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U.S. GEOLOGICAL SURVEY

MINERAL RESOURCES OF ADDITIONS TO THE LA MADRE MOUNTAINS WILDERNESS STUDY AREA, CLARK COUNTY, NEVADA

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

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SUMMARY

Abstract

At the request of the U.S. Bureau of Land Management, approximately 7,995 additional acres of the La Madre Mountains Wilderness Study Area (NV-050-412) were evaluated for mineral resources (known) and mineral resource potential (undiscovered). In this report, the area studied is referred to as the "wilderness study area" or simply "the study area;" any reference to the La Madre Mountains Wilderness Study Area refers only to that part of the wilderness study area for which a mineral survey was requested by the U.S. Bureau of Land Management. Library research was conducted in 1990 to assess the mineral resources and resource potential of the additions to the study area; no field work was conducted.

No mines, prospects, or mineral resources were identified during pre-field studies of the additions to the La Madre Mountains Wilderness Study Area. There is low potential for oil and gas in the additions to the La Madre Mountains Wilderness Study Area.

Character and Setting

The additions to the La Madre Mountains Wilderness Study Area (fig. 1) cover approximately 7,995 acres in the southern Spring Mountains about 15 mi west of Las Vegas, Nevada. The study area consists of two additions, which are underlain by Paleozoic marine limestones and dolomites and Mesozoic continental sandstones and siltstones. Movements along northwest-trending high-angle faults, large-scale thrust faults, and associated folds have greatly disrupted these strata; in some places, Cambrian dolomites rest on top of Jurassic sandstones as a result of these disruptions. The terrain is rugged with elevations ranging from about 4,400 ft in the east to about 9,400 ft in the west. The climate is arid to semiarid and vegetation is sparse; yucca, agave, sage, cholla, and hedgehog cactus are present at lower elevations, and piñon pine, juniper, and scrub oak are found above about 5,500 ft.

INTRODUCTION

This mineral survey was requested by the U.S. Bureau of Land Management and is the result of a cooperative effort by the U.S. Geological Survey and the U.S. Bureau of Mines. An introduction to the wilderness review process, mineral survey methods, and agency responsibilities was provided by Beikman and others (1983). The U.S. Bureau of Mines evaluates identified resources at individual mines and known mineralized areas by collecting data on current and past mining activities and through field examination of mines, prospects, claims, and mineralized areas. Because no field work was conducted for this report, methodology for this study was limited to library research, examination of Bureau of Land Management mining claim indices, and contacts with other agencies for pertinent mining related information. Identified resources are classified according to a system that is a

