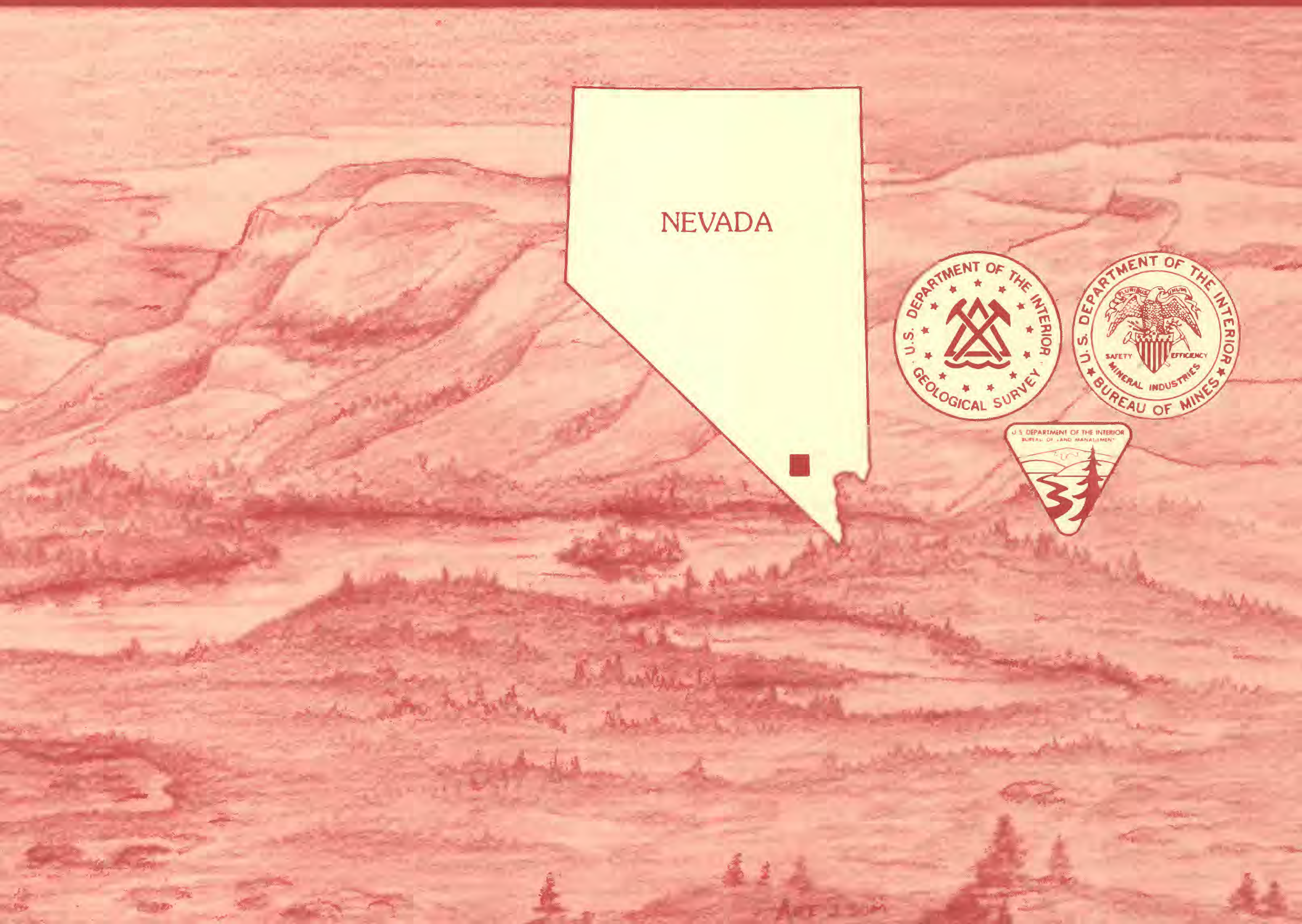
Mineral Resources of the La Madre Mountains Wilderness Study Area, Clark County, Nevada

U.S. GEOLOGICAL SURVEY BULLETIN 1730-A



Chapter A

Mineral Resources of the La Madre Mountains Wilderness Study Area, Clark County, Nevada

By JAMES E. CONRAD and HARLAN N. BARTON
U.S. Geological Survey

DAVID A. LIPTON
U.S. Bureau of Mines

U.S. GEOLOGICAL SURVEY BULLETIN 1730–A
MINERAL RESOURCES OF WILDERNESS STUDY AREAS: SOUTHERN NEVADA

DEPARTMENT OF THE INTERIOR
DONALD PAUL HODEL, Secretary

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

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1986

For sale by the
Books and Open-File Reports Section
U.S. Geological Survey
Federal Center, Box 25425
Denver, CO 80225

Library of Congress Cataloging-in-Publication Data

Conrad, James E.
Mineral resources of the La Madre Mountains Wilderness Study Area, Clark County, Nevada.

