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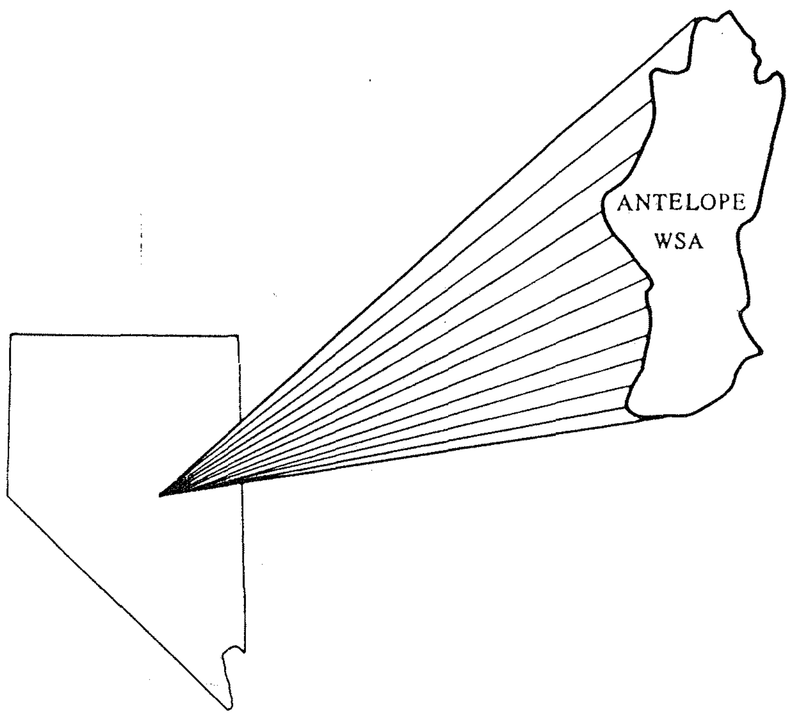
Open File Report

Mineral Resources of the Antelope Wilderness Study Area, Nye County, Nevada



BUREAU OF MINES

UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL RESOURCES OF THE ANTELOPE WILDERNESS STUDY AREA, NYE COUNTY, NEVADA

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UNITED STATES DEPARTMENT OF THE INTERIOR
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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 the Antelope Wilderness Study Area (NV-060-231/241), Nye County, NV.

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, E. 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.

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ILLUSTRATIONS

SUMMARY

No mineral resources were delineated during our investigation of the Antelope Wilderness Study Area (WSA). Only a few claims have been located in the area and only four workings were found. There has been, however, considerable exploration and mining activity in and near the south end of the study area. The Morey mining district, just southeast of the WSA, produced silver, and lesser amounts of gold and lead, sporadically from the mid-1860's through the mid-1960's. Long Lac Mineral Exploration (Texas), Inc. is actively exploring a large block of claims for hot-spring type, low-grade, large-tonnage gold deposits. Their claim block extends into the study area.

The WSA, located midway between Tonopah and Eureka, encompasses approximately 87,400 acres. It is underlain by Tertiary rhyolitic and latitic volcanic rocks and by Paleozoic sedimentary rocks. At least three areas in the Paleozoic rocks have many of the favorable criterion for hot-spring type gold deposits; they have been faulted, silicified, brecciated, and hydrothermally altered, and have anomalous concentrations of precious metals and pathfinder elements. With additional exploration in the south part of the Antelope WSA, gold resources may be discovered.

Extensive sand and gravel and stone deposits in the study area are suitable for many construction purposes; however, adequate material is available closer to major markets in the region. Oil and gas leases extend into the WSA, but are not evaluated in this report.

INTRODUCTION

This report describes the U.S. Bureau of Mines' (USBM) portion of a cooperative study with the U.S. Geological Survey (USGS) to evaluate mineral resources and potential of the Antelope (NV-060-231/241) Wilderness Study Area (WSA). The USBM examined and evaluated claims, prospects, and mineralized zones; the USGS conducted broader geological, geochemical, and geophysical surveys.

Information from these mineral surveys relates to one aspect of the area's suitability for wilderness classification. Although the near-term goal is to provide data for land-use decisions, the long-term objective is to help ensure that the Nation has an adequate and dependable supply of minerals at reasonable cost.

