981), and by aeromagnetic and aeroradiometric traverses of the NURE (National Uranium Resource Evaluation) program. In addition, 24 supplementary gravity stations were established during November 1985 by J. H. Hassemer of the U.S. Geological Survey in support of the present investigations. These data do not address the direct detection of mineral deposits in the study area but may impact assessment of its resource potential.

A total-intensity residual aeromagnetic anomaly map of the study area and vicinity is shown on figure 3. The geomagnetic field is highly perturbed in the vicinity of the Parsnip Peak Wilderness Study Area, mainly because of the volcanic nature of much of the terrain and the presence of numerous strongly magnetized rocks in the shallow subsurface. Intense east-trending anomalies just to the south of the study area and just east of Parsnip Peak, passing across Spring Valley, suggest thick tabular or dikelike intrusive bodies concealed beneath sedimentary deposits of the intermontane basins and ash flows of the Wilson Creek Range. Arcuate trends of contours delineating these anomalies may reflect structural control of intrusions by ring fractures of the Indian Peak–Wilson Creek caldera complex (Best and others, in press). Similarly intense anomalies in the vicinity of Mt. Wilson and in the White Rock Range are possibly also due to shallow intrusions. An alternative source of such strong local anomalies might be thick sequences of mafic flows or welded ash-flow tuffs containing massive basal vitrophyres; nonwelded tuffs and all of the sedimentary rocks known in this region should be much more weakly magnetized.

Anomalies in the northern half of the area of figure 3, including the Parsnip Peak–Spring Valley anomaly, lie within the Blue Ribbon lineament of Rowley and others (1978), an east-west-trending structural zone about 15 mi wide which extends from eastern Nevada to central Utah, and which has been a locus of volcanism, shallow intrusion, and hydrothermal activity at least since the mid-Tertiary. This lineament crosses the east-northeast-trending Pioche mineral belt (Shawe and Stewart, 1976) a few miles east of the study area, and such a structural intersection might be expected to be a favorable site for the formation of hydrothermal mineral deposits. A complete Bouguer anomaly map (fig. 4) shows that most of the study area occupies a deep, roughly elliptical gravity low elongated northwest-southeast and centered in Spring Valley to the east of the study area. Local minima in this depression are more than 40 milligals below the highest levels shown on figure 4, which are near Pioche, Nev. Relatively steep gradients which delineate the depression on the northeast closely follow a range-front fault system on the flank of the White Rock Mountains (fig. 1), but on the southwest they are well within the Wilson Creek Range. Thus the Quaternary fill and Tertiary lake deposits of modern Spring Valley cannot entirely explain the anomaly; its low-density source must extend southwestward beneath volcanics of the Wilson Creek Range.

The Spring Valley low is close to the center of a much broader (18 by 30 mi) elliptical gravity low, also oriented northwest, whose southwestern margin passes approximately through Pioche and whose northeast margin is northeast of the area of figure 4. This larger feature is believed to reflect subsidence of high-density basement rocks in the Indian Peak–Wilson Creek caldera complex. The Spring Valley low may be the expression of a smaller caldera within the Indian Peak–Wilson Creek caldera. The gravity pattern is complicated by emplacement of higher density Tertiary intrusive bodies at high levels, in part controlled by ring fractures related to caldera formation, as was suggested by the magnetics. A more refined attempt to locate ring faults and other concealed caldera structures might contribute to construction of a model of the prevolcanic surface, which would be vital in developing an exploration plan in any future search for a northeastern extension of the Pioche district.

The NURE airborne traverses were spaced about 3 mi apart in this region and yielded a very general picture of gamma-radioactivity levels. According to Joseph Duval (written commun., 1985), the Parsnip Peak Wilderness Study Area has moderately high radioactivity, with values of 2.5–4.5 percent potassium, 3.0–6.5 ppm equivalent uranium, and 16–30 ppm equivalent thorium. No potassium or uranium anomalies are within the study area or in the immediate vicinity; however, a thorium anomaly occurs along the eastern boundary.

