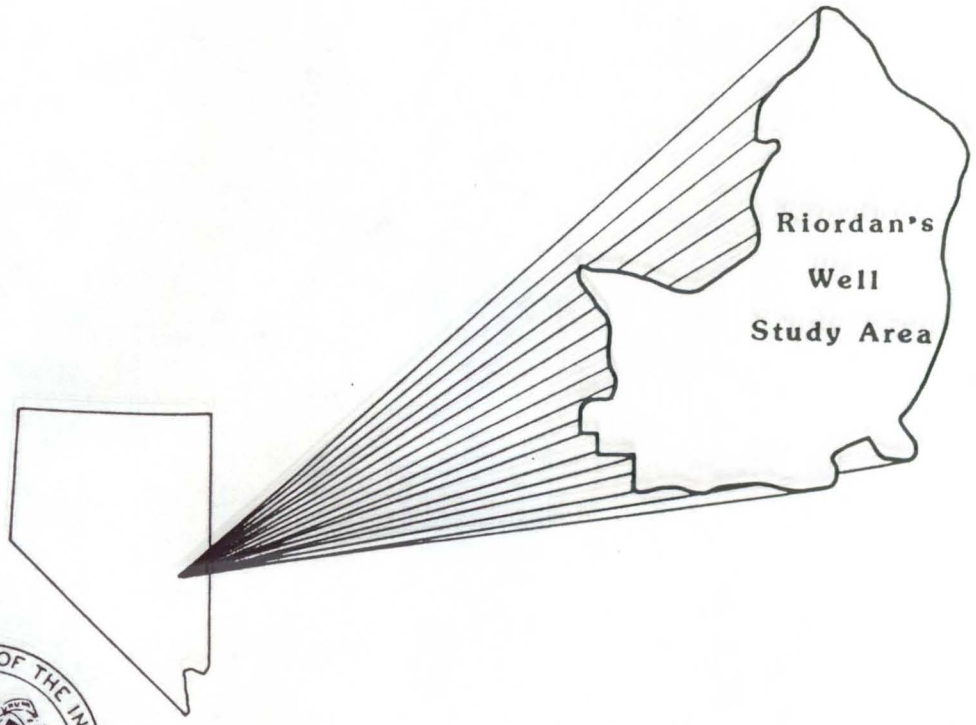
MLA 26-87

Mineral Land Assessment/1987
Open File Report

Mineral Resources of the Riordan's Well Study Area, Nye County, Nevada



BUREAU OF MINES

UNITED STATES DEPARTMENT OF THE INTERIOR

MLA 26-87

MINERAL RESOURCES OF THE RIORDAN'S WELL STUDY AREA, NYE COUNTY, NEVADA

By
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UNITED STATES DEPARTMENT OF THE INTERIOR
Donald P. Hodel, Secretary

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Robert C. Horton, Director

PREFACE

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and U.S. Bureau of Mines to conduct mineral surveys on U.S. Bureau of Land Management administered land designated as Wilderness Study 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 Bureau of Mines mineral survey of a portion of the Riordan's Well Wilderness Study Area (NV-040-166), Nye County, Nevada.

This open-file report will be summarized in a joint report published by the U.S. Geological Survey. The data were gathered and interpreted by Bureau of Mines personnel from Western Field Operations Center, East 360 Third Ave., Spokane, WA 99202. The report has been edited by members of the Branch of Mineral Land Assessment at the field center and reviewed at the Division of Mineral Land Assessment, Washington, DC.

CONTENTS

ILLUSTRATIONS

SUMMARY

In 1985, at the request of the U.S. Bureau of Land Management, the U.S. Bureau of Mines studied a 37,542-acre portion of the 57,002-acre Riordan's Well Wilderness Study Area (NV-040-166) in order to evaluate its mineral resources. The area studied is located in Nye County, NV, about 60 miles southwest of Ely, NV. Subeconomic mineral resources of limestone and sand and gravel were identified in the study area.

The Troy and Irwin mining districts, 4 miles to the west, were active between 1868 and 1963, producing small amounts of gold, silver, lead, and tungsten from mines well outside the study area. Except for minor prospecting activity, most mining activity in the study area has been since 1980, consisting of claim locations and geochemical surveys.

The study area is underlain by Paleozoic and Tertiary sedimentary rocks and Tertiary volcanic rocks that dip to the east. The section is broken by numerous thrust and high-angle faults. Along faults and bedding plane contacts are small epithermal occurrences typified by silicification, acid leaching, and concentrations of gold, silver, and pathfinder elements. The 141 current lode claims are centered on three areas of epithermal alteration, with those mineral occurrences in the south-center part of the study area being the largest and most significant. While there are no mineral resources exposed, there is the possibility for low-grade, bulk-tonnage precious-metal deposits associated with these epithermal systems.

The extensive limestone and sand-gravel deposits in the study area are considered to be subeconomic resource due to the great distance to any prospective markets. About one-half of the study area is covered by oil and gas leases. The northern half of the study area is within the Sheep Pass Formation depositional basin from which oil is being produced. Oil and gas resources were not evaluated in this study.

INTRODUCTION

This report describes the USBM (U.S. Bureau of Mines) portion of a cooperative study with the USGS (U.S. Geological Survey) to evaluate mineral resources and mineral resource potential of the Riordan's Well study area at the request of the BLM (U.S. Bureau of Land Management). The USBM examines individual mines, prospects, claims, and mineralized zones, and evaluates identified (known) mineral and energy resources. The USGS evaluates potential for undiscovered resources based on areal geological, geochemical, and geophysical surveys. Results of the investigations will be used to help determine the suitability of the Riordan's Well study area for inclusion into the National Wilderness Preservation System. Although the immediate goal of this and other USBM mineral surveys is to provide data for the President, Congress, government agencies, and the public for land-use decisions, the long-term objective is to ensure the Nation has an adequate and dependable supply of minerals at a reasonable cost.

Setting

The Riordan's Well study area encompasses 37,542 acres of the 57,002-acre WSA (Wilderness Study Area) in eastern Nevada about 60 mi (miles) southwest of Ely, NV (fig. 1). It lies in the east half of the central Grant Range and is bound on the east by White River Valley. Access to the south, east, and north sides of the study area is from a number of county and BLM roads that are graded, graveled and maintained, and unmaintained jeep roads that provide good access except during periods of very wet weather. The west side is, for the most part, inaccessible by motor vehicle since the jeep road up Heath Canyon is closed by washouts. The nearest railroad is an inactive line of Northern Nevada Railroad at Ely.

The terrain consists of a north-trending range with the highest elevation of 9,352 ft (feet) in the south part of the study area, which is underlain by more erosionally resistant limestone; the lowest elevation is about 5,700 ft on the west side in Heath Canyon (fig. 2). The northern part of the study area is mostly underlain by less resistant volcanic and sedimentary rocks forming a more subdued topographic relief.