Setting

The Antelope Wilderness Study Area encompasses approximately 87,400 acres in central Nevada, about midway between Tonopah and Eureka (fig. 1). It lies at the north end of the Hot Creek Range, the south end of the Antelope Range, and is bound on the west by the Little Fish Lake Valley (fig. 2). Elevations range from 9,439 ft (feet) at Moonshine Peak, the highest point, to 6,400 ft along Hicks Station Wash, the lowest. Dirt roads provide access to all sides of the study area. The dry climate

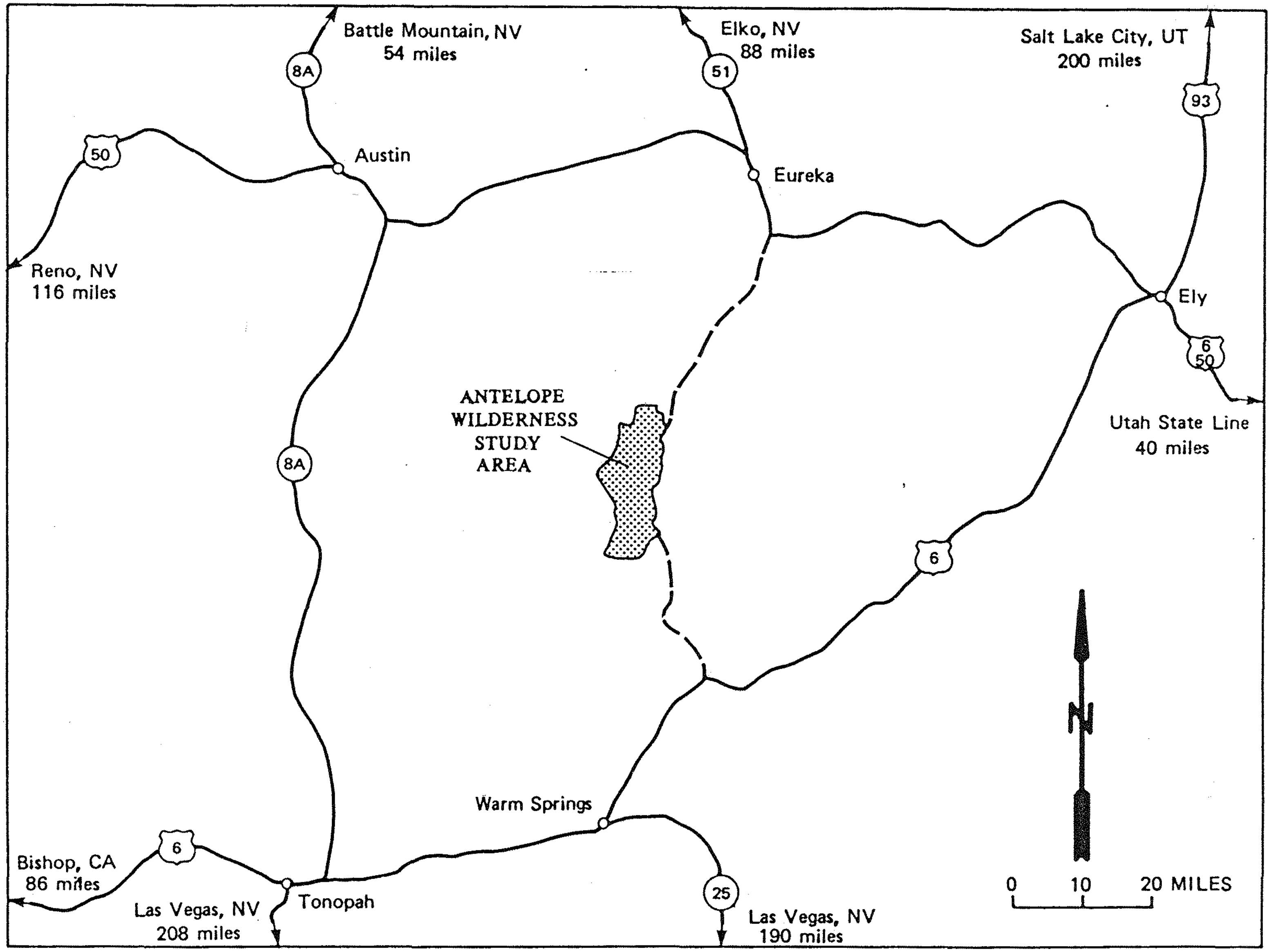

FIGURE 1. – Location map, Antelope Wilderness Study Area (NV-060-231/241), NV

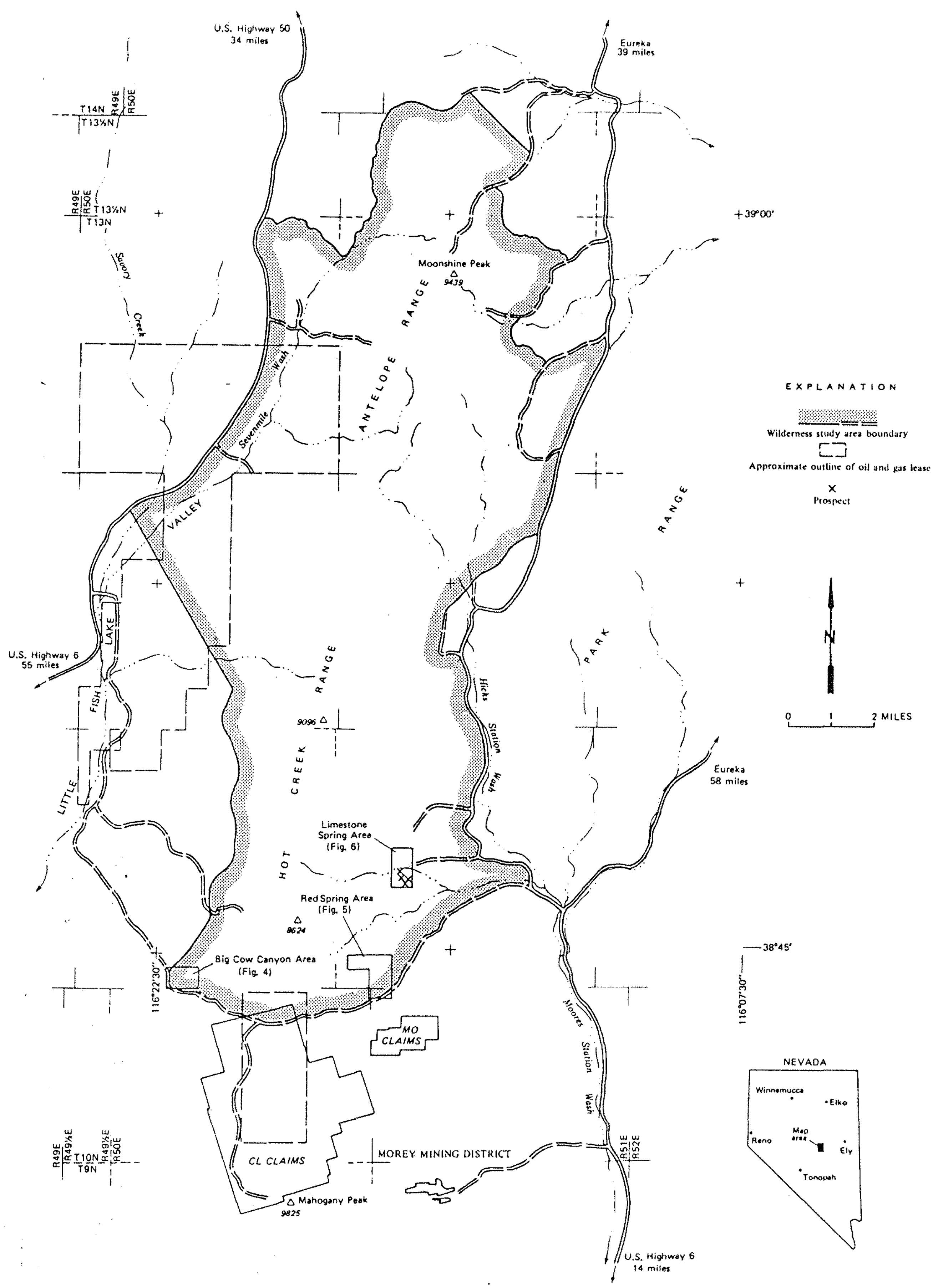

FIGURE 2. — Prospects, active mining claims, and mineralized areas in and adjacent to the Antelope Wilderness Study Area (NV-060-231/241), NV

limits vegetation to semi-arid grasses, sagebrush, mountain mahogany, juniper, and limber pine. Snowfall during the winter is usually light and would not impede access for more than short time intervals.

Previous Studies

Little detailed work has been done within the WSA. Potter (1976) studied the Paleozoic stratigraphy of the northern Hot Creek Range and the north edge of his study falls just within the south end of the WSA. Dixon and others (1972) mapped the geology of the Pritchard Station quadrangle and Hose (1978) mapped the Cockalorum Wash quadrangle. The Cockalorum Wash quadrangle covers the extreme north part of the WSA while the Pritchards Station quadrangle covers the east side. Kleinhampl and Ziony (1967) prepared a preliminary geologic map of northern Nye County which includes the entire WSA.

The Tertiary history of Little Fish Lake Valley was studied in detail by Ekren and others (1974); their report includes information about the Tulle Creek-Pritchards Station aeromagnetic lineament which passes through the south end of the WSA. The Morey mining district is located just southeast of the south part of the WSA. Lenzer (1972) thoroughly discusses the district's rock formations, structural geology, and mineral deposits including their paragenesis.