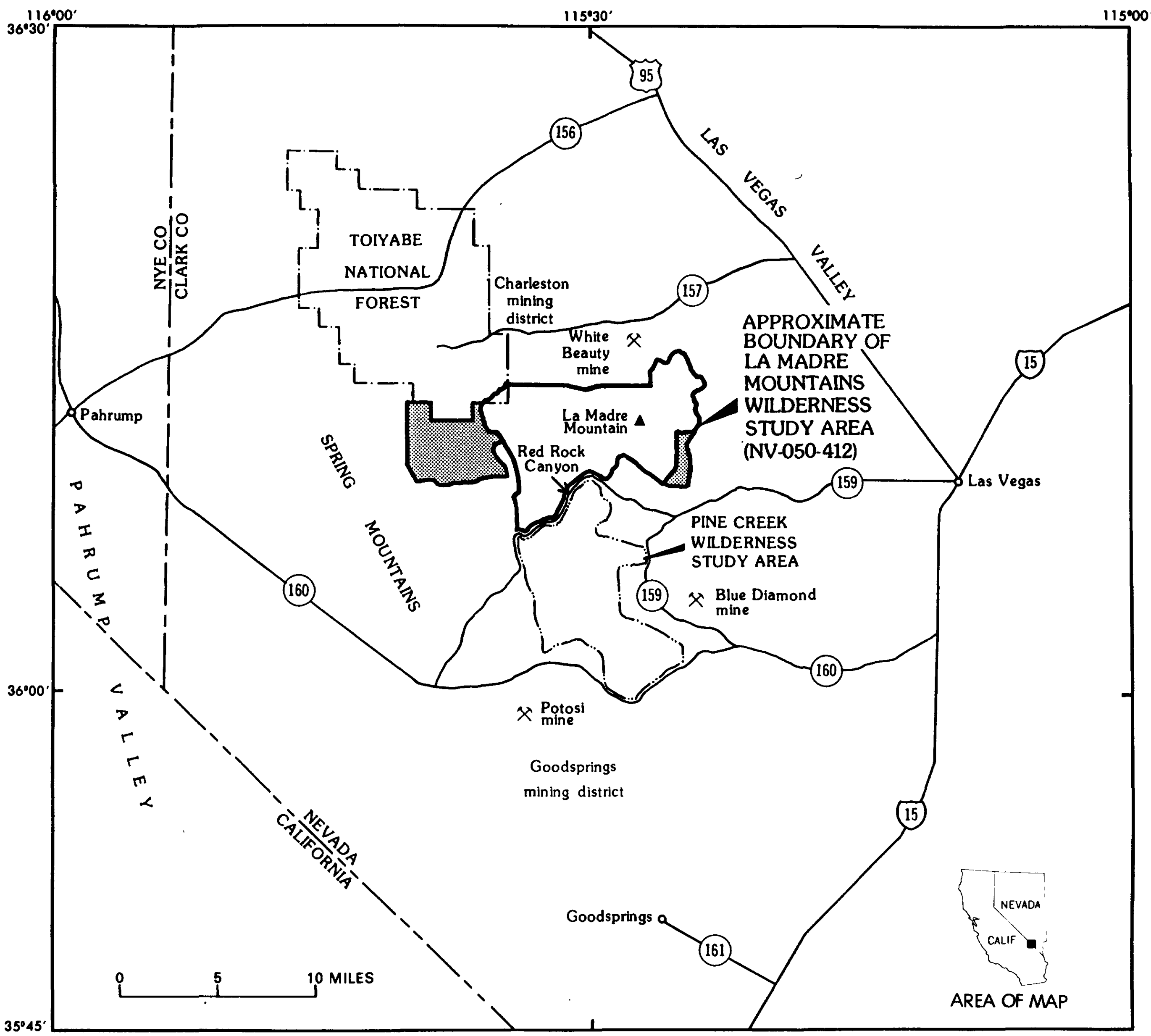

Figure 1. Index map showing location of the additions (shaded areas) to the La Madre Mountains Wilderness Study Area, Clark County, Nevada.

modification of that described by McKelvey (1972) and U.S. Bureau of Mines and U.S. Geological Survey (1980). U.S. Geological Survey studies are designed to provide a reasonable scientific basis for assessing the potential for undiscovered mineral resources by determining geologic units and structures, possible environments of mineral deposition, presence of geochemical and geophysical anomalies, and applicable ore-deposit models. Goudarzi (1984) discussed mineral assessment methodology and terminology as they apply to these surveys. See appendixes for the definition of levels of mineral resource potential and certainty of assessment and for the resource/reserve classification.

Sources of Data

The additions to 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 (1980; 1984). The study area is included in a study of the mineral deposits of Clark County by Longwell and others (1965). Lipton (1985) performed the mineral investigation of the original study area for the U.S. Bureau of Mines. The mineral resources and resource potential of the La Madre Mountains Wilderness Study Area, not including these additions, were previously assessed in Conrad and others (1986).

Recommendations

Geologic mapping is needed to define possible industrial commodities including gypsum, building stone, and sand and gravel, which are known to occur in the region but have not been identified in the study area. Geochemical and geophysical studies are needed to assess whether metallic mineralization occurred in parts of the study area. The additions to the La Madre Mountains Wilderness Study Area should be studied as part of a comprehensive mineral survey by the U.S. Bureau of Mines and the U.S. Geological Survey.

APPRAISAL OF IDENTIFIED RESOURCES

By Jerry E. Olson
U.S. Bureau of Mines

Mining activity

According to U.S. Bureau of Land Management mining claim indices, there are no active claims in the additions to the La Madre Mountains Wilderness Study Area. One claim near the southeast border of the western addition was closed in 1983. Available literature and U.S. Geological Survey topographic maps do not show any mining activity, past or present, within the two additions.