The climate is dry with intermittent streams that carry water only during snow melt or occasional heavy rainstorms. There are a number of springs in the limestone terrain, the largest of which is at the head of Forest Home Creek. Vegetation cover at high elevations consists of pinon pine, juniper, mountain mahogany, and manzanita; at the highest part of the area is an uncommon forest of white fir, limber pine, and ponderosa pine. At lower elevations, cover consists mostly of sagebrush and rabbit grass. Major animal species include rabbit, deer, wild horses, and possibly bighorn sheep. There are no reported endangered or threatened wildlife or plant species in the study area (unpublished BLM Wilderness Study Report, 1984).

Previous Studies

Since there has been very little mineral-related activity in the study area in the past, most publications on economic geology and mining are centered on the Troy and Irwin mining districts to the west of the study area (Hill, 1916; Kral, 1951), on the oil fields in Railroad Valley (Murray and Bortz, 1967), and on the oil potential for the central Grant Range (Winfrey, 1960).

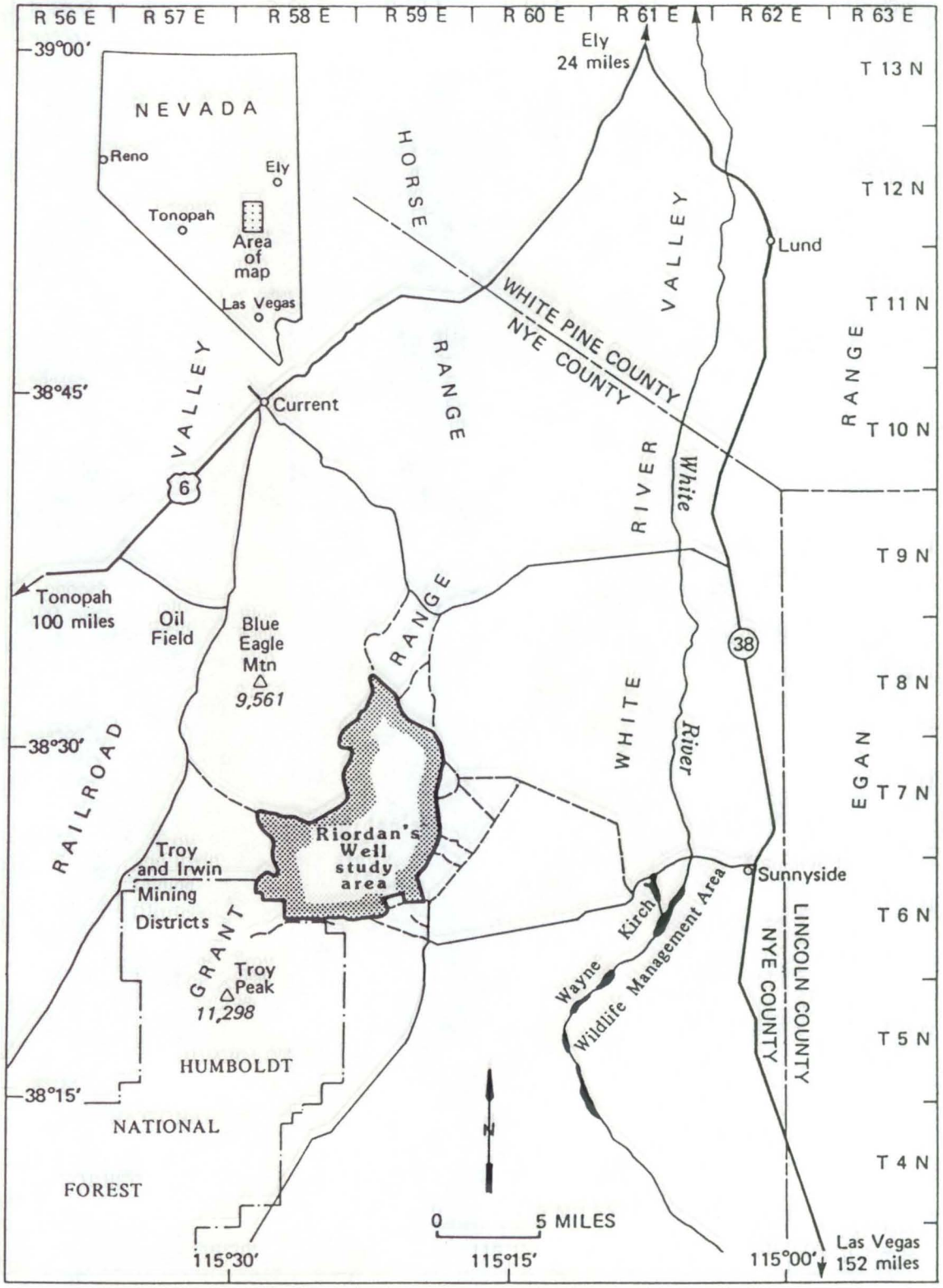
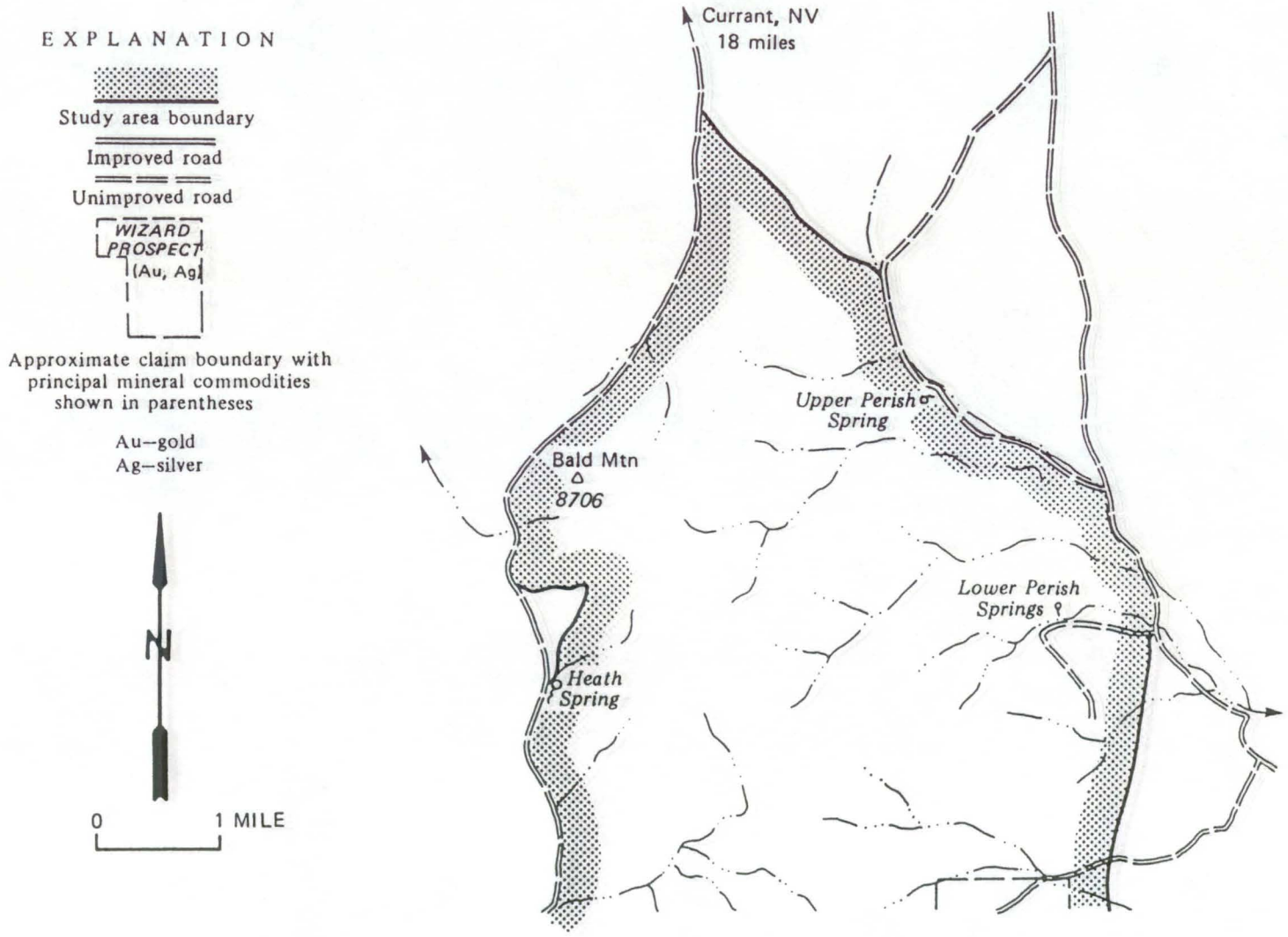