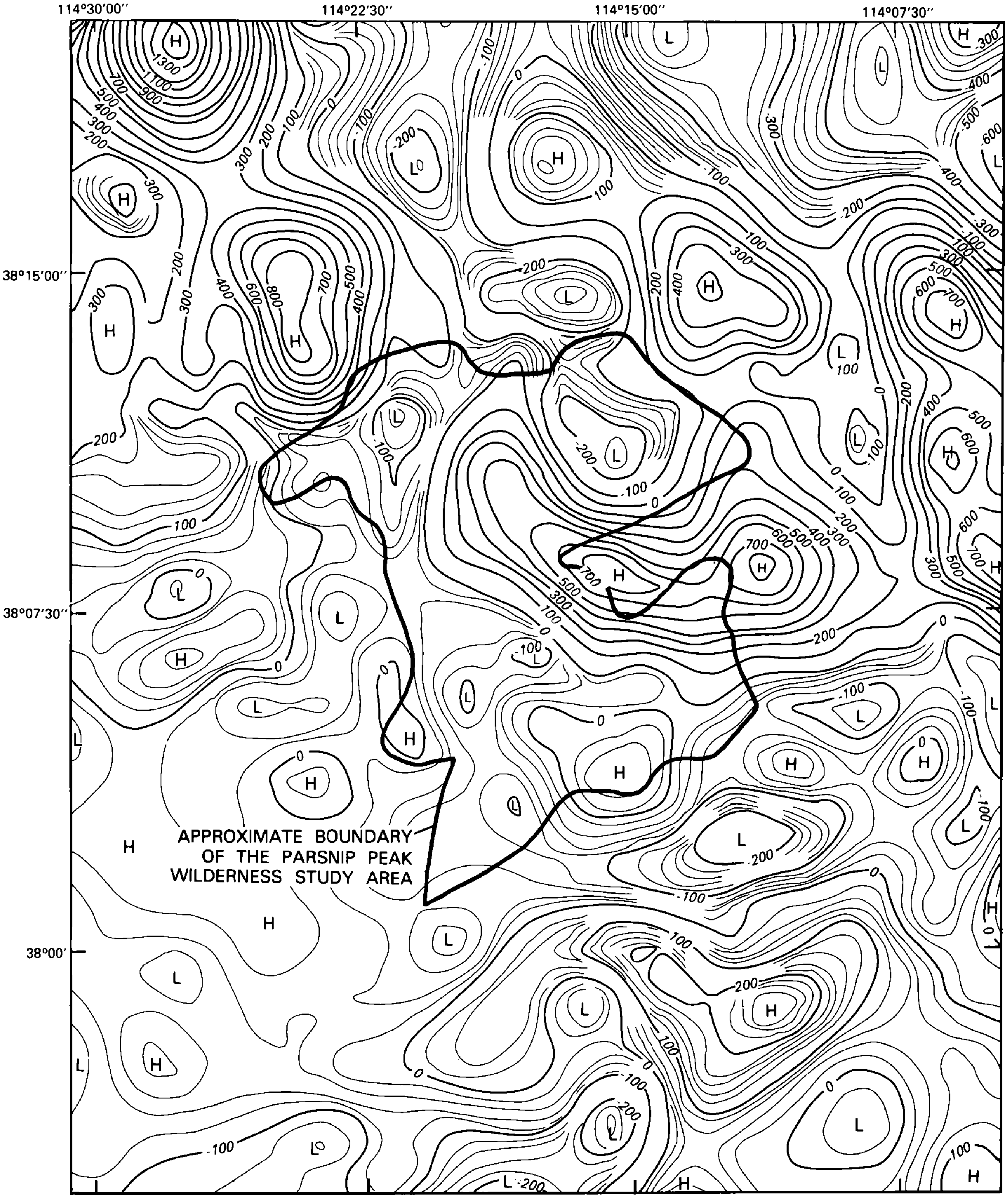


Figure 3 (above and facing page). Residual total-intensity aeromagnetic anomaly map of the Parsnip Peak Wilderness Study Area and vicinity, Nevada.