Identified Resources

On the basis of pre-field studies only, no mining activity or mineral resources are indicated within the two additions. Limited field reconnaissance work should be conducted to ensure that no mineralized sites have been overlooked, and to examine the nature and extent of carbonate rocks and other nonmetallic commodities that may be present.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

By James E. Conrad *and* H. Richard Blank, Jr.
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Geology

The La Madre Mountains Wilderness Study Area is underlain by a sequence of Paleozoic marine sedimentary rocks and Mesozoic marine and continental sedimentary rocks about 11,000 ft thick (fig. 2). Structure in the region is dominated by large east-directed thrust faults and related folds of Mesozoic age. The study area lies in the eastern part of the Spring Mountains, a coherent crustal 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 transitional between more miogeosynclinal rocks to the west and more cratonal rocks to the east (Axen, 1980). Rocks older than Devonian are primarily dolomite, whereas post-Devonian rocks are mainly limestone. Terrigeneous materials are minor in rocks older than Mississippian, but they increase up section to form a major part of the Pennsylvanian and Permian strata.

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

The 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 La Madre Mountains Wilderness Study Area. Movement along these thrusts has placed Cambrian dolomites on top of Jurassic sandstones. The combined minimum horizontal displacement on these faults is about 19 mi (Axen, 1984).

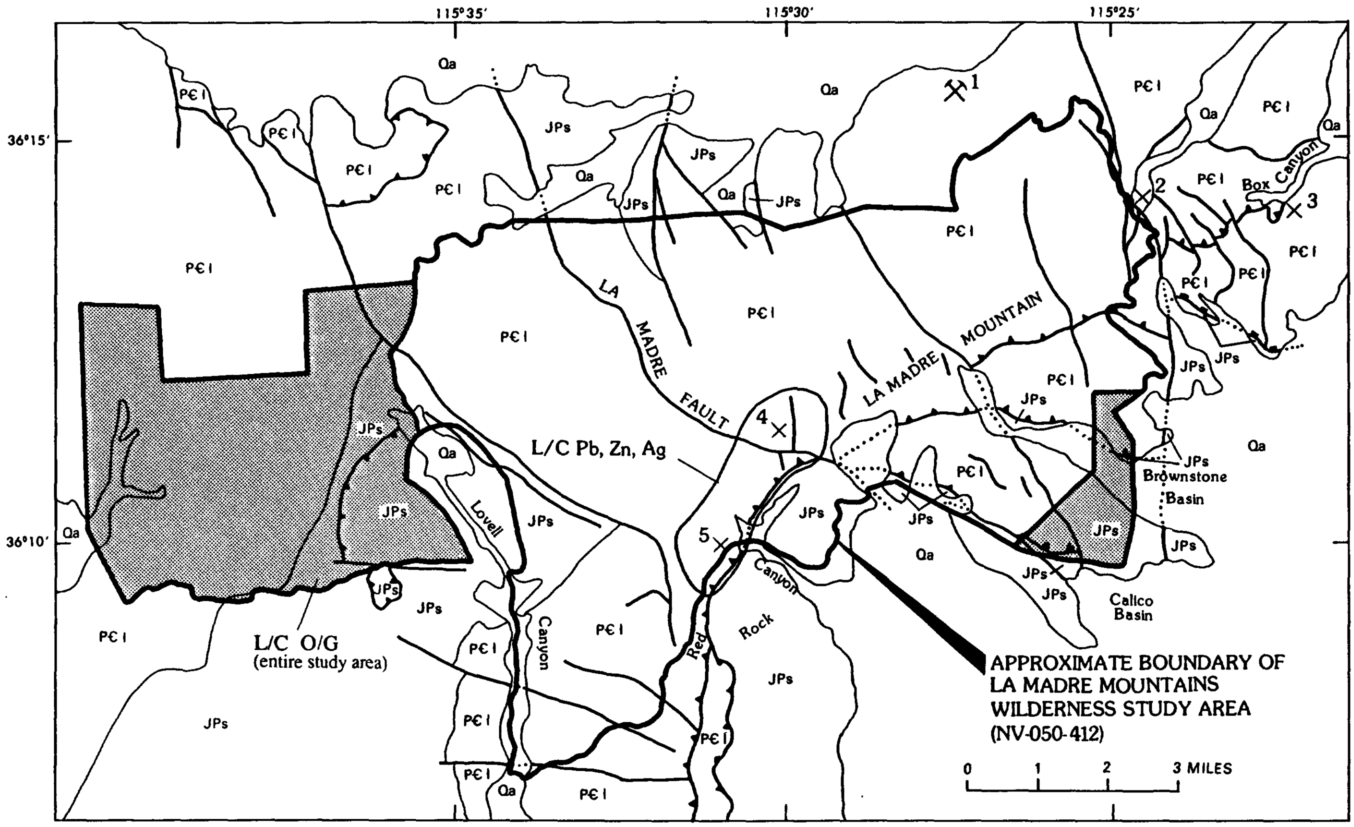
Folds in the area are either small, intraformational folds of various orientations or large-amplitude, long-wavelength structures that trend northeast and are probably associated with the thrust faults (Burchfiel and others, 1974). High-angle faults trend north to northwest in the study area. Right-lateral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