U.S. Geological Survey Bulletin 1730–A
Bibliography: p. 9
Supt. of Docs. No.: I 19.3:1730–A
1. Mines and mineral resources—Nevada—La Madre Mountains Wilderness. 2. Geology—Nevada—La Madre Mountains Wilderness. 3. La Madre Mountains Wilderness (Nev.) I. Barton, Harlan N. II. Lipton, David A. (David Abraham), 1954– . III. Title. IV. Series.
QE75.B9 No. 1730–A 557.3 s 86–600162
[TN424.N3] [553'.0979'13]

STUDIES RELATED TO WILDERNESS

Bureau of Land Management Wilderness Study Area

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 the La Madre Mountains Wilderness Study Area (NV-050-412), Clark County, Nevada.

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By James E. Conrad *and* Harlan N. Barton
U.S. Geological Survey

David A. Lipton
U.S. Bureau of Mines

SUMMARY

Abstract

The La Madre Mountains Wilderness Study Area (NV-050-412) encompasses 34,010 acres on the east side of the Spring Mountains, Clark County, Nev. Fieldwork for this report was carried out in 1984. No mineral or energy resources were identified within the study area. Two prospects were located and examined within the study area; these have traces of copper, and sporadic, high grade blebs containing silver, lead, and zinc. These prospects and the surrounding area have low mineral resource potential for silver, lead, and zinc.

Character and setting

The La Madre Mountains Wilderness Study Area is located in the eastern part of the Spring Mountains 12 mi west of Las Vegas, Nev. (fig. 1). The terrain is rugged, with relief as much as 3,500 ft. Spectacular cliffs and steep canyons are present along the southern and eastern parts of the study area; these give way to less rugged terrain in the higher, northwest part of the study area. The area is underlain by a sequence of marine limestones and dolomites of Cambrian to Permian age (570-240 million years before present), and mostly subaerial sandstone and siltstone deposits of Triassic and Jurassic age (240-138 million years before present). Northwest-trending high-angle faults, large-scale thrust faults, and associated folds have greatly disrupted these strata, placing Cambrian (570-500 million years before present) dolomite on top of Jurassic (205-138 million years before present) sandstone in some places.

Mining activity in the Spring Mountains began in 1857 with the discovery of lead ore in the Goodsprings district, about 12 mi south of the wilderness study area (Longwell and others, 1965). Peak production in this area occurred during World War I, but by 1964 these mines were mostly dormant. Small quantities of lead and zinc ore were mined from the Charleston district, about 10 mi north of the study area, but there has been no production since 1956. The major mineral resource presently mined in the Spring Mountains is gypsum from the Blue Diamond mine, located about 7 mi southeast of the wilderness study area. Ten mining claims have been located within the study area, but in 1984 there were no active claims.

Mineral Resource Potential

The Spring Mountains lie within a province characterized by hydrothermal deposits of silver, lead, and zinc. In this region, these base and precious metals occur in veins or bedded replacement bodies in carbonate rocks, and are generally associated with thrust faults and high-angle, northwest-trending, normal faults that served as pathways for metal-bearing solutions.

Two prospects were identified and examined within the wilderness study area: the Emerald and the Mountain View prospects (fig. 2, nos. 4 and 5). These are located in Red Rock Canyon near the Keystone thrust and the La Madre (high-angle) fault. Samples from these prospects contain small amounts of copper and sporadic, high-grade blebs of silver, lead, and zinc. Geochemical sampling of stream sediments in this area delineates a zone of slight silver, lead, and zinc anomalies. The prospects and adjacent areas along the Keystone thrust are judged to have low mineral resource potential for silver, lead, and zinc (fig. 2).