EXPLANATION

Anomaly contours— Showing residual total-intensity magnetic field of the Earth in nanoteslas (nT). Contour interval. 20 nT and 100 nT

H **Anomaly high**

L **Anomaly low**

Mineral and Energy Resources

Sedimentary-Hosted Disseminated Gold Deposits

The model.—Sedimentary-hosted disseminated gold deposits are related to surficial and near-surface processes that result in extensive silicification, hydrothermal brecciation, and veining in the host rock (Berger, 1985). Tooker (1985) summarized the characteristics of sedimentary-hosted disseminated gold deposits in Nevada. These include the following: limestone, calcareous siltstone, or chert host rock; heat source of intrusive plugs, hot-spring activity, or a caldera center; silicification and argillization of rock; persistent association of gold, silver, mercury, arsenic, antimony, and thallium; and a deposit size of less than 1 square mile to tens of square miles.

Mineral resource potential.—A small outcrop of limestone and dolomite in the study area has many of the characteristics of sedimentary-hosted disseminated gold deposits: the host rock is limestone; a heat source was a caldera center (the Wilson caldera); the source rock has been altered, including extensive silicification; and rock samples from the outcrop contained anomalous concentrations of arsenic, antimony, thallium, mercury, and gold. The mineral resource potential for arsenic, antimony, mercury, and gold in the limestone and dolomite is rated high, with certainty level C.

Metals

The rest of the Parsnip Peak Wilderness Study Area has low mineral resource potential for deposits containing metals, with certainty level B. Panned-concentrate samples from the northeastern part of the study area contain anomalous concentrations of tin, but no mineralized rock was observed in outcrop, and tin was detected in only two rock samples. The tin may be present as cassiterite in microfractures or as vug fillings. The source of the tin may have been an underlying shallow intrusion, as suggested by geophysical data.

Perlite

Perlite mines are present along the western side of the study area, and small exposures of perlite were commonly observed in mapping of rhyolite volcanic flow rock. For these reasons the mineral resource potential for perlite in the rhyolite volcanic flow rocks is rated moderate, with certainty level B.

Energy Resources

The wilderness study area lacks host rocks and structures favorable for the occurrence of oil, gas, or coal. The mineral resource potential for these commodities is therefore low, with certainty level C. The study area may be underlain by Paleozoic sedimentary rocks, but the depth to these rocks cannot be determined without extensive geophysical exploration. Any hydrocarbons associated with these rocks could have been destroyed by the high temperatures associated with the eruption of the Tertiary volcanic rocks. The potential for underlying oil and gas or coal-bearing rock is therefore also low, with certainty level C.

Although there are abundant springs in the study area, none of them contained warm or hot water; temperatures ranged from 50 °F to 75 °F. The potential for geothermal energy in the study area is low, with certainty level B.

RECOMMENDATIONS FOR FURTHER WORK

Additional sampling, testing, and drilling of the perlite deposits is needed to delineate the size of the deposits, to determine whether the perlite deposit which crops out in the Blue Rock placer claims extends into the study area, and to determine more precisely the quality of the perlite.

A more detailed geophysical study is necessary to better define the margins of the Wilson caldera, which would be a valuable aid in searching for mineral deposits in the area. Drilling and sampling of the mineralized limestone and dolomite on the western side of the study area is needed to determine the extent and grade of the mineralized rock.