Geophysical Studies

The La Madre Mountain Wilderness Study Area is included in reconnaissance aeromagnetic and gravity coverage of the Las Vegas 1° x 2° quadrangle (Saltus and Ponce, 1988; Kane and others, 1979). Additional gravity stations were established south of the study area (H.R. Blank, Jr., unpub. data, 1990). Also, aeroradiometric and aeromagnetic profiles across the area were obtained in conjunction with the National Uranium Resource Evaluation (NURE) program (Aero Service Corp., 1979).

Aeromagnetic Data

The aeromagnetic survey for the southwestern portion of the Las Vegas 1° x 2° quadrangle, which includes the study area, was flown along east-west lines spaced one mile apart and draped 1,000 ft above the terrain (U.S. Geological Survey, 1979). A residual total-intensity anomaly map of the study area and vicinity at a 20-nanotesla (nT) contour interval is shown in figure 3. The contours represent field variations after stripping the International Geomagnetic Reference Field and reducing intensities to an adjusted datum.



EXPLANATION

Area with low resource potential (L)

Levels of certainty of assessment

- B — Data only suggest level of potential
- C — Data give good indication of level of potential

⚒ 1 — Mine with identified resources--number refers to list below

× 2 — Prospect--number refers to list below

Commodities

Ag	Silver
Pb	Lead
Zn	Zinc
O/G	Oil and gas

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 AND PALEOZOIC
P€l	PERMIAN TO CAMBRIAN	PALEOZOIC

Geologic map units

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

Contact

Normal fault--Dotted where concealed

Thrust fault--Sawteeth on upper plate; dotted where concealed

Figure 2. Map showing mineral resource potential of the additions (shaded areas) to the La Madre Mountains Wilderness Study Area, Clark County, Nevada.