The White Beauty mine, located about 1 mi north of the wilderness study area, contains gypsum interbedded with limestone of the Pennsylvanian and Permian (330-240 million years before present) Bird

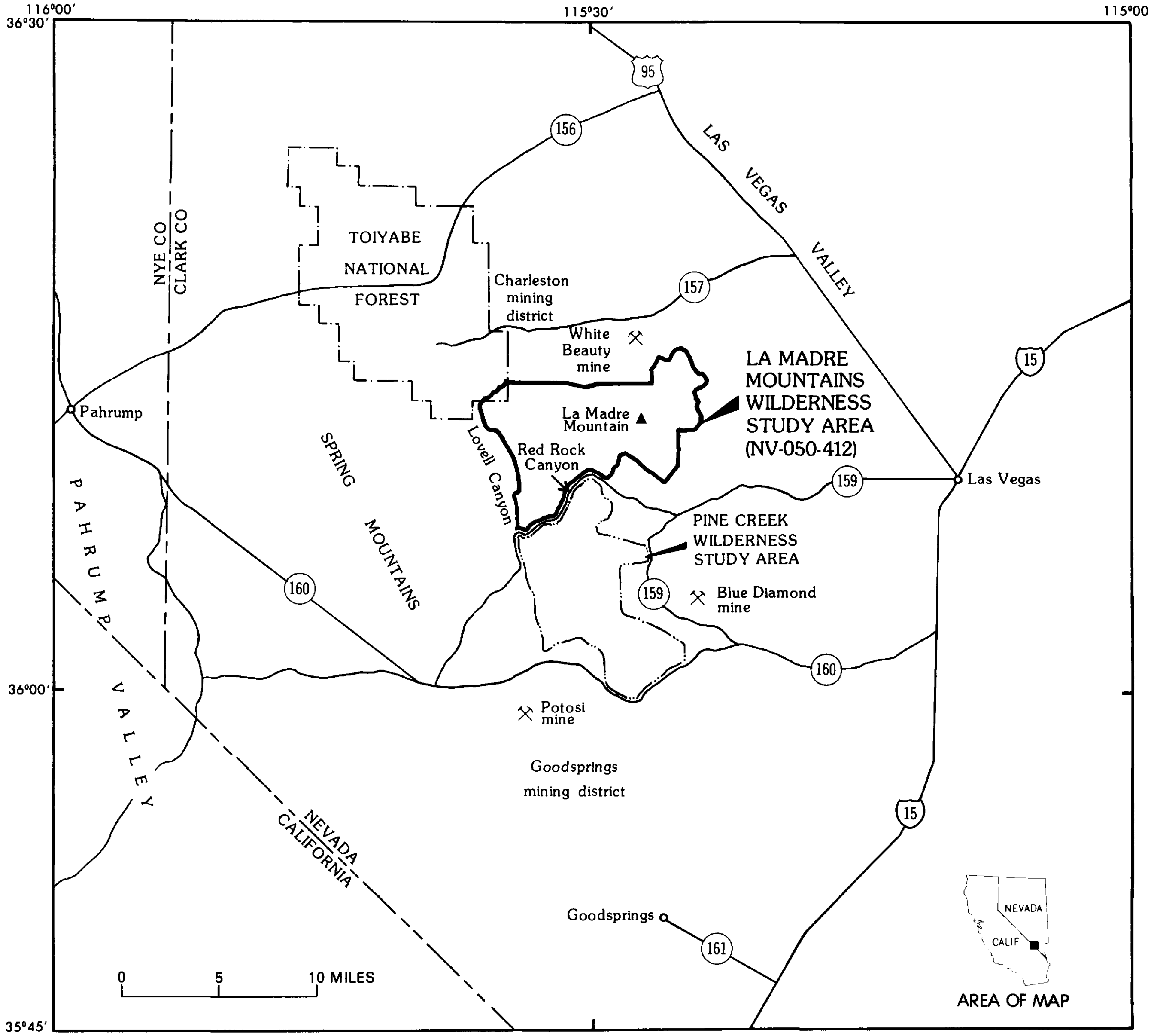

Figure 1. Index map showing location of the La Madre Mountains Wilderness Study Area, Clark County, Nevada.

Spring Formation. The gypsum pinches out before it reaches the study area, and there are no known deposits within the study area.

The wilderness study area has a low potential for petroleum resources (Sandberg, 1983).

INTRODUCTION

The La Madre Mountains Wilderness Study Area (NV-050-412) comprises 34,010 acres in the Spring Mountains of southwestern Nevada, approximately 12 mi west of Las Vegas (fig. 1). The terrain is rugged with elevations ranging from about 4,600 ft in Brownstone Basin to 8,154 ft at La Madre Mountain. The climate is arid to semiarid and vegetation is sparse, with yucca, agave, sage, desert willow, prickly pear, barrel cactus, cholla, and hedgehog cactus at lower elevations, and pinon pine, juniper, and scrub oak above about 5,500 ft. There are several intermittent springs in the area, but no permanent streams.