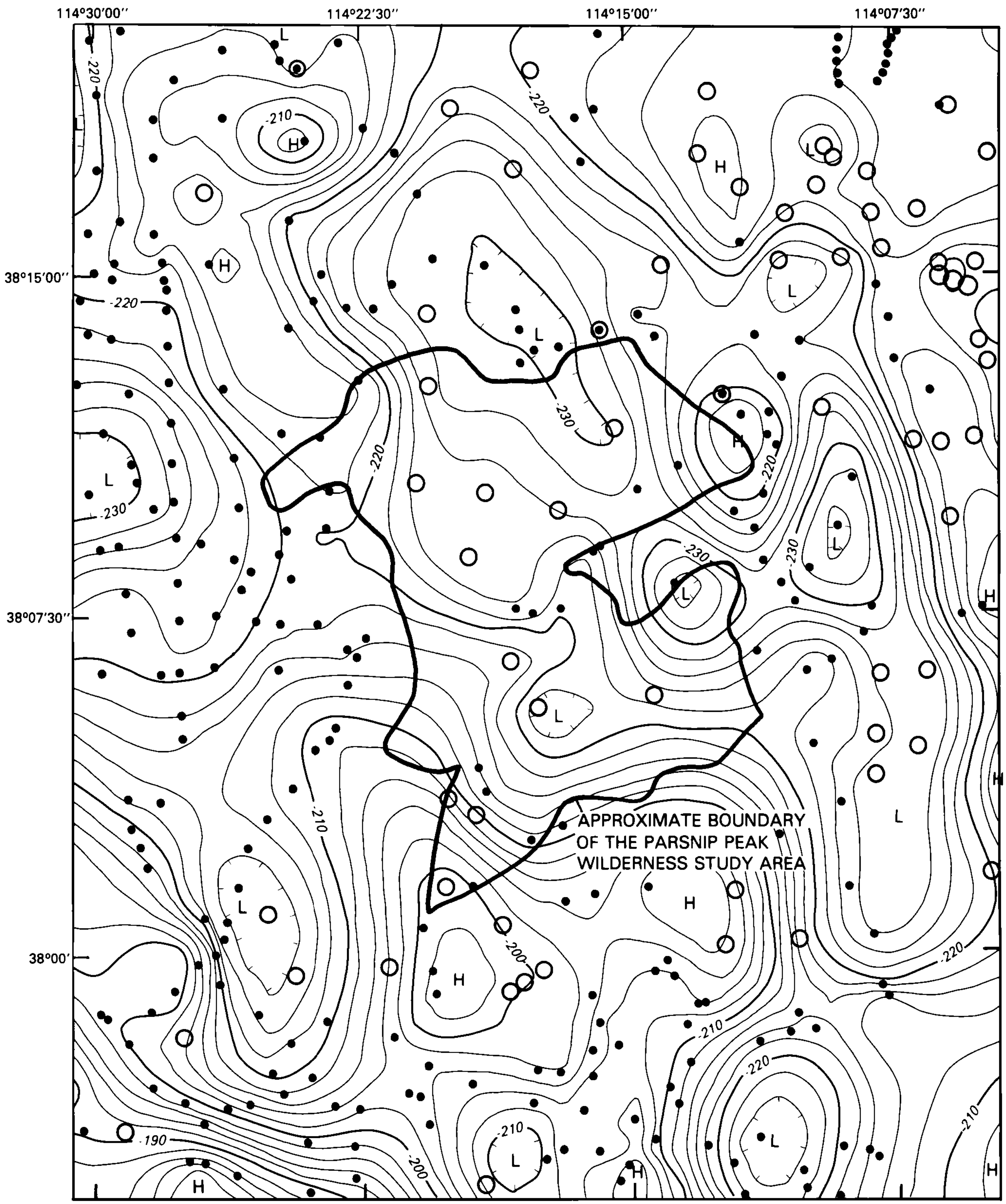
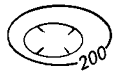


Figure 4 (above and facing page). Complete Bouguer gravity anomaly map of the Parsnip Peak Wilderness Study Area and vicinity, Nevada.

EXPLANATION



Complete Bouguer gravity anomaly contour—Contour interval, 2 milligals. Hachures indicate closed areas of lower gravity

H **Anomaly high**

L **Anomaly low**

● **Gravity station from U.S. Defense Mapping Agency data**

O **Gravity station established for this study**

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GEOLOGIC TIME CHART

Terms and boundary ages used by the U. S. Geological Survey, 1986

EON	ERA	PERIOD		EPOCH	BOUNDARY AGE IN MILLION YEARS
Phanerozoic	Cenozoic	Quaternary		Holocene	0.010
				Pleistocene	1.7
		Tertiary	Neogene Subperiod	Pliocene	5
				Miocene	24
			Paleogene Subperiod	Oligocene	38
				Eocene	55
				Paleocene	66
	Mesozoic	Cretaceous		Late	96
				Early	138
		Jurassic		Late Middle Early	205
		Triassic		Late Middle Early	~ 240
	Paleozoic	Permian		Late Early	290
		Carboniferous Periods	Pennsylvanian	Late Middle Early	~ 330
			Mississippian	Late Early	360
		Devonian		Late Middle Early	410
		Silurian		Late Middle Early	435
		Ordovician		Late Middle Early	500
		Cambrian		Late Middle Early	~ 570[1]
Proterozoic	Late Proterozoic				900
	Middle Proterozoic				1600
	Early Proterozoic				2500
Archean	Late Archean				3000
	Middle Archean				3400
	Early Archean				3800?
pre-Archean[2]					4550

[1] Rocks older than 570 m.y. also called Precambrian, a time term without specific rank.