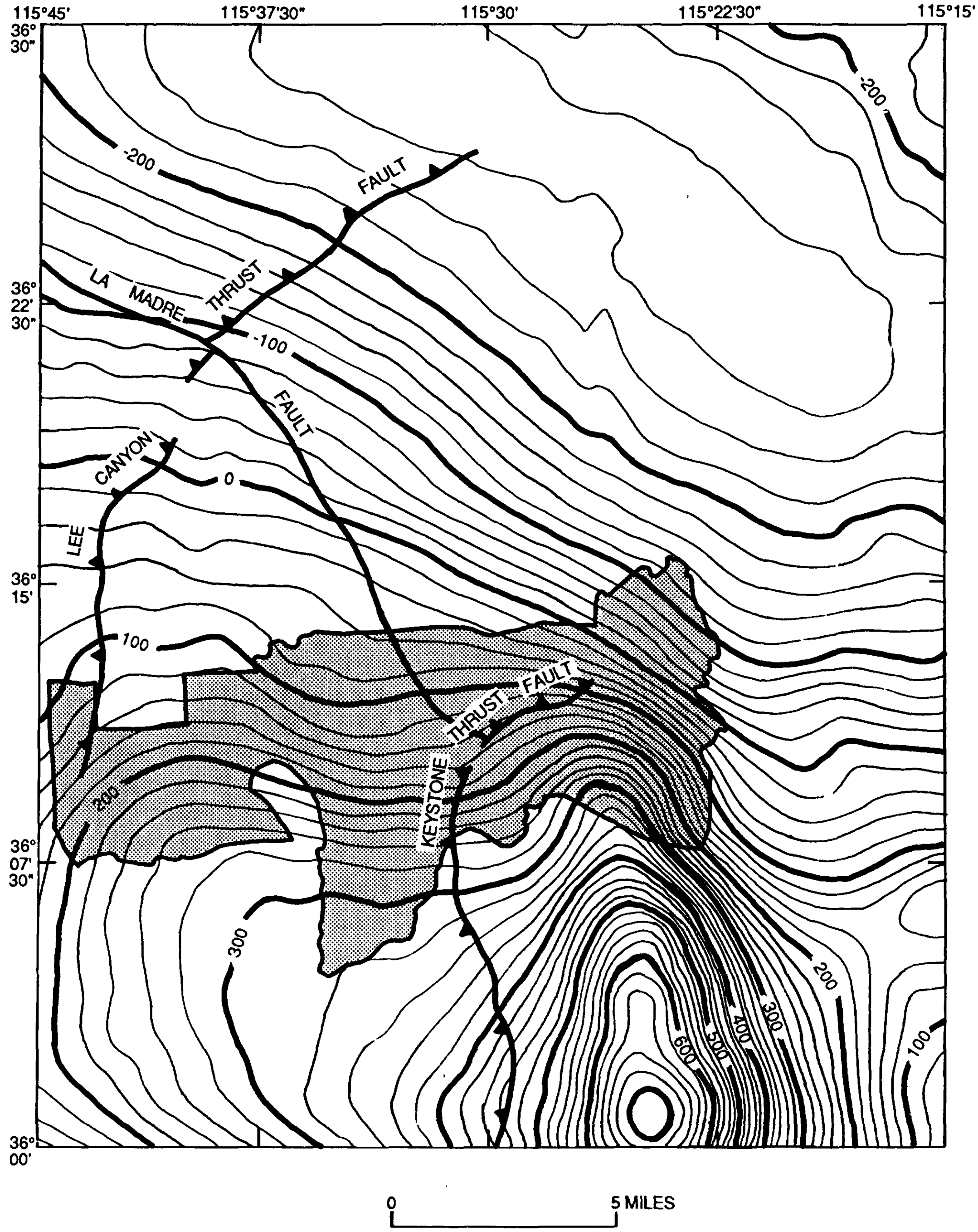


Figure 3. Residual total-intensity aeromagnetic map of the La Madre Mountains Wilderness Study Area and additions (shaded area), Clark County, Nevada. Contour interval, 20 nanoteslas. Mapped faults modified from Longwell and others, 1979; Burchfiel and others, 1974. Sawteeth on upper plate. Scale 1:250,000.

The study area is situated on the north flank of a very broad and intense positive aeromagnetic anomaly that coincides roughly with the entire area of the northern Spring Mountains. Like this part of the range, the anomaly is elongate west-northwesterly, roughly parallel to the trend of adjacent Las Vegas Valley. Any range-front faults are entirely concealed by alluvium but are likely to strike west-northwest to northwest, parallel to the main trend of anomaly contours in the valley.

The amplitude of the Spring Mountains anomaly high at 1,000 ft above the terrain is nearly 1,000 nT with respect to the low in Las Vegas Valley; its strength and long wavelength place this anomaly among the most prominent aeromagnetic features of the Great Basin physiographic province. No strongly magnetic rocks are exposed at the surface and mapped structures such as the major thrust faults and the steep La Madre fault do not noticeably perturb the field lines. A substantial part of the total amplitude is attributable to a sharper north-trending high centered over the community of Blue Diamond (fig. 1) and apparently superimposed on the broader anomaly associated with the range. The Blue Diamond area is situated topographically below La Madre Mountain and on the crest of a structural high that exposes Jurassic rocks beneath a succession of thrust plates, which dip away from it to the north and west. The depth to the top of the source of the Blue Diamond anomaly is estimated to be about 4 km, or near the crest of the source of the range anomaly, which can be modeled as a gentle dome (H.R. Blank, Jr., unpub. data, 1990). Whereas the magnetization of the latter appears to be about 4 amperes per meter (A/m), corresponding to moderately to strongly magnetized source, the magnetization of the crestal source may be more than twice that value and corresponds to an extremely strongly magnetized body, one composed in part, perhaps, of iron deposits. We speculate that the range anomaly is due to an elevated Precambrian metamorphic and igneous basement complex ("core complex"), and that the superimposed anomaly is due to a late Mesozoic to Tertiary (post-Keystone thrust) intrusion that has penetrated through the basement to Paleozoic rocks and produced contact-metasomatic magnetite. If the putative intrusion is of intermediate composition, for example, monzonite, it could be magnetite-rich and have a strong magnetic signature, but monzonite is unlikely to account for all of the observed anomaly (compare monzonitic intrusions of the "iron axis" of southwestern Utah). We cannot rule out a Precambrian source for the superposed anomaly, but this interpretation requires that its association with a structural high be pure coincidence.