Present Study

During 1984 and 1985, personnel from the U.S. Bureau of Mines' Western Field Operations Center investigated the Antelope WSA for its mineral resources. All available information on geology, mining, and exploration in the area, including county mining claim records, was reviewed prior to field work.

Claimants were contacted, when possible, for permission to examine properties and publish the results. In some cases, the claimant later accompanied the authors to the property. Field studies involved searches for all mines, prospects, and claims indicated by pre-field studies to be within the study area. Those found were examined, and where warranted, were mapped and sampled. In addition, ground and air reconnaissance was done in areas of obvious rock alteration.

Thirty employee-days were spent traversing the area and 370 samples were taken. They were of three types: 1) chip - a regular series of rock chips taken in a continuous line across a mineralized zone or other exposure; 2) random chip - an unsystematic series of chips taken from an exposure of apparently homogeneous rock; and 3) grab - rock pieces taken unsystematically from a dump, stockpile, or of float (loose rock lying on the ground). All samples were crushed, pulverized, mixed and split, and checked for radioactive and fluorescent minerals. Each sample was analyzed for gold and silver content by fire-assay and inductively coupled plasma (ICP) methods. The detection limit by these methods is 0.007 ppm (parts per million) gold and 0.3 ppm silver. Two-hundred-twenty-nine samples were also analyzed for arsenic and mercury. The arsenic content was determined by ICP/atomic absorption methods. One of several special methods, determined by rock lithology and mercury concentration, was used for mercury analyses. The detection limit for arsenic and mercury by these methods is 2.0 ppm.

The Bureau of Mines is also investigating the Fandango Wilderness Study Area (NV-060-190) which is immediately south of the Antelope WSA. Results from that study will appear in a separate open-file report.

ACKNOWLEDGEMENTS

Our gratitude is extended to Mr. Bob Bennett, geologist with Long Lac Mineral Exploration (Texas), Inc., for familiarizing us with the rock formations, alteration, and mineralization near the south end of the WSA. Appreciation is also extended to pilot Jack Fulton, El Aero Services, Inc., for his expert flying ability and knowledge of the area.

GEOLOGIC SETTING

The Antelope Wilderness Study Area is in the Basin and Range province of central Nevada. The WSA covers an uplifted block, bounded by high angle faults on both its east and west sides. As defined by Tertiary volcanic flows, the block dips east in the north portion of the WSA and both east and west in the south portion.

The geology is dominated by volcanic rocks, chiefly the Oligocene Windous Butte Formation (fig. 3). The formation consists of rhyolitic welded tuff that grades upward to quartz latite (Ekren and others, 1974). Kleinhampl and Ziony (1967) dated the Windous Butte at between 33 and 35.3 m.y. (million years) while Gromme and others (1972) concluded that the formation was 30.7 m.y. old. These volcanic rocks are inferred to have been extruded from a caldera complex an area of volcanic subsidence about 40 mi (miles) long (north to south) and 30 mi wide (east to west) (U.S. Geological Survey, 1970). The Morey Peak caldera, a part of this complex, is only 2 mi from the study area (Lenzer, 1972). The caldera boundary is marked in some places by brecciated tuffs and Paleozoic rocks, and in others by ringlike fracture systems (U.S. Geological Survey, 1968).

Sedimentary rocks, generally Paleozoic siltstone, mudstone, limestone, dolomite, shale, and chert, outcrop at several places in the WSA but are best exposed at the south end (Potter, 1976). These Paleozoic rocks are generally separated from the volcanic rocks by the Tulle Creek-Pritchards Station lineament. The lineament is an east-west aeromagnetic discontinuity running from Tulle Creek in the Monitor Range, east across the WSA, and through the Pritchards Station quadrangle. At Tulle Creek, the lineament coincides with a major east-west fault (Ekren and others, 1974) and in the Pritchards Station quadrangle, it coincides with an east-trending, left-lateral, transcurrent fault (Dixon and others, 1972). Ekren and others (1974) believe that the Tulle Creek-Pritchards Station strike-slip fault changes into a low-angle thrust where it goes through the WSA. Here, the low angle fault dips north and separates the Windous Butte Formation from