FIGURE 1.– Location of the Riordan's Well study area, Nye County, NV


EXPLANATION
Study area boundary
Improved road
Unimproved road
WIZARD PROSPECT
(Au, Ag)
Approximate claim boundary with principal mineral commodities shown in parentheses
Au—gold
Ag—silver
N
0
1 MILE
Currant, NV
18 miles
Upper Perish Spring
Bald Mtn
8706
Lower Perish Springs
Heath Spring

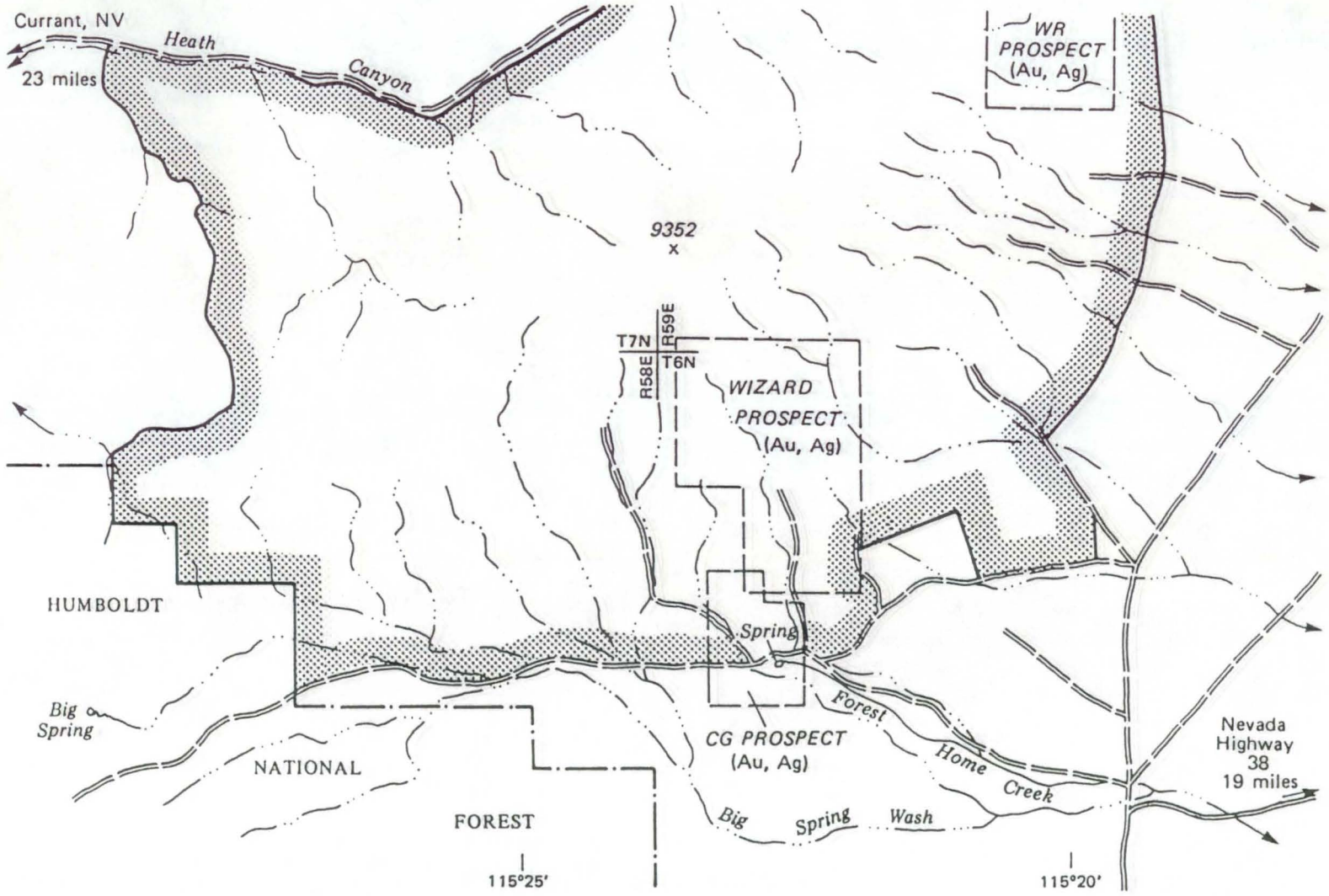


FIGURE 2.– Prospects and claims in and adjacent to the Riordan's Well study area, Nye County, NV

Regional studies covering the study area include descriptive geology by Spurr (1903), stratigraphy by Osmond (1954), and Webb (1958), structural geology by Misch (1960), geologic mapping by Kleinhampl and Zoiny (1967), Tertiary tectonics by Moores and others (1968), and Tertiary volcanics by Cook (1960, 1965). Bedrock geology of the Grant Range is discussed in four theses covering the northern portion of the range (Kirkpatrick, 1960), the north-central portion (Hyde, 1963), the southern portion (Cebull, 1967), and the entire range (Scott, 1965). Geological information which focused on the study area is in a thesis by Huttrer (1963) and in a publication by Hyde and Huttrer (1970).

Recent studies of Riordan's Well WSA for wilderness consideration have resulted in several unpublished reports including reconnaissance geochemistry by Hofstra and others (1984) and a GEM (geology-energy-minerals) study by Great Basin GEM Joint Venture (1983).