All parts of the wilderness study area are easily accessible. Numerous graded dirt roads branching off of State Route 157 provide access along the north edge of the study area. Along the southeast part of the study area, numerous dirt roads and jeep trails lead from State Route 159 to Red Rock Canyon, Calico Basin, and Brownstone Basin. The Red Rock Canyon jeep trail, which separates the La Madre Mountains Wilderness Study Area from the Pine Creek Wilderness Study Area to the south, is passable by four-wheel drive vehicles, although it is subject to periodic washout. Access to the west part of the study area is from the Lovell Canyon Road, which branches off State Route 160.

The La Madre Mountains Wilderness Study Area and adjacent areas in the Spring Mountains have been studied by many workers. Early work by Spurr (1903), Longwell (1926), Glock (1929), and Hewett (1931) formed the basis for modern understanding of the geology of the region, including studies by Davis (1973), Gans (1974), Burchfiel and others (1974), and Axen (1984). Information on mineral deposits in Clark County is in Longwell and others (1965). A mineral resource potential report on the Pine Creek Wilderness Study Area, which adjoins the La Madre Mountains Wilderness Study Area to the south, was written by Bohannon and Morris (1983).

The U.S. Geological Survey carried out field investigations in the wilderness study area in 1984. The work included field checking of existing maps, new mapping where necessary, and geochemical sampling. Heavy-mineral concentrates from stream sediments and selected rock samples were collected; the analytical data are given in Day and Barton (1986).

The U.S. Bureau of Mines conducted a library search for information on mines and prospects within the wilderness study area. This data was supplemented by information from claim owners and Clark County and U.S. Bureau of Land Management claim records. Field studies by U.S. Bureau of Mines personnel were conducted in 1984. Twenty-one samples were collected from mines, prospects, and mineralized areas to help appraise the mineral resources of the wilderness study area (Lipton, 1985). Samples were analyzed by fire-assay, atomic-absorption, and inductively coupled argon-plasma spectrophotometric methods. Complete analytical data are on file at the U.S. Bureau of Mines, Western Field Operations Center, E. 360 3rd Avenue, Spokane, Wash., 99202.

APPRAISAL OF IDENTIFIED RESOURCES

By David A. Lipton, U.S. Bureau of Mines

There were no active mines or prospects within the wilderness study area in 1984. The nearest active mine, the Blue Diamond mine 7 mi to the southeast, produces gypsum from several open pits. Several sand and gravel operations also were producing from pits located 4 mi east of the study area.

An examination of Clark County records indicates that 10 claims have been located within the wilderness study area. In April 1984, there were no active claims. The White Beauty patented claim lies about 1 mi north of the study area. Current oil and gas leases cover the entire study area.

There has been no recorded mineral production from within the wilderness study area; however, the White Beauty mine (fig. 2, no. 1) produced gypsum from 1972 to 1975 (Boyd, unpub. report, 1983).

Exposures of Triassic(?) and Jurassic Aztec Sandstone 0.25 mi south of the wilderness study area were quarried for building stone during the early 1900's. Another attempt at commercial building-stone production was made in the early 1960's, but was discontinued after a few months (Fisher, unpub. report, 1967).

In the late 1920's, mines in the Charleston district a few miles northwest of the wilderness study area produced $5,000 worth of oxidized lead-zinc ore from replacement deposits in dolomitized limestones (Longwell and others, 1965). Eleven oz of silver and 18,300 lbs of lead valued at $2,574 were produced in 1953 and 1954 (Longwell and others, 1965). No mining activity has been reported since 1956.

The Goodsprings (Potosi) district, 12 mi south of the wilderness study area, was one of the first lead-zinc districts to be developed in Nevada (about 1857). The Potosi mine, regarded as the oldest in the district, produced over 44,000,000 lbs of zinc and just under 3,000,000 lbs of lead from 72,500 tons of ore from replacement deposits in limestone and dolomite between 1905 and 1927 (Butner, 1942).

Sites examined for this study are shown on figure 2 and listed in table 1 (Lipton, 1985). Only two properties, the Emerald and Mountain View prospects (fig. 2, nos. 4 and 5), were found inside the wilderness study area, the 10 claims filed in the study area being either multiple claims on these two properties, or were not developed. Three other claims outside the study area were examined to determine their characteristics and the possibility of extension into the study area.

The Emerald and Mountain View prospects contain blebs and zones with anomalously high silver, lead, and zinc contents (table 1). They are situated in an area of abundant north-striking faults northwest of the Keystone thrust. These prospects contain no identified resources.