Although the source of the crestal anomaly probably extends at least as far north as the boundary of the La Madre Mountains Wilderness Study Area, any iron deposits that may be associated with this anomaly would lie at depths too great for exploitation in the foreseeable future.

Gravity Data

Gravity coverage in the vicinity of the study area is relatively sparse. Data from all stations have been reduced by standard procedures (Cordell and others, 1982) and terrain-corrected out to 100 mi from each station using a digital image of the topography. The resulting complete Bouguer anomaly map (fig. 4) represents an update of the corresponding part of the published map of the Las Vegas 1° x 2° sheet (Kane and others, 1979). Because of errors introduced in the near-station terrain corrections where the topography is rugged, uncertainties in complete Bouguer anomaly values locally may exceed the contour interval. Nevertheless, the map probably depicts the characteristics of the anomaly field with sufficient accuracy for this assessment.

The Bouguer gravity expression of the northern Spring Mountains as a whole is an anomaly high of maximum amplitude about 25 milligals (mGal) with respect to the mean datum of the surrounding terrain and 60 mGal with respect to the anomaly low of Las Vegas Valley. However, a weak gravity low is present over the Blue Diamond area, corresponding to the area of the most intense aeromagnetic anomaly. The gravity field can be reproduced using the magnetic model geometry provided the source of the strong magnetic high is