Present Study

Prior to field examination, pertinent literature, county mining records, and USBM, Nevada Bureau of Mines, and BLM files were researched. Claimants, mine owners, and mining companies were contacted to obtain information on claim location, history, and economic geology.

Field work conducted during the summer of 1985 consisted of examining prospects and mineralized sites indicated by prefield research to be within or adjacent to the study area. The study area was reconnoitered by helicopter and foot or jeep traverses to locate prospects not disclosed by prefield studies.

A sampling program designed to indicate size and type of mineral resource was applied to each site. Chip samples were taken, when possible, at intervals perpendicular to mineralized structures in order to delineate grade and tonnage of the occurrence. Select samples of vein or mineralized rock were handpicked from dumps when the mineral structure was not exposed or was mined out. These samples were used to qualitatively describe the mineral occurrence. Grab samples were randomly taken from dumps or rock float in order to estimate a possible resource in a disseminated mineral occurrence and to document the distribution of precious metals and pathfinder elements.

Three hundred forty-nine samples were collected during the field study. Samples were crushed, pulverized, and split; one split was sent to the Bureau of Mines Research Center, Reno, NV, and the other retained at the Western Field Operations Center for future reference. Gold and silver were analyzed by fire-assay/ICP (inductively coupled plasma) methods with detection limits of 0.007 and 0.3 ppm (parts per million),

respectively (1 ppm = 0.029 oz/ton). Other elements were analyzed using ICP and atomic absorption methods. At least one sample from each mineralized structure was analyzed for 40 1/ elements by semiquantitative spectrometry. Elements in anomalous concentrations were reanalyzed by quantitative methods to confirm values. All samples were checked for radioactivity and fluorescence. A complete set of sample analyses is on file at the Western Field Operations Center, E. 360 Third Avenue, Spokane, WA, and is available to the public.

ACKNOWLEDGEMENTS

The assistance and cooperation of BLM personnel, Ely, NV, claim owners Icarus Exploration and Permian Exploration, and Lacana Gold Inc. are very much appreciated. Bureau of Mines geologist Fredrick Johnson is commended for his valuable input to the study.

GEOLOGIC SETTING

The Riordan's Well study area is in the Basin and Range geologic province of eastern Nevada and includes a portion of the north-trending Grant Range, an eastward-tilted fault block of thrust-faulted Paleozoic sedimentary rocks that have been locally overlain by Tertiary sediments and volcanic rocks.

Bedrock consists of 24,000 ft (Huttrer, 1963, p. 41) of Paleozoic sedimentary rock units in the southern and northwestern parts of the study area, and Tertiary volcanic and sedimentary rock units in the northern and eastern parts. Paleozoic units are a typical miogeosynclinal sequence ranging in age from Cambrian and Ordovician on the southeast side of the study area to Pennsylvanian on the east. Rock types are predominately limestone and dolomite with lesser amounts of shale, conglomerate, sandstone, quartzite, marble, and schist. Several of the units are gently folded and are separated by eastward-dipping thrust faults. Tertiary rock units are on a major erosional unconformity and include Eocene limestone and shale, Oligocene tuff and ignimbrite, and Miocene-Pliocene limestone, sandstone, and conglomerate. The whole section is cut by high-angle faulting, some of which is related to the Late Tertiary block faulting that characterizes the Basin and Range province.

1/ Aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, chromium, cobalt, copper, gallium, gold, iron, lanthanum, lead, lithium, magnesium, manganese, molybdenum, nickel, niobium, palladium, phosphorus, potassium, platinum, scandium, silicon, silver, sodium, strontium, tantalum, tellurium, tin, titanium, vanadium, yttrium, zinc, and zirconium.

Mineral occurrences in the study area are mainly the product of carbonate sediment-hosted epithermal systems developed where ancient mineralizing hot springs were active along faults and bedding plane contacts. When this type of deposit contains very finely disseminated gold, it is generally referred to as Carlin-type (Hausen and Kerr, 1968; Dickson and others, 1985). Mineral occurrences at the WR, CG, and Wizard prospects in the southern part of the study area, as well as at several mineralized areas in the central part of the study area, share several characteristics with Carlin-type deposits, including relatively simple rock alteration (mostly silification and acid leaching), high-angle faulting, carbonate host rocks, and local Tertiary volcanic rocks. Geochemical similarities include concentrations of gold, silver, arsenic, antimony, and mercury. Similar to the Alligator Ridge (Klessig, 1984) and Rain (Knutsen and West, 1984) mines in northeastern Nevada, many of the epithermal occurrences in the study area are along bedding plane contacts within Devonian to Mississippian-age shales and limestones.

The northern end of the study area is underlain by the Eocene Sheep Pass Formation which is part of a Tertiary depositional basin which is producing oil. Operating oil wells are in Railroad Valley about 8 mi to the northwest of the study area, and most of the area to the east in White River Valley has been seismically explored and locally drilled. The Sheep Pass Formation is believed to be of economic importance as both a reservoir and probable source rock for petroleum resources (Winfrey, 1960).

MINING HISTORY

The earliest mining activity dates back to 1868 when ore deposits were discovered about 5 mi southwest of the study area in Troy Canyon (Raymond, 1874, p. 227). The Troy unorganized mining district was centered on the Troy mine, the site of the original discovery. In 1905 another small mining district was started in Irwin Canyon, 4 mi west of the study area (Hill, 1916, p. 141). These two districts between 1873 and 1963 produced small amounts of gold and silver and some lead with a total value of $31,781 (Kleinhampl and Ziony, 1984, p. 191) from quartz veins in sedimentary rock proximate to the Troy pluton.

In the 1950's, tungsten was mined at the Terrell and Nye mines about 4 mi west of the study area between Irwin and Grant canyons. Production was from tactite bordering the Troy pluton and totaled between $100,000 and $250,000 in value (Kleinhampl and Ziony, 1984, p. 191).

Prospecting in the study area probably coincided with activity in the Troy and Irwin mining districts. Claims were first located in the 1920's on the south side of the study area. During this time, the south-central part of the study area was explored, resulting in a number of small prospect pits and trenches and one shaft. The three properties active in 1986, the CG, Wizard, and WR, total 141 lode claims and were located between 1980 and 1984 as part of a regional exploration program for Carlin-type deposits in eastern Nevada. Other than geochemical surveying, there has to date (1986) been little mining activity on these properties.

The Eagle Springs oil field in Railroad Valley was discovered in 1954 and is in production in 1986. Exploration for oil in the White River Valley on the east side of the study area has been sporadic throughout the 1960's, 1970's, and 1980's. Currently (1986), almost one-half of the study area is covered by oil and gas leases.

PROSPECTS, CLAIMS, AND MINERALIZED AREAS

The major areas of jasperoid and altered bedrock are at the WR prospect on the east side of the study area and the CG and Wizard prospects on the south-central side (fig. 2). These prospects and the areas immediately adjacent are discussed in the following section.