The gypsum deposit at the White Beauty mine

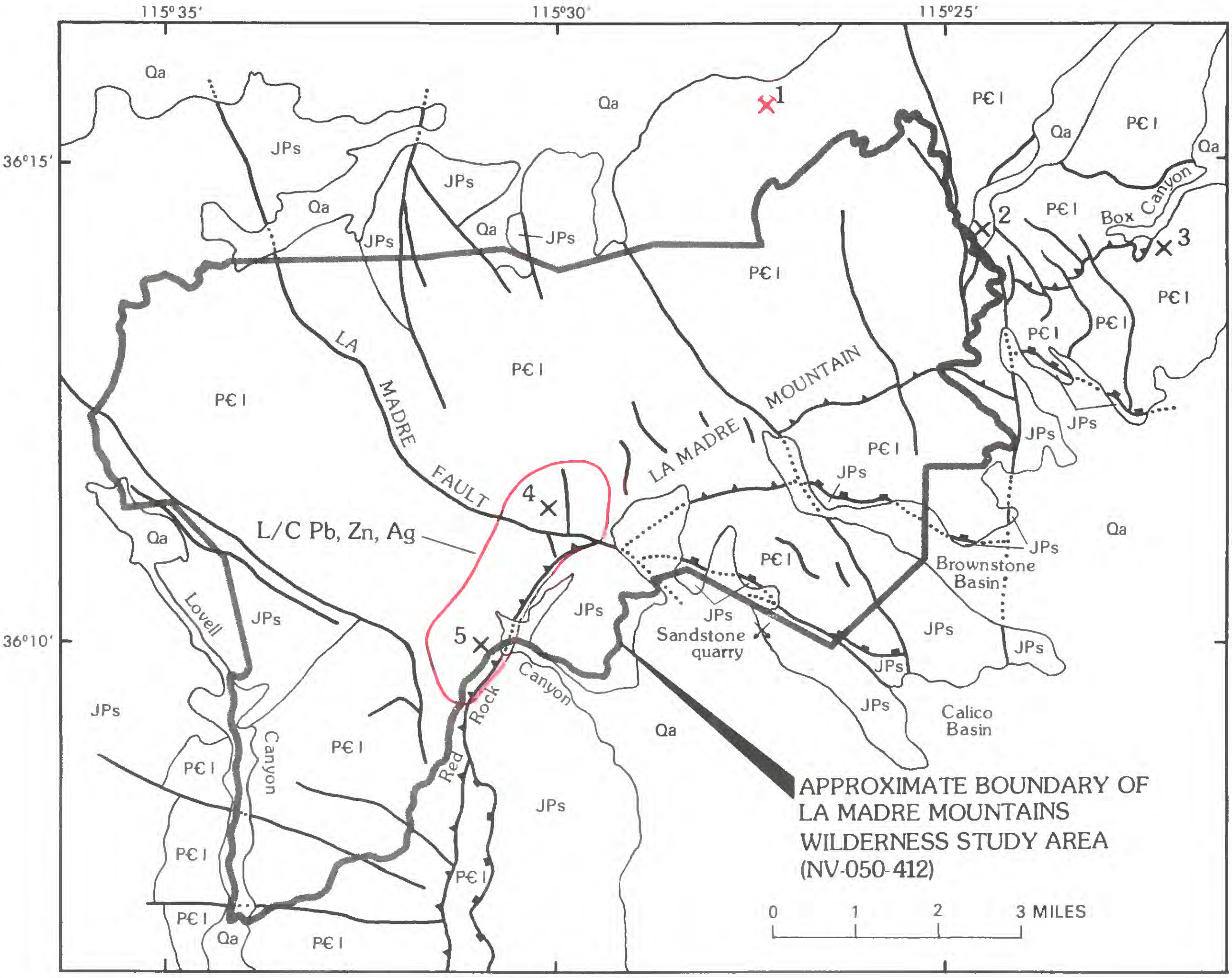

Figure 2. Map showing mineral resource potential of the La Madre Mountains Wilderness Study Area, Clark County, Nevada.