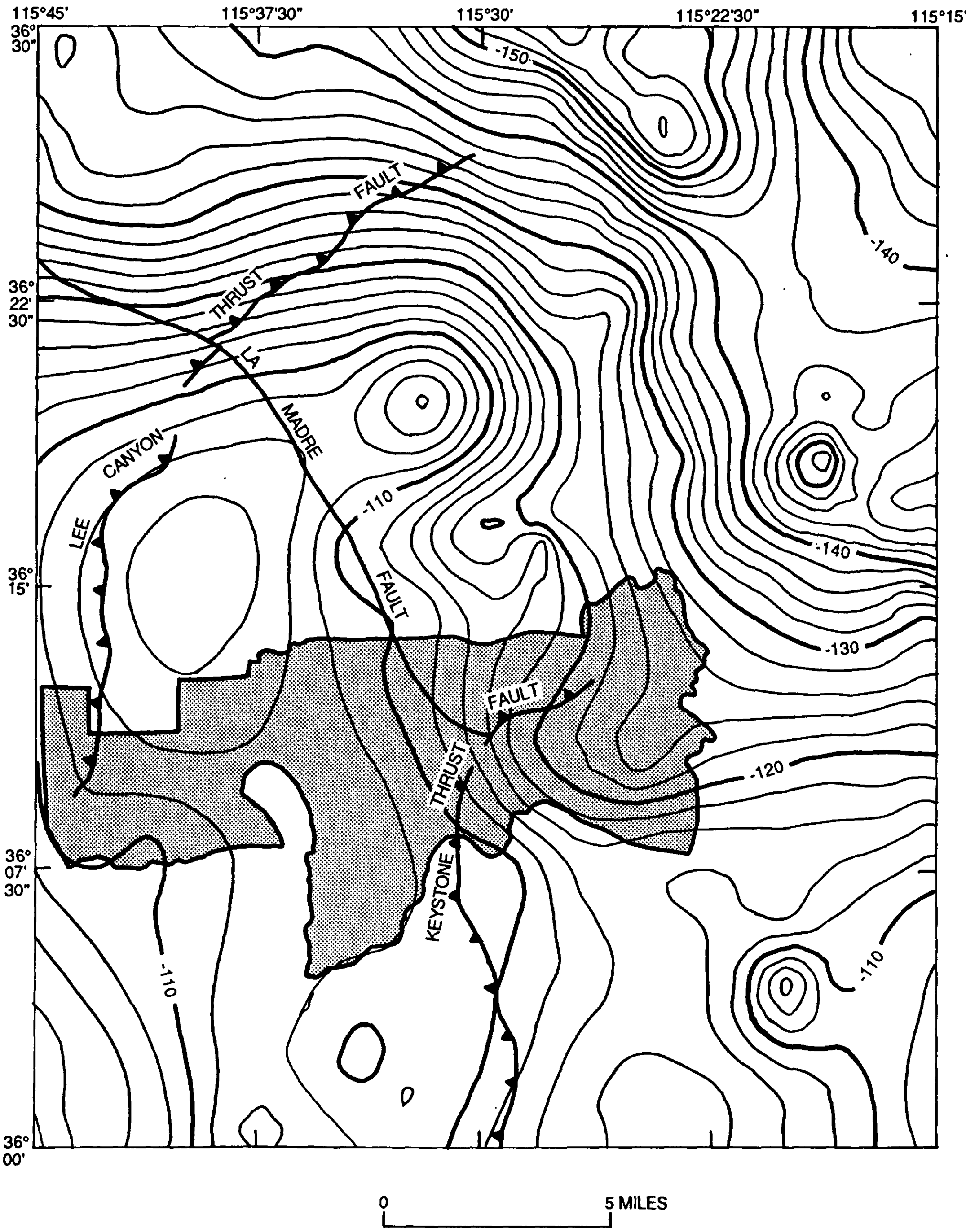


Figure 4. Complete Bouguer gravity anomaly map of the La Madre Mountains Wilderness Study Area and additions (shaded area), Clark County, Nevada. Contour interval, 2 milligals. Mapped faults modified from Longwell and others, 1979; Burchfiel and others, 1974. Sawteeth on upper plate. Scale 1:250,000.

slightly less dense than the mean density of the Paleozoic section, and the domal basement is slightly more dense than the Paleozoic rocks. Also, the gravity effects of the Jurassic clastic rocks and valley-fill deposits on either flank of the range must be taken into consideration. In general, the model results do not conflict with the hypothesis that the source of the apical gravity and magnetic anomalies is an intrusive body of intermediate composition.

Radiometric Data

The NURE (National Uranium Resource Evaluation) data for the La Madre Mountain study area have been evaluated by J.S. Duval of the U.S. Geological Survey. He reported that the area has low overall radioactivity with values of 0-1 percent potassium, 1.8-2.4 parts per million (ppm) equivalent uranium, and 0-4 ppm equivalent thorium; there are no anomalies within the boundaries of the study area or in the immediate vicinity (J.S. Duval, written commun., 1985).

Mineral and Energy Resource Potential

Published information, including previously studied parts of the La Madre Mountains Wilderness Study Area, give no indications of significant mineralization in the additions to the La Madre Mountains Wilderness Study Area. One small area of low potential for silver, lead, and zinc resources was identified in the La Madre Mountains Wilderness Study Area (Conrad and others, 1986). Samples from two prospects in this area contained small amounts of silver, lead, zinc, and copper, and stream-sediment samples in this vicinity also contained slightly anomalous amounts of silver, lead, and zinc. This area of low resource potential does not extend into the additions to the La Madre Mountains Wilderness Study Area.

The oil and gas potential of the region including the study area is low (Sandberg, 1983), certainty level B. There are no producing oil or gas wells in the Spring Mountains, so this assessment may be too high.

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APPENDIXES

DEFINITION OF LEVELS OF MINERAL RESOURCE POTENTIAL AND CERTAINTY OF ASSESSMENT

LEVELS OF RESOURCE POTENTIAL

H 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.

M 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 reasonable likelihood for resource accumulation, and (or) where an application of mineral-deposit models indicates favorable ground for the specified type(s) of deposits.

L 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 permissive. This broad category embraces areas with dispersed but insignificantly mineralized rock, as well as areas with little or no indication of having been mineralized.

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

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

LEVELS OF CERTAINTY

A Available information is not adequate for determination of the level of mineral resource potential.
B Available information only 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.

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 →

Abstracted with minor modifications from:

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RESOURCE/RESERVE CLASSIFICATION

	IDENTIFIED RESOURCES			UNDISCOVERED RESOURCES	
	Demonstrated		Inferred	Probability Range	
	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 McKelvey, V.E., 1972, Mineral resource estimates and public policy: American Scientist, v. 60, p. 32-40; and 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.

GEOLOGIC TIME CHART

Terms and boundary ages used by the U.S. Geological Survey in this report

EON	ERA	PERIOD		EPOCH	AGE ESTIMATES OF BOUNDARIES IN MILLION YEARS (Ma)
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	[1]~570
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 Ma also called Precambrian, a time term without specific rank.
[2]Informal time term without specific rank.