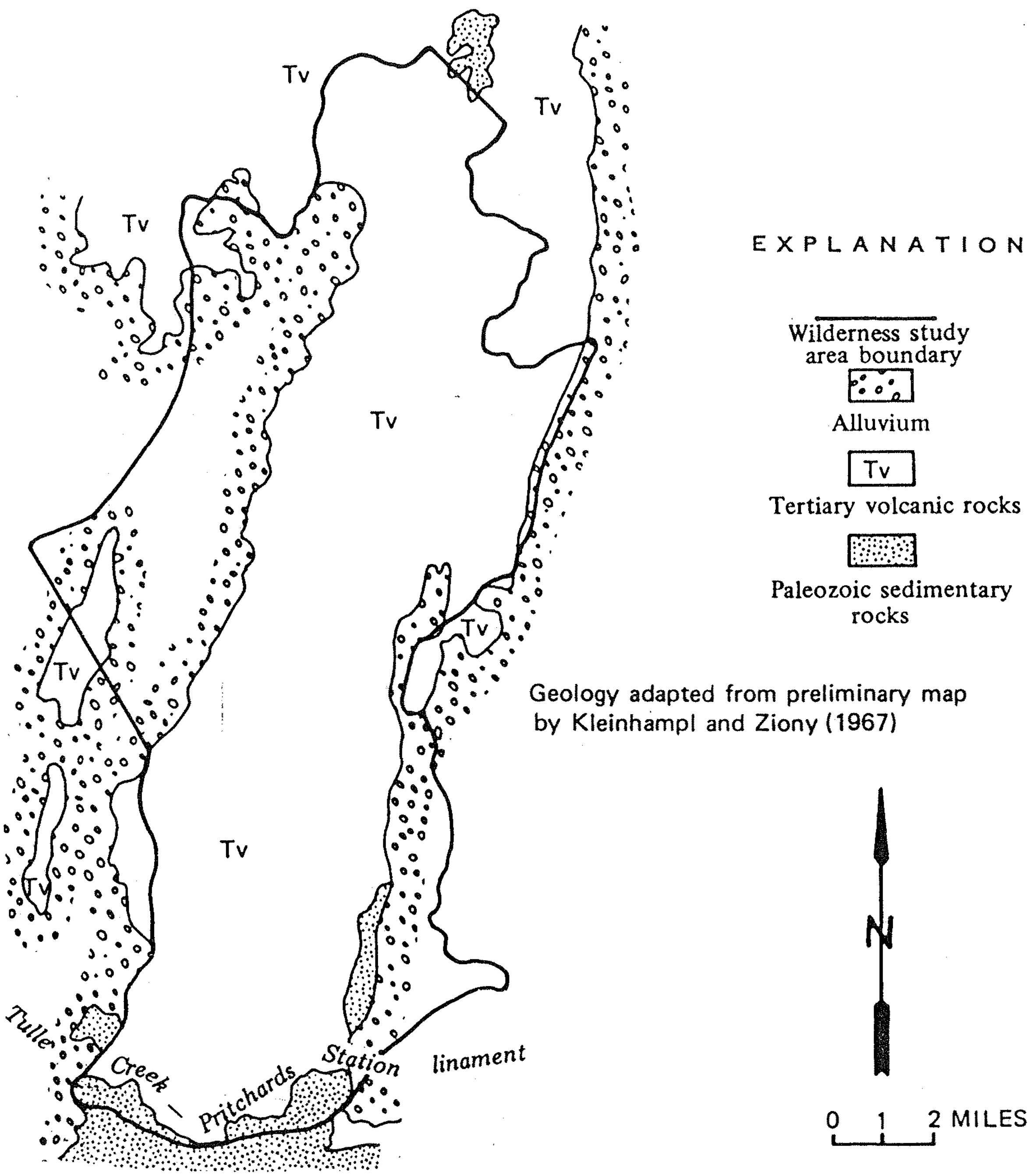

FIGURE 3. – Generalized geologic map, Antelope Wilderness Study Area (NV-060-231/241), NV

older volcanic rocks or Paleozoic rocks along the south edge of the plate. Along the fault, both the Paleozoic sedimentary rocks and Tertiary volcanic rocks have been intensely brecciated (Ekren and others, 1974).

MINING HISTORY

The Morey mining district, about 5 mi southeast of the WSA, is the nearest area having past production. The first discovery there was in 1865 and the district was organized in 1866. Silver, with lesser amounts of gold and lead, were produced sporadically until about 1966. The district was most active from 1866 to 1891 and from 1937 to 1947; total production is valued at less than $1 million (Kleinhampl and Ziony, 1984).

Exploration activity in the Antelope Wilderness Study Area has been low. A search of Nye County and Bureau of Land Management mining records revealed that only part of a block of active mining claims and no historical claims were located in the WSA. Many of the location descriptions for the historical claims, however, are very vague and some could have been located in the WSA. Old claim corners and prospect pits were found during reconnaissance of the south part of the area. Oil and gas leases extend into the west and south part of the WSA, but are not evaluated in this report.

The active claim block (CL claims) is held by Long Lac Mineral Exploration (Texas), Inc. Most of the block lies south of the WSA, but about 14 claims extend into it. Long Lac is actively exploring the area for hot-spring type, large tonnage, low-grade gold deposits. Their exploration program has included detailed geologic mapping, geochemical sampling, and drilling.