In addition, several exposures of jasperoid and acid leached bedrock along faults in Mississippian-age Joana Limestone and Chainman Shale are near the head of Heath Canyon in the vicinity of Heath Springs. Thirteen samples taken here contained as much as 1.213 ppm silver, 80 ppm arsenic, and 4 ppm antimony. These occurrences are small and lack significant concentrations of economic elements. Another area of jasperoid and acid leached bedrock is along the contact of Pennsylvanian-age limestone and Mississippian-age sandstone and shale about 0.5 mi northeast of the northeast corner of the Wizard prospect. Twenty samples contained as much as 0.695 ppm gold, 2.360 ppm silver, 8,700 ppm arsenic, and 10.9 ppm antimony. These values suggest similar mineral occurrences as on the Wizard prospect.

CG Prospect

The prospect consists of a group of 25 claims covering about 517 acres on the south side of the study area at elevations ranging from 6,160 to 6,680 ft (fig. 2). Access from Nevada Highway 38 is by 20 mi of graveled, maintained roads and 3 mi of unmaintained roads.

CG claims nos. 1-18 were located in 1980 by Permian Exploration, Salt Lake City, Utah. During the same year, a soil sample survey was performed. An additional seven claims were located in 1982. In 1986 the prospect was still held by Permian Exploration.

Exploration of the prospect area was, most likely, for low-grade, bulk-tonnage, precious metal deposits along a fault between the Ely Limestone and Joana Limestone (fig. 3). The jasperoid and heavily iron-stained, acid-leached rocks exposed on the southwest side of the prospect were probably the initial discovery. Two old prospect pits are in this area. Subsequent soil sampling outlined geochemical anomalous areas on the east and south sides of the property along the fault (fig. 3).

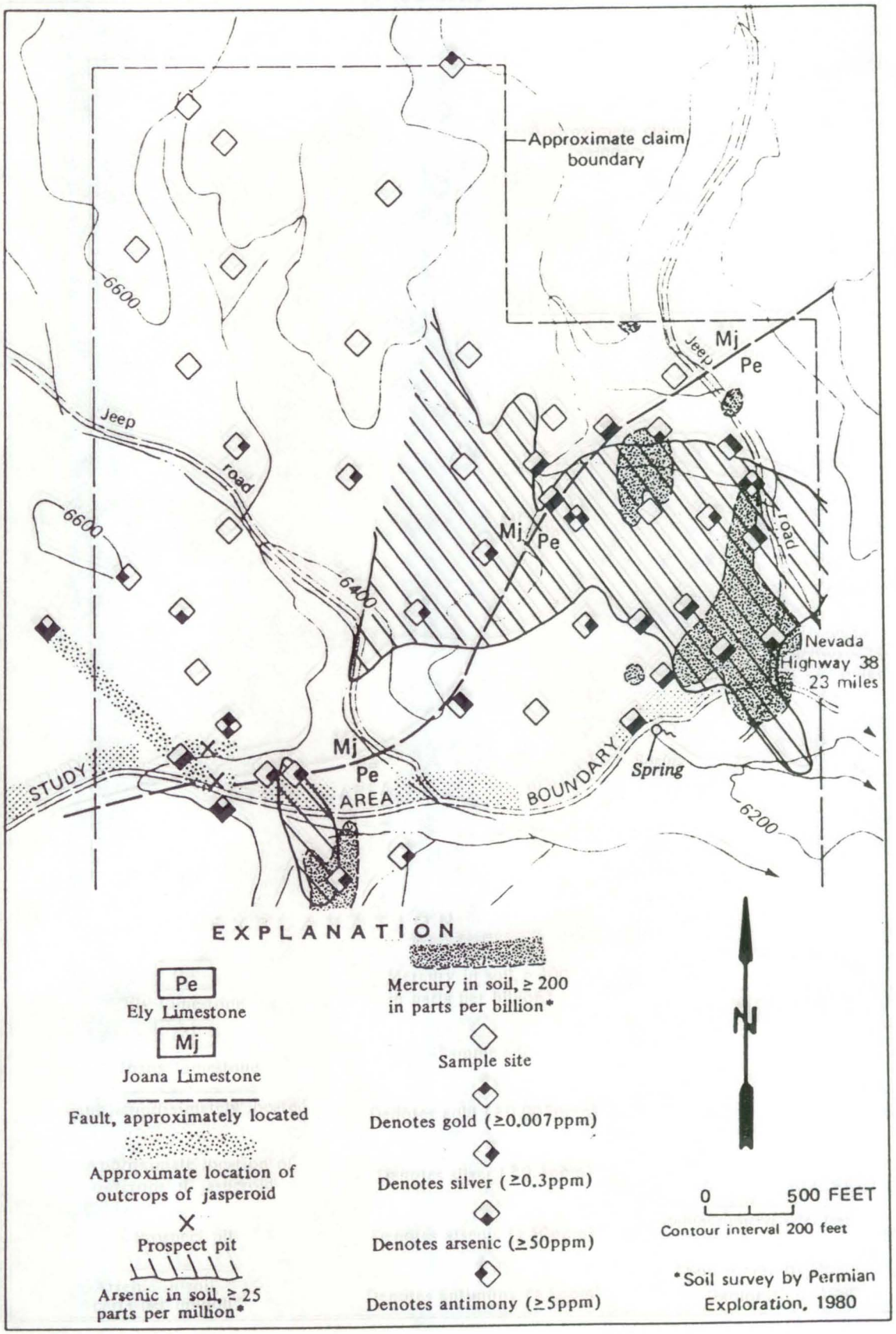


FIGURE 3.– CG prospect, sample locations, workings and geochemical data

A total of 47 grab and chip samples were taken on the property (fig. 3). Five contained gold averaging 0.05 ppm, 26 contained silver averaging 0.6 ppm, 15 contained arsenic ranging from 50 ppm to 1,830 ppm, and 5 contained antimony ranging from 5 ppm to 99 ppm. The geochemical soil survey by Permian Exploration found mercury as high as 1,800 ppb (parts per billion) and arsenic anomalies as high as 520 ppm.

Arsenic, antimony, and mercury content in rock samples along with jasperoids and acid-leached rock indicate the presence of an epithermal occurrence. While there is no direct evidence for metal deposits, there is a possibility for resources on this prospect.