EXPLANATION

Area with low resource potential; see Appendix 1 for explanation of resource potential and certainty levels

× 1 — Mine with identified resources; number refers to Table 1

× 2 — Prospect; number refers to Table 1

COMMODITIES

Ag silver
Pb lead
Zn zinc

MINES AND PROSPECTS

1. White Beauty mine
2. Karen Placer prospect
3. Iron Age prospect
4. Emerald prospect
5. Mountain View prospect

CORRELATION OF MAP UNITS

Qa	Quaternary	CENOZOIC
JPs	Jurassic to Permian	MESOZOIC
P€l	Permian to Cambrian	PALEOZOIC

GEOLOGIC MAP UNITS

Qa	Alluvium (Quaternary)
JPs	Sandstone, siltstone, and minor limestone (Jurassic to Permian)
P€l	Limestone, dolomite, and cherty dolomite (Permian to Cambrian)

MAP SYMBOLS

CONTACT

FAULT--Dotted where concealed

KEYSTONE THRUST FAULT--Sawteeth on upper plate; dotted where concealed

RED SPRING THRUST FAULT--Boxes on upper plate; dotted where concealed

Figure 2. Continued.

(fig. 2, no. 1) pinches out before it reaches the wilderness study area boundary. The larger and more accessible gypsum deposit at the active Blue Diamond mine nearby serves existing markets.

Sand and gravel and limestone suitable for construction materials are abundant in the wilderness study area, but, because similar materials are available closer to major markets, occurrences in the study area are not classified as resources.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

By James E. Conrad and Harlan N. Barton, U.S. Geological Survey

Geology

The La Madre Mountains Wilderness Study Area is underlain by a sequence of Paleozoic marine sedimentary rocks and Mesozoic marine and continental deposits about 10,700 ft thick. Structure in the region is dominated by large, east-directed thrust faults and related folds of Mesozoic age. The study area lies in the northeast part of the Spring Mountains, a coherent block that has been relatively undisturbed by basin and range faulting.

The wilderness study area is on the eastern edge of a westward-thickening sequence of miogeosynclinal strata that can be considered to be transitional between more miogeosynclinal rocks to the west and cratonal rocks to the east (Axen, 1980). Rocks older than Devonian are primarily dolomite, whereas post-Devonian rocks are mainly limestone. Terrigenous sediments are minor in rocks older than the Carboniferous, but they increase up section to form a major part of the Pennsylvanian and Permian strata. This includes the Pennsylvanian and Permian Bird Spring Formation, a thick sequence of limestone and siltstone that underlies most of the northwest part of the study area.

In early Mesozoic time, a transition from marine deposition to continental deposition occurred. About 4,200 ft of mostly terrigenous clastic and aeolian rocks of Middle Triassic and younger age include the massive, crossbedded, Aztec Sandstone. Deposition of these rocks terminated with large-scale thrust faulting and associated deformation after Early Jurassic time.

The wilderness study area is located on the eastern edge of a major Mesozoic thrust belt that can be traced from southern Nevada to Canada. Seven major thrust faults are found in the Spring Mountains, and two of these, the Keystone and Red Spring thrusts, are exposed in the study area. The Red Spring thrust is the older and structurally lower of the two and places the Middle and Upper Cambrian Bonanza King Formation on the Aztec Sandstone. This fault is dramatically exposed at the top of the sandstone cliffs just south of the study area. The Keystone thrust has less stratigraphic displacement, placing the Bonanza King Formation above rocks of Late Cambrian to Mississippian age. The combined minimum horizontal displacement on these faults is about 19 mi (Axen, 1984).

Folds in the area are either small, intraformational folds of various orientations or large-amplitude, long-wavelength structures that trend northeast and are probably associated with the thrust faults (Burchfiel and others, 1974). High-angle faults trend north to northwest in the wilderness study area. Right-lateral movement on the Las Vegas shear zone in Las Vegas Valley has rotated the eastern part of the study area clockwise.

Geochemical Studies

For the geochemical survey, heavy-mineral concentrates taken from stream sediments were augmented by selected rock samples. Details on sample preparation and analysis, along with the presentation of data and sample sites, are found in Day and Barton (1986). Heavy-mineral concentrates and rock samples were analyzed for 31 elements by the semiquantitative emission-spectrographic method of Grimes and Marranzino (1968). Rock samples were also analyzed for antimony, arsenic, bismuth, cadmium, and zinc by atomic-absorption spectroscopy (Ward and others, 1969). Heavy-mineral concentrate samples were collected from 58 streambed sites within or peripheral to the wilderness study area, giving a sampling density of approximately one sample/mi^2.

The most anomalous of the sites sampled are outside the wilderness study area in the vicinity of the Iron Age prospect (fig. 2., no. 3), reported to contain small quantities of lead and zinc ore in dolomitized limestone (Longwell and others, 1965). A heavy-mineral concentrate sample from near the prospect contains the following element concentrations in parts per million (ppm): antimony 2,000, bismuth 100, copper 700, lead 50,000, silver 5, and tin 100. A nearby rock sample contained the following concentrations in ppm: arsenic 290, bismuth 4, cadmium 6.7, copper 1,000, lead 200, molybdenum 70, silver 10, tin 15, and zinc 6.