[2] Informal time term without specific rank.

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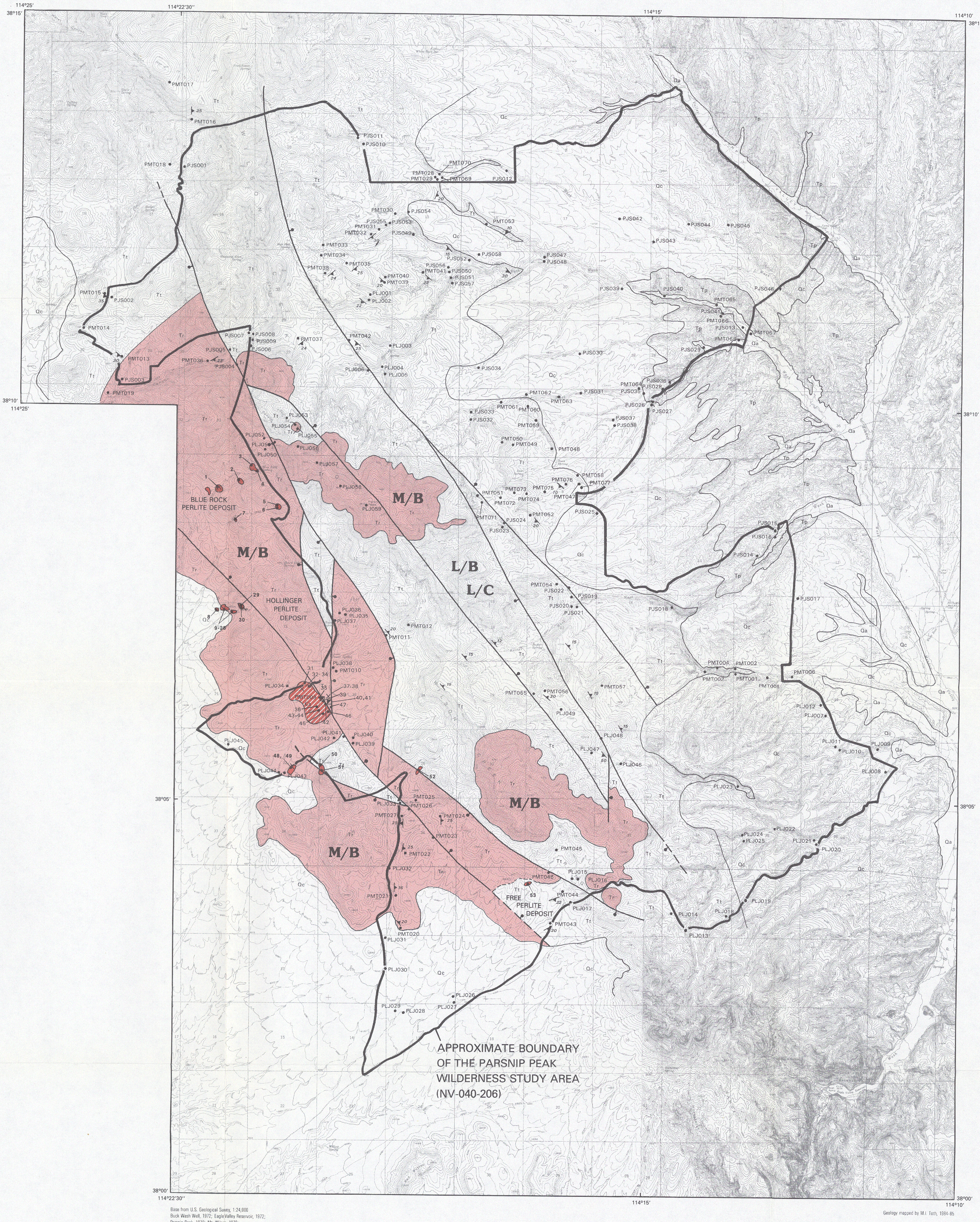
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