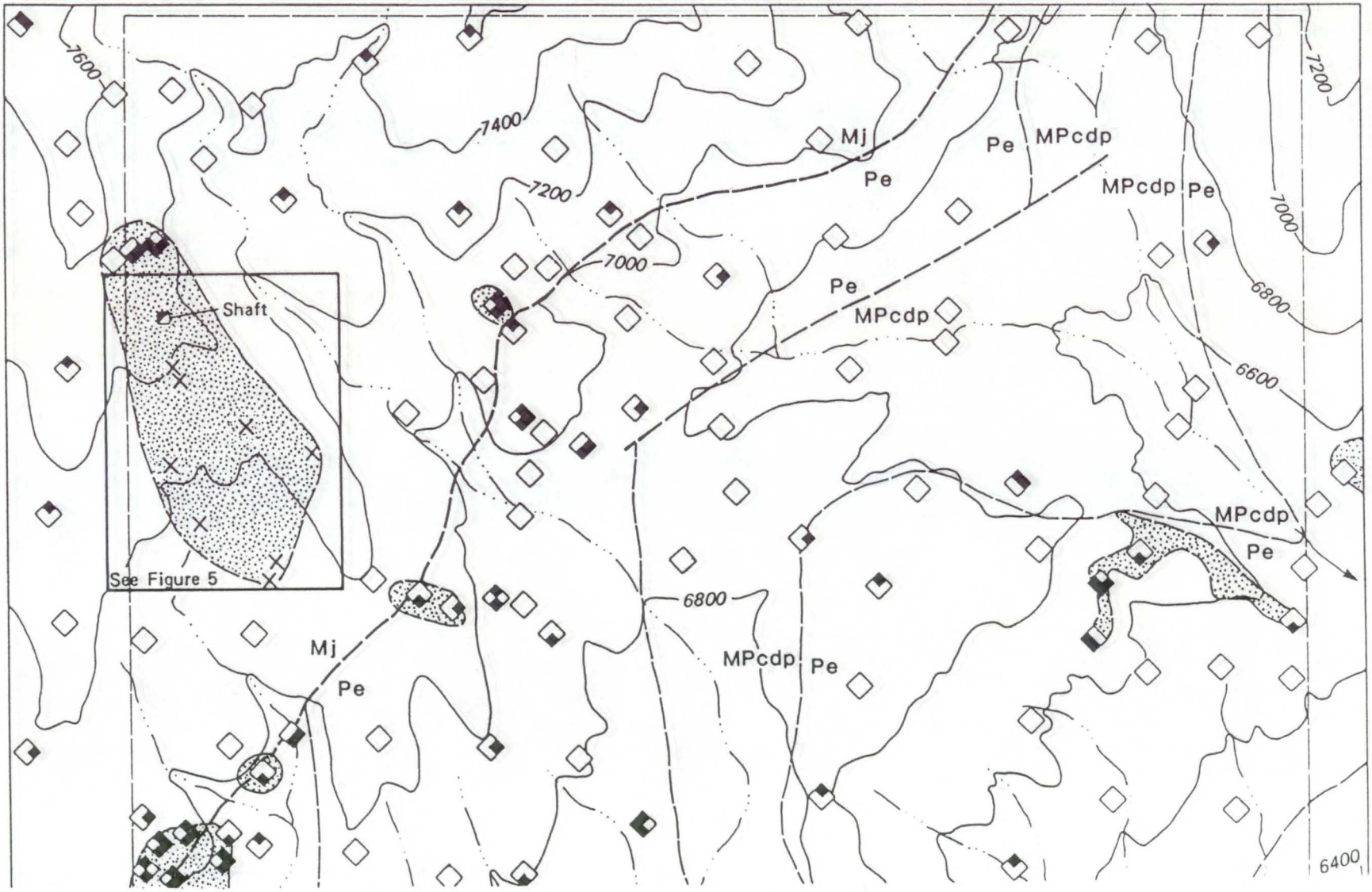
Wizard Prospect

This prospect includes 76 claims covering about 1,570 acres on the south side of the study area at elevations from 6,120 to 7,670 ft (fig. 2). Access from Nevada Highway 38 is by 20 mi of graveled, maintained roads and 4 mi of unmaintained roads and jeep trails.

The claim group, the Wizard nos. 1-76, was located in 1984 by Thomas Frank of Reno, NV. On the northwest side of the property is a 40-ft-deep shaft and eight prospect pits. These old, hand dug workings were located in 1926 as the Iron Cap claims. In 1986 the claim owner is Icarus Exploration, Portland, OR.

Bedrock consists of limestone, conglomerate, sandstone, and shale of the Ely Limestone, Chainman Shale, Diamond Peak Formation, and the Joana Limestone (fig. 4). On the southeast side of the prospect, there are some Tertiary volcanics. Jasperoid, acid-leached rock and gossan are exposed along faults and bedding plane contacts. Limestone units contain some marble and travertine, and small amounts of chlorite and epidote. Sandstone occasionally exhibits liesegang banding Several jasperoid exposures include typical features of epithermal-type deposits, such as vertical siliceous breccia zones and silica cap deposits developed along bedding. The largest area of acid leaching and silicification is on the northwest side of the prospect (fig. 5). The alteration is probably associated with several unmapped faults in the Joana Limestone.

A total of 188 rock chip. grab, and select samples were taken from exposures of jasperoid, altered country rock, and bedrock throughout the prospect area (figs. 4 and 5). The 157 samples shown on figure 4 include 48 containing gold averaging 0.05 ppm and ranging from 0.019 ppm to 0.547 ppm, 27 containing silver averaging 1.179 ppm and ranging from 0.340 to 12.33 ppm, 26 containing arsenic ranging from 57 ppm to 1,110 ppm, and 4 containing antimony ranging from 6.0 ppm to 18.6 ppm. In addition, five samples contained mercury ($\leq$2 ppm), mainly scattered along the west side of the property. The 31 samples shown on figure 5 include eight containing gold averaging 0.052 and ranging from 0.018 ppm to 0.180 ppm, eight containing silver averaging 1.988 ppm and ranging from 0.400 ppm to 8.603 ppm, 23 containing arsenic ranging from 52 ppm to 1,760 ppm, and 7 containing antimony ranging from 5 ppm to 38 ppm. Five samples contained mercury ($\leq$2 ppm) in the southern part of the area of alteration.