Only very minor anomalous concentrations of certain elements are found within the wilderness study area. Four of these are from sites located along the southeast boundary of the study area. Of these four samples, two contain 2,000 ppm lead without anomalies in any other elements, one contains 1,000 ppm lead with 1,000 ppm zinc, and one 300 ppm lead with 3 ppm silver.

Five heavy-mineral concentrate samples from widely scattered sites in Paleozoic carbonate rocks in the western half of the wilderness study area contain 500 to 700 ppm zinc. No other anomalies are associated with these low zinc anomalies.

CONCLUSIONS

Geologic studies, geochemical sampling, examination of mines and prospects, and review of mine production and ore types indicate that the La Madre Mountains Wilderness Study Area lies within a province characterized by hydrothermal deposits containing silver, lead, and zinc in veins or bedded replacement bodies in carbonate rocks. These deposits are mainly associated with thrust faults and major northwest-trending, high-angle faults that cut the Spring Mountains.

The two prospects in the wilderness study area, the Emerald and Mountain View prospects, are located in Red Rock Canyon near the Keystone thrust and the La Madre fault. These faults may have served as conduits for metal-bearing solutions that mineralized the area. Although no resources were identified in these prospects, samples from both contained small amounts of silver, lead, and zinc in sporadic, high-grade blebs, and traces of copper. Geochemical sampling of the surrounding area showed slightly anomalous amounts of silver, lead, and zinc. In general, hydrothermal activity in the area appears to have been slight. There are no igneous bodies in or near the study area, and the geochemical anomalies associated with the mineralization are small. The Red Rock Canyon area northwest of the Keystone thrust fault (fig. 2) has a low potential for silver, lead, and zinc resources with a certainty of C (see appendix 1 and figure 3 for definition of certainty levels).

The principal nonmetallic mineral mined in the region, gypsum, occurs in deposits interbedded with limestone of Permian to Triassic age. There are no known gypsum deposits in the wilderness study area, and discovery of any significant near-surface deposits is unlikely.

Current oil and gas leases cover the entire wilderness study area, but there are no producing wells in the Spring Mountains. The potential for petroleum resources is low (Sandberg, 1983).

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APPENDIX 1. Definition of levels of mineral resource potential and certainty of assessment

Mineral resource potential is defined as the likelihood of the presence of mineral resources in a defined area; it is not a measure of the amount of resources or their profitability.

Mineral resources are concentrations of naturally occurring solid, liquid, or gaseous materials in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible.

Low mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment where the existence of resources is unlikely. This level of potential embraces areas of dispersed mineralized rock as well as areas having few or no indications of mineralization. Assignment of low potential requires specific positive knowledge; it is not used as a catchall for areas where adequate data are lacking.

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 chance for resource accumulation, and where an application of genetic and (or) occurrence models indicates favorable ground.

High mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resources, where interpretations of data indicate a high likelihood for resource accumulation, where data support occurrence and (or) genetic models indicating presence of resources, and where evidence indicates that mineral concentration has taken place. Assignment of high resource potential requires positive knowledge that resource-forming processes have been active in at least part of the area; it does not require that occurrences or deposits be identified.

Unknown mineral resource potential is assigned to areas where the level of knowledge is so inadequate that classification of the area as high, moderate, or low would be misleading. The phrase "no mineral resource potential" applies only to a specific resource type in a well-defined area. This phrase is not used if there is the slightest possibility of resource occurrence; it is not appropriate as the summary rating for any area.

Expression of the certainty of the mineral resource assessment incorporates a consideration of (1) the adequacy of the geologic, geochemical, geophysical, and resource data base available at the time of the assessment, (2) the adequacy of the occurrence or the genetic model used as the basis for a specific evaluation, and (3) an evaluation of the likelihood that the expected mineral endowment of the area is, or could be, economically extractable.

Levels of certainty of assessment are denoted by letters, A-D (fig. 3).

A. The available data are not adequate to determine the level of mineral resource potential. Level A is used with an assignment of unknown mineral resource potential.

B. The available data are adequate to suggest the geologic environment and the level of mineral resource potential, but either evidence is insufficient to establish precisely the likelihood of resource occurrence, or occurrence and (or) genetic models are not known well enough for predictive resource assessment.

C. The available data give a good indication of the geologic environment and the level of mineral resource potential, but additional evidence is needed to establish precisely the likelihood of resource occurrence, the activity of resource-forming processes, or available occurrence and (or) genetic models are minimal for predictive applications.