PROSPECTS AND MINERALIZED AREAS

The south part of the WSA meets many of the criterion associated with hot-spring-type, precious metal deposits. According to Silberman (1982), some of those criterion are the presence of: 1) complex high-angle structures (caldera rim fracture zones and Basin- and Range-type faulting); 2) strike-slip faults with high-angle splays in areas where there has been felsic volcanic activity; 3) areas of complex volcanic centers with a variety of flow rocks; 4) evidence of thermal spring activity such as wide silicified zones; 5) argillic and, particularly, advanced argillic alteration with alunite; 6) zones of stockwork quartz veining, particularly where the veins are thin and discontinuous; and 7) signs of repeated fracturing, veining, and brecciation. Favorable geochemical evidence would include anomalous concentrations of gold, silver, arsenic, mercury, thallium, and antimony.

Three areas, Big Cow Canyon, Red Spring, and Limestone Spring, contained evidence of having been claimed. These areas also appeared to have higher concentrations of precious and pathfinder elements relative to the other samples taken in the Paleozoic rocks. These three areas are discussed in the following text.

Big Cow Canyon Area

This area is underlain by Mississippian (Potter, 1976) siltstone, sandstone, and limestone, jasperoid, and Tertiary volcanic rocks. High-angle faults are present and all the volcanic rocks are in fault contact with the sedimentary rocks. Hydrothermal alteration has occurred in most of the area and was strongest around vents. Some small areas (several hundred feet across) are silicified to the extent that the original rock texture is not visible in hand specimens (jasperoid). The vent areas, and some of the silicified areas, are heavily limonite- and hematite-stained. Brecciation and hydrofracturing were moderate to light.

Fifty-five samples were taken in the Big Cow Canyon area (fig. 4). Fourteen (25%) contained gold, eight (15%) contained silver, 11 (20%) contained anomalous arsenic ($\geq$ 50 ppm), and none contained mercury. Values ranged to as much as 0.159 ppm gold, 1.811 ppm silver, and 1890 ppm arsenic. Complete descriptions and analyses for these samples are available at the Bureau of Mines' Western Field Operations Center.

Red Spring Area

The Red Spring area is generally underlain by Devonian and Triassic (Potter, 1976) dolomite, limestone, siltstone, mudstone, and quartzite. Tertiary rhyolite, welded tuff, and ash crop out along the north edge and southeast corner of the area shown in Figure 5. Most of the area has been subjected to hydrothermal alteration and brecciation. Some of the brecciation in and around the silicified zones may have been from hydrofracturing but most was probably associated with a low-angle fault zone trending east-west through the north part of the area. Ekren and others (1974) believe that this fault is part of the Tulle Creek-Pritchards Station strike-slip fault and that here it passes into a low-angle thrust fault. In area A (fig. 5), the brecciated zone may be as much as 1,000 ft wide. In area B (fig. 5), the brecciation appears to have been less intense and there is a marked decrease in the amount of silicification.

Forty-six samples were taken in the Red Spring area (fig. 5). Complete descriptions and analyses for these samples are available at the Bureau of Mines' Western Field Operations Center. Of the 24 samples taken in area A of Figure 5, six (25%) contained gold, 12 (50%) contained silver, seven (29%) contained anomalous arsenic ($\geq$50 ppm), and none contained mercury. Values for those samples in area A ranged to as much as 0.360 ppm gold, 5.753 ppm silver, and 7700 ppm arsenic.

Of the 16 samples taken in area B of Figure 5, eight (50%) contained gold, five (31%) contained silver, only one (6%) contained anomalous arsenic ($\geq$ 50 ppm), and none contained mercury. Values for those samples in area B ranged to as much as 0.363 ppm gold, 0.800 ppm silver, and 650 ppm arsenic.