7600
7400
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See Figure 5

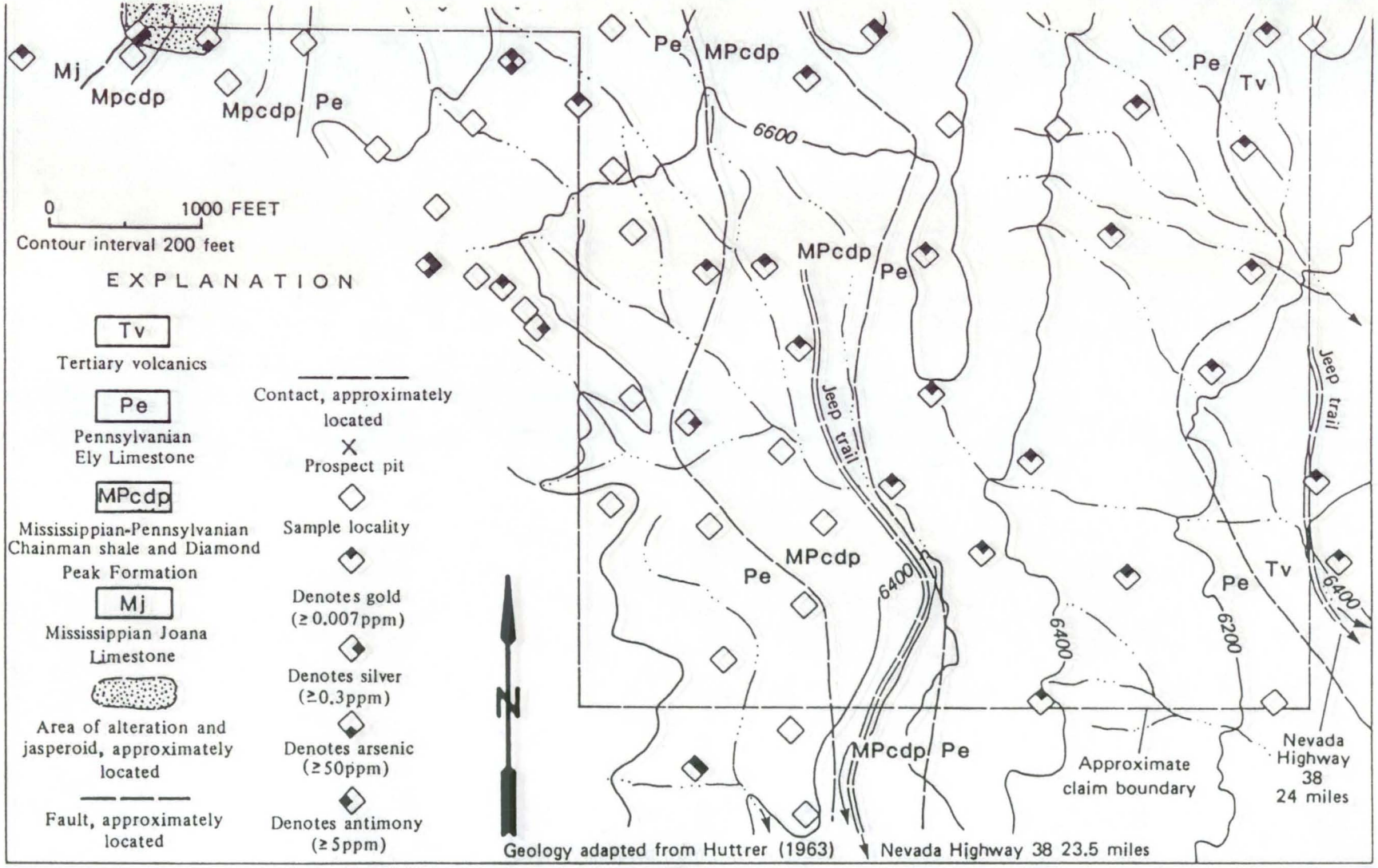

FIGURE 4.– Wizard prospect, sample locations

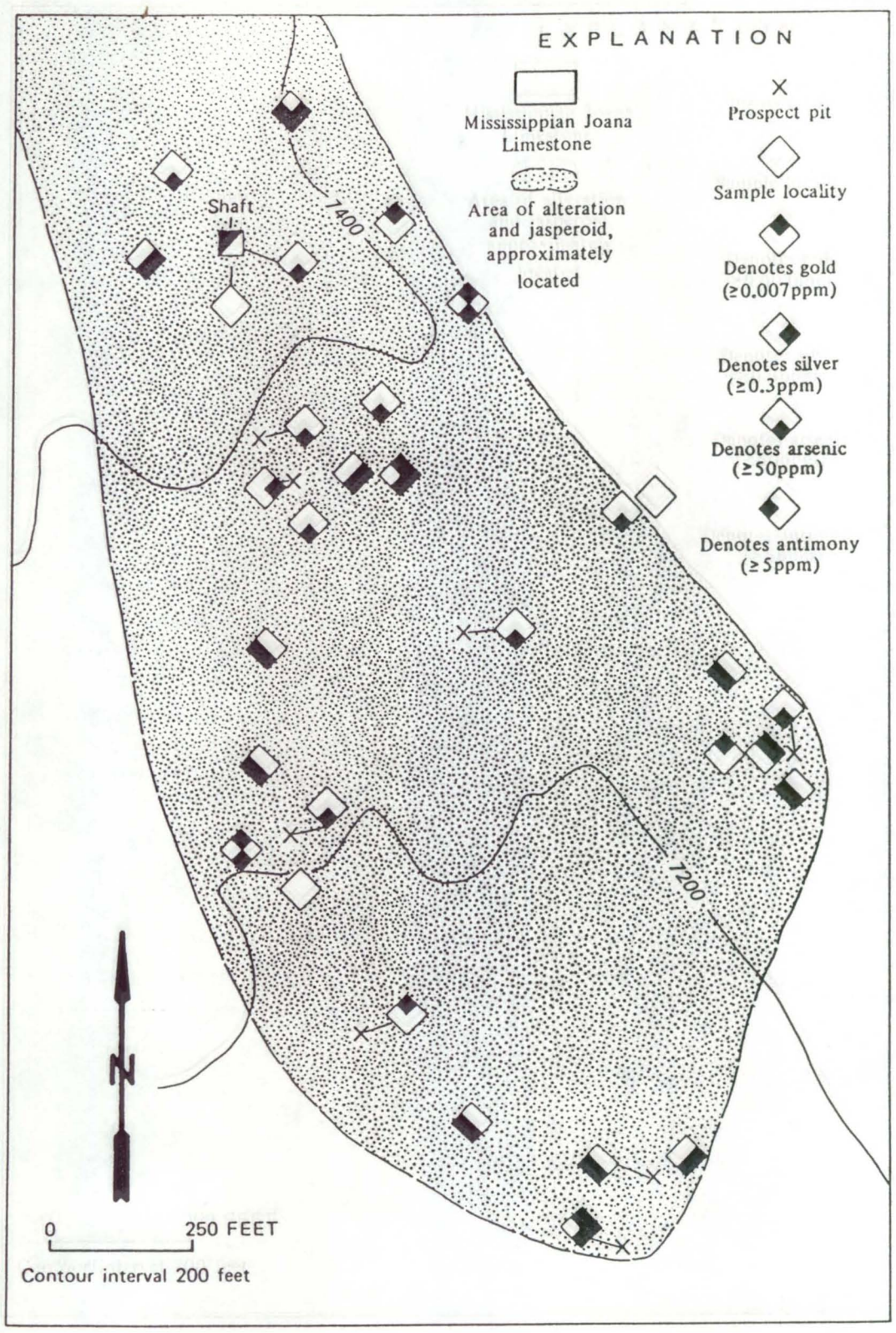

FIGURE 5. – Wizard prospect, detail of area of acid leaching and silicification, and sample locations

The surface geology and sample results strongly indicate that low-grade, bulk-tonnage, epithermal-type, precious metal deposits exist on this property.

WR Prospect

The claim block covers about 824 acres on the east side of the study area at elevations ranging from 6,100 to 7,200 ft (fig. 2). Access from Nevada Highway 38 is by 29 mi of improved and unimproved roads and 2 mi of jeep trail.