BULLETIN 1728-D
PLATE 1



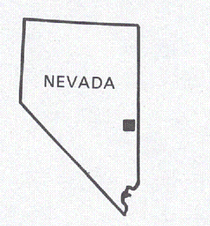
Base from U.S. Geological Survey, 1:24,000
Buck Wash Well, 1972; Eagle Valley Reservoir, 1972;
Parsnip Peak, 1970; Mt. Wilson, 1970;
and Pierson Summit, 1970

Geology mapped by M.I. Toth, 1984-85

APPROXIMATE MEAN
DECLINATION, 1972

SCALE 1:50 000

CONTOUR INTERVAL 20 AND 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929



EXPLANATION OF IDENTIFIED RESOURCES AND MINERAL RESOURCE POTENTIAL

- Areas of identified resources of perlite
- H/C — Geologic terrane having high mineral resource potential for arsenic, antimony, mercury, and gold, with certainty level C
- M/B — Geologic terrane having moderate mineral resource potential for perlite, with certainty level B
- L/B — Geologic terrane having low mineral resource potential for metals and geothermal energy, with certainty level B—Applies to entire study area
- L/C — Geologic terrane having low mineral resource potential for oil, gas, and coal, with certainty level C—Applies to entire study area

CORRELATION OF MAP UNITS

Qa Qc } QUATERNARY
Unconformity
Tp
Tr } TERTIARY
Tt
Unconformity
Єs } CAMBRIAN

DESCRIPTION OF MAP UNITS

- Qa — **Alluvium (Quaternary)**
- Qc — **Colluvium (Quaternary)**
- Tp — **Panaca Formation (Pliocene)**—Lake deposits consisting of flat-lying tuffaceous siltstone, mudstone, and fine-grained limestone
- Tr — **Rhyolite flows of the Blawn Formation (Miocene)**—Light-colored, crystal-rich, commonly layered lava flows
- Tt — **Ash-flow tuffs, undifferentiated (Miocene)**—Ash-flow tuffs of the Bauers and Swett Tuff Members of the Condor Canyon Formation and ash-flow tuffs and minor sedimentary rocks of the Blawn Formation
- Єs — **Limestone and dolomite, undifferentiated (Cambrian)**

Contact—Dashed where approximately located or inferred

Fault—Dashed where inferred; bar and ball on downthrown side

25 **Strike and dip of compaction foliation and flow layering**

PMT024 **U.S. Geological Survey geochemical sample locality**—Showing number

U.S. Bureau of Mines sample locality—Showing number

- 50 Perlite outcrop
- 39 Prospect pit
- 37,38 Shaft
- 29 Trench
- 36 Rock

LEVEL OF RESOURCE POTENTIAL ↑	A	B	C	D
	U/A UNKNOWN POTENTIAL	H/B HIGH POTENTIAL	H/C HIGH POTENTIAL	H/D HIGH POTENTIAL
		M/B MODERATE POTENTIAL	M/C MODERATE POTENTIAL	M/D MODERATE POTENTIAL
		L/B LOW POTENTIAL	L/C LOW POTENTIAL	L/D LOW POTENTIAL
				N/D NO POTENTIAL

LEVEL OF CERTAINTY →

LEVELS OF RESOURCE POTENTIAL

- **H** High mineral resource potential
- **M** Moderate mineral resource potential
- **L** Low mineral resource potential
- **U** Unknown mineral resource potential
- **N** No known mineral resource potential

LEVELS OF CERTAINTY

- **A** Available data not adequate
- **B** Data indicate geologic environment and suggest level of resource potential
- **C** Data indicate geologic environment, give good indication of level of resource potential, but do not establish activity of resource-forming processes
- **D** Data clearly define geologic environment and level of resource potential and indicate activity of resource-forming processes in all or part of the area

Diagram showing relationships between levels of mineral resource potential and levels of certainty. Shading shows levels that apply to this study area

MAP SHOWING IDENTIFIED RESOURCES, MINERAL RESOURCE POTENTIAL, SIMPLIFIED GEOLOGY, AND SAMPLE LOCALITIES, PARSNIP PEAK WILDERNESS STUDY AREA, LINCOLN COUNTY, NEVADA