D. The available data clearly define the geologic environment and the level of mineral resource potential, and indicate the activity of resource—forming processes. Key evidence to interpret the presence or absence of specified types of resources is available, and occurrence and (or) genetic models are adequate for predictive resource assessment.

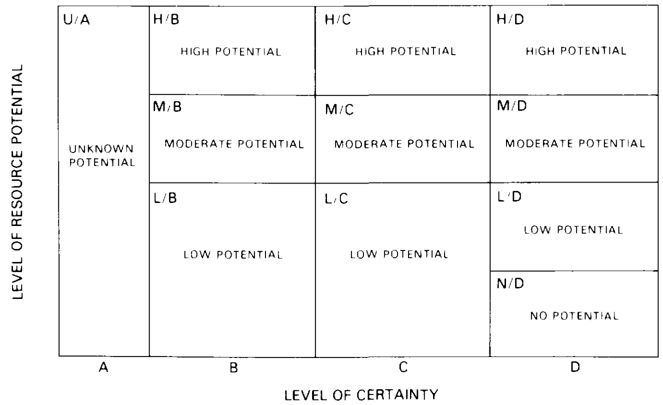

Figure 3. Major elements of mineral resource potential/certainty classification.

Table 1. Mines and prospects in and adjacent to the La Madre Mountains Wilderness Study Area

[Underlined name indicates identified mineral resources; asterisk (*) indicates outside study area]

Map no. (fig. 2)	Name	Summary	Workings and production	Sample and resource data
1*	White Beauty mine	Gray limestone of the Bird Spring Formation is interbedded with white sugary gypsum. The gypsum trends N. 30° E., dips about 25° NW, and is exposed for as much as 7,300 ft along its trend and 1,400 ft down dip. Thickness of the exposed intercalated limestone and gypsum is from 10 to 100 ft; it appears to be lenticular and pinches out on the northeast and southwest.	One open pit, 1,000 ft long, 500 ft wide, and 20 ft deep, and several test pits. An unspecified amount of production was reported from 1972 to 1975.	One chip and one select sample were taken. They contain 96.3 percent and 94.7 percent gypsum, respectively. X-ray diffraction indicates minor quartz and feldspar. According to a report by Boyd (unpub. report, 1983), the owner estimated the reserves at 14 million tons, with an additional 22 million tons inferred.
2*	Karen placer prospect	A recent alluvial bar is composed of limestone, sandstone, and dolomite gravel. Thickness of the gravel could not be determined.	No workings.	A sample of alluvium had 0.016 mg of fine gold. The equivalent value is $\$0.015/yd^3$ at $350/oz gold price.
3*	Iron Age prospect	Gray limestone contains a stockwork of limonite veins. They range in thickness from paper thin to 4 ft, are sinuous, and lengths range from a few inches to about 50 ft. The limonite contains trace amounts of malachite.	One adit, two shafts, two inclined shafts, and five pits.	Two select samples from the stockpiles had 55 percent and 53 percent iron, 0.13 percent and 0.13 percent copper, and trace lead and zinc.
4	Emerald prospect	Blue-gray limestone contains isolated zones of iron oxide. Mineralized shear zones contain veins of sphalerite and trace amounts of malachite, galena, chalcopyrite, and smithsonite. The zones range from 0.6 ft to 2.8 ft thick and are exposed for as much as 80 ft along the northeast and northwest strikes.	Six adits which range from 8 to 105 ft long; one shaft 72 ft deep, one caved shaft, and one pit.	Fourteen samples were taken (ten chip, three select, and one grab). All contained low copper, lead, and zinc values. Silver was detected in nine samples, two select samples had 0.3 and 1.1 oz/ton and one chip sample had 0.7 oz/ton. Three chip samples contained 4.3 percent, 7.8 percent, and 37.0 percent zinc. Two select samples contained 38 percent and 12.2 percent zinc.
5	Mountain View prospect	Pods of limonite are randomly distributed in fractured gray limestone and dolomite. Blebs of galena and sphalerite are dispersed with the limonite.	One pit and one inclined shaft 20 ft deep.	Three select samples contained trace, 0.4, and 1.5 oz/ton silver, 2.5 percent, 2.98 percent, and 5.80 percent zinc, 1.8 percent, 2.9 percent, and 4.4 percent lead, 0.1 percent, 0.1 percent, and 0.2 percent copper, and 44 percent, 48 percent, and 50 percent iron.

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March 3, 1849