The claim group of 40 claims was located in 1982 by Inspiration Development Co., Claypool, AZ, as an epithermal-type gold prospect. While claim staking, a soil geochemical sampling program was performed using 100-ft sample intervals on 500-ft fences. Lacana Mining Corp., in 1983, evaluated the property for potential epithermal gold as an Alligator Ridge mine type deposit (Lacana Mining Corp., written commun., 1986). Interest in the property waned after 1983, and the property in 1986 was still held by Inspiration Development.

Interest has focused on areas of jasperoid along bedding planes at the contact between the Devonian Guilmette Formation and the Mississippian Joana Limestone (fig. 6). Volcanic rocks on the east side of the property consist of ignimbrite.

Eighty-one grab and chip samples were taken; 68 from the claim group and 13 from exposures of jasperoid north and south of the claim group (fig. 6). Areas underlain by sedimentary rock had 12 samples with gold averaging 0.045 ppm, 22 samples with silver averaging 0.708 ppm, 10 samples with arsenic ranging from 63 to 330 ppm, and 7 samples with antimony ranging from 6.0 to 17.1 ppm. Volcanic rock had seven samples with gold averaging 0.025 ppm.

The presence of jasperoid, along with values in gold, silver, arsenic, and antimony, suggest that an epithermal system was once active along the bedding plane contact between the Joana Limestone and Guilmette Formation. While there is no strong indication of any significant precious-metal component to this system, the possibility for low-grade, bulk-tonnage, precious metal deposits at depth cannot be ruled out.

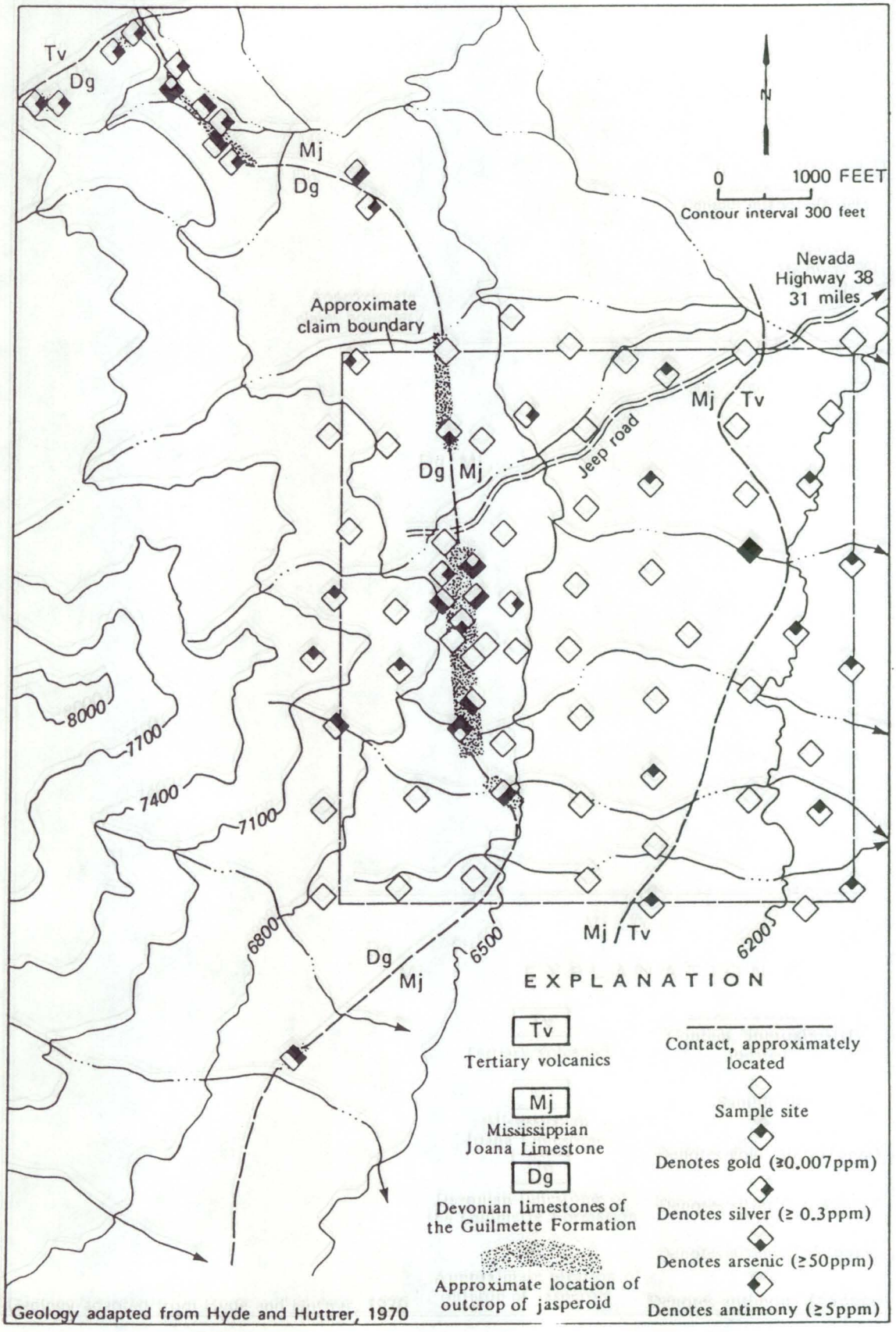

FIGURE 6.– WR prospect, sample locations

APPRAISAL OF MINERAL RESOURCES

While there are no identified metallic mineral resources exposed in the Riordan's Well study area, the CG, Wizard, and WR prospects, have epithermal occurrences and are good, typical exploration targets for Carlin-type gold deposits. The prospects have geological and geochemical characteristics that mimic those at other gold deposits in eastern Nevada such as at the Rain and Alligator Ridge mines. Exposures of jasperoid or siliceous caps indicate that most of the epithermal systems and possible gold-bearing zones would be at depth. The low values of gold found during this study do not reduce the possibility for gold deposits; many of the Carlin-type gold mines in Nevada showed little or no gold during initial exploration.

The Wizard and CG prospects at the southern edge of the study area had the highest concentrations of pathfinder elements and the largest areas containing detectable gold values. Although no gold resources were identified, such resources may be present at these prospects. Additional work, such as drilling and bulk sampling, would be needed to fully evaluate the area.

The current high value for gold ($391/oz, Engineering and Mining Journal, 1987, p. 9) combined with new, inexpensive methods of heap leaching to recover gold and silver have created considerable interest in low-grade, bulk-tonnage precious metal deposits. Most of the new domestic gold mines are on deposits of this type, and many of them are in Nevada.

There are extensive limestone and sand and gravel deposits within the study area. However, the great distance to any potential market and high transportation cost combined with the abundance of these commodities in the region are factors in assigning these commodities to the subeconomic resources classification.

RECOMMENDATIONS FOR FURTHER WORK

More detailed mapping and sampling on the CG and Wizard prospects could be warranted provided there is a substantial increase in the price of gold. Higher prices would result in more exploration interest in typical epithermal-type prospects such as those in the study area. Follow-up drilling of favorable target areas would confirm the presence or absence of Carlin-type precious metal deposits.

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