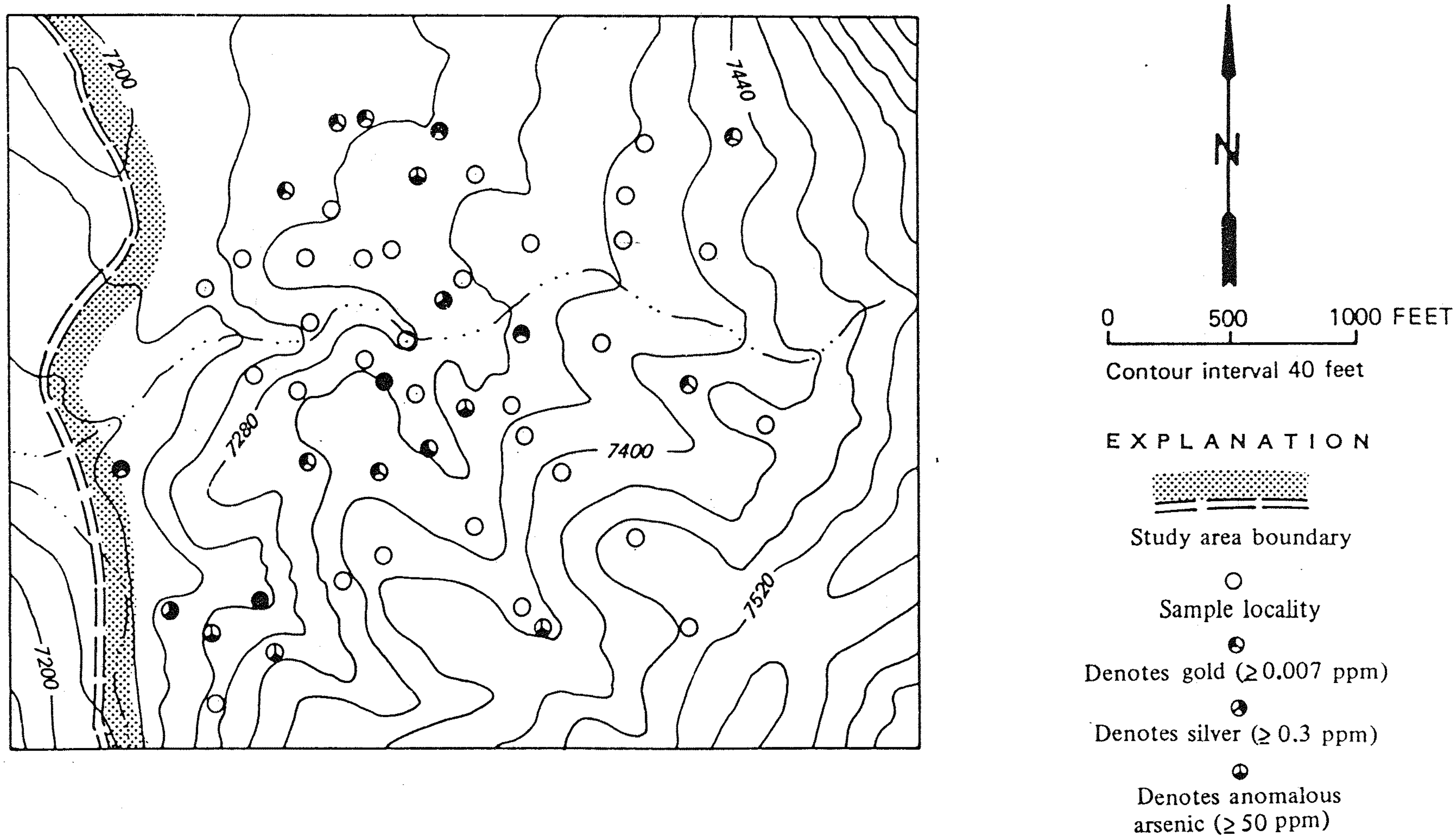

FIGURE 4. – Sample locations, Big Cow Canyon area

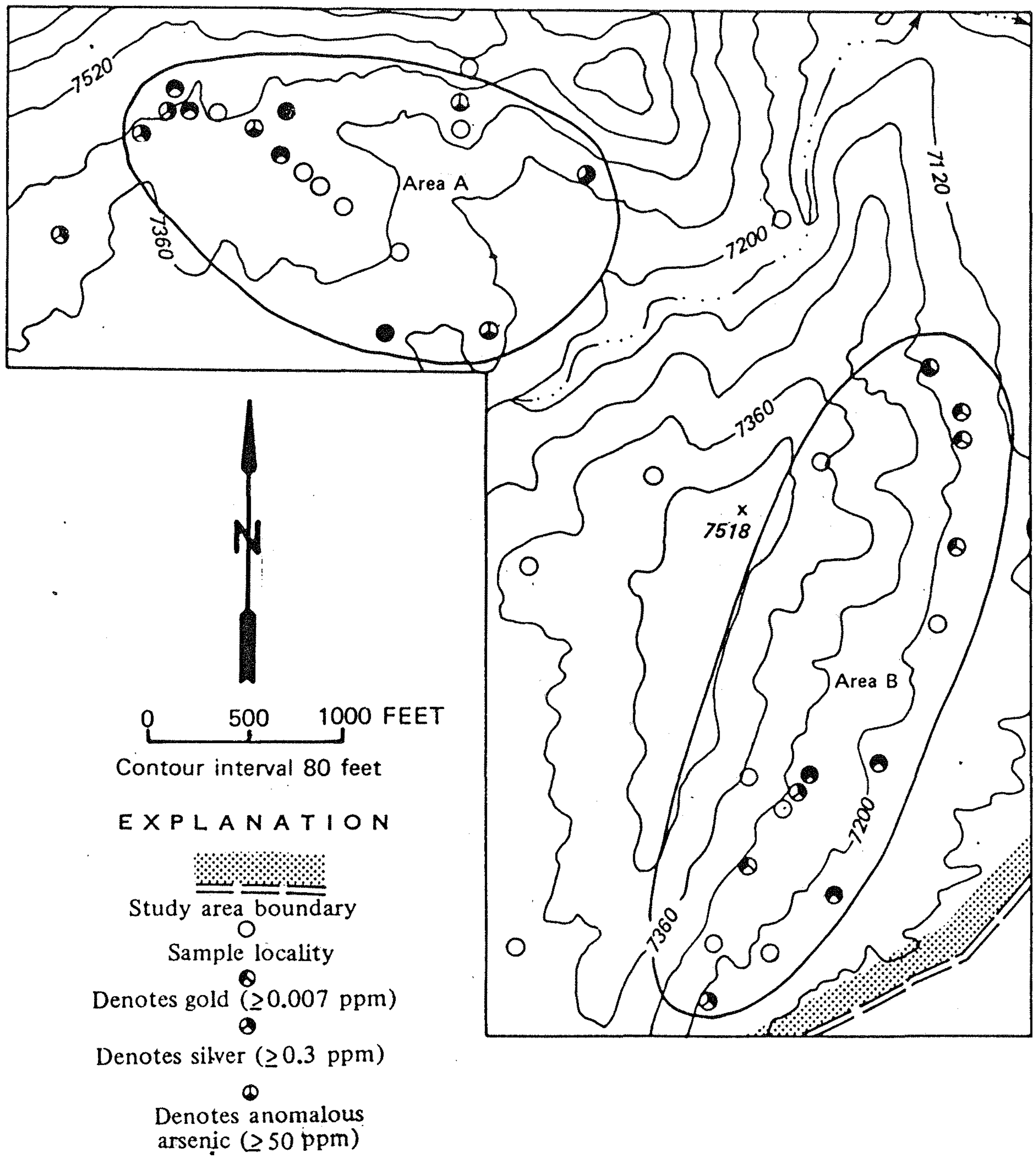

FIGURE 5. — Sample locations, Red Spring area

Limestone Spring Area

The Limestone Spring area is underlain by Tertiary tuff, ash, and rhyolite, and Devonian (Kleinhampl and Ziony, 1967) dolomite. An east-west strike-slip fault, with numerous high-angle splays, follows the wash shown in the center of Figure 6. A major north-trending, high-angle, large displacement fault intersects this strike-slip fault near the west-center part of the figure. It is around this intersection that brecciation and hydrothermal alteration was the most intense. Limonitic, partially silicified, explosion breccia outcrops near the center of the figure.

No large zones of jasperoid were found, as in the other two areas, but highly silicified rock occurs locally and along faults.

Four small prospect pits were found in the area. Three were dug in hematitic and limonitic gossan. The southern-most pit was dug in heavily hematite-stained, quartzite breccia.

Forty-three samples were taken in the Limestone Spring area (fig. 6). Five (12%) contained gold, 12 (28%) contained silver, six (14%) contained anomalous arsenic ($\geq$ 50 ppm), and eight (19%) contained mercury. Values ranged to as much as 0.022 ppm gold, 5.340 ppm silver, 390 ppm arsenic, and 28 ppm mercury. Complete descriptions and analysis for these samples are available at the Bureau of Mines' Western Field Operations Center.

APPRAISAL OF MINERAL DEPOSITS

The Limestone Spring area appears to be the most likely of the three specific areas to have gold resources. Supporting evidence includes: 1) proper ground preparation by normal and strike-slip faulting; 2) intense silicification locally and along faults; 3) widespread brecciation and the presence of explosion breccia; 4) the close proximity to a major, complex, volcanic center (Morey Peak caldera); 5) areas of intense hydrothermal alteration, and 6) the presence of a strong mercury anomaly.

Evidence which supports the possibility of gold resources occuring in the Red Spring and Big Cow Canyon areas is much the same. These two areas lack the strong mercury anomaly present in the Limestone Spring area, but have higher arsenic anomalies.

The development of heap leaching gold recovery methods, combined with historically relatively high gold prices (about $350/oz) and depressed prices for other metals, has made deposits of this type the current vogue in mining. Most new domestic mine openings have been on deposits of this type, and many of them have been in Nevada.

Extensive sand and gravel and stone deposits in the study area are suitable for many construction purposes. However, transportation cost to current markets, a major part of total production cost for these high bulk - low unit value commodities, would far exceed the value. Adequate material is available closer to major markets in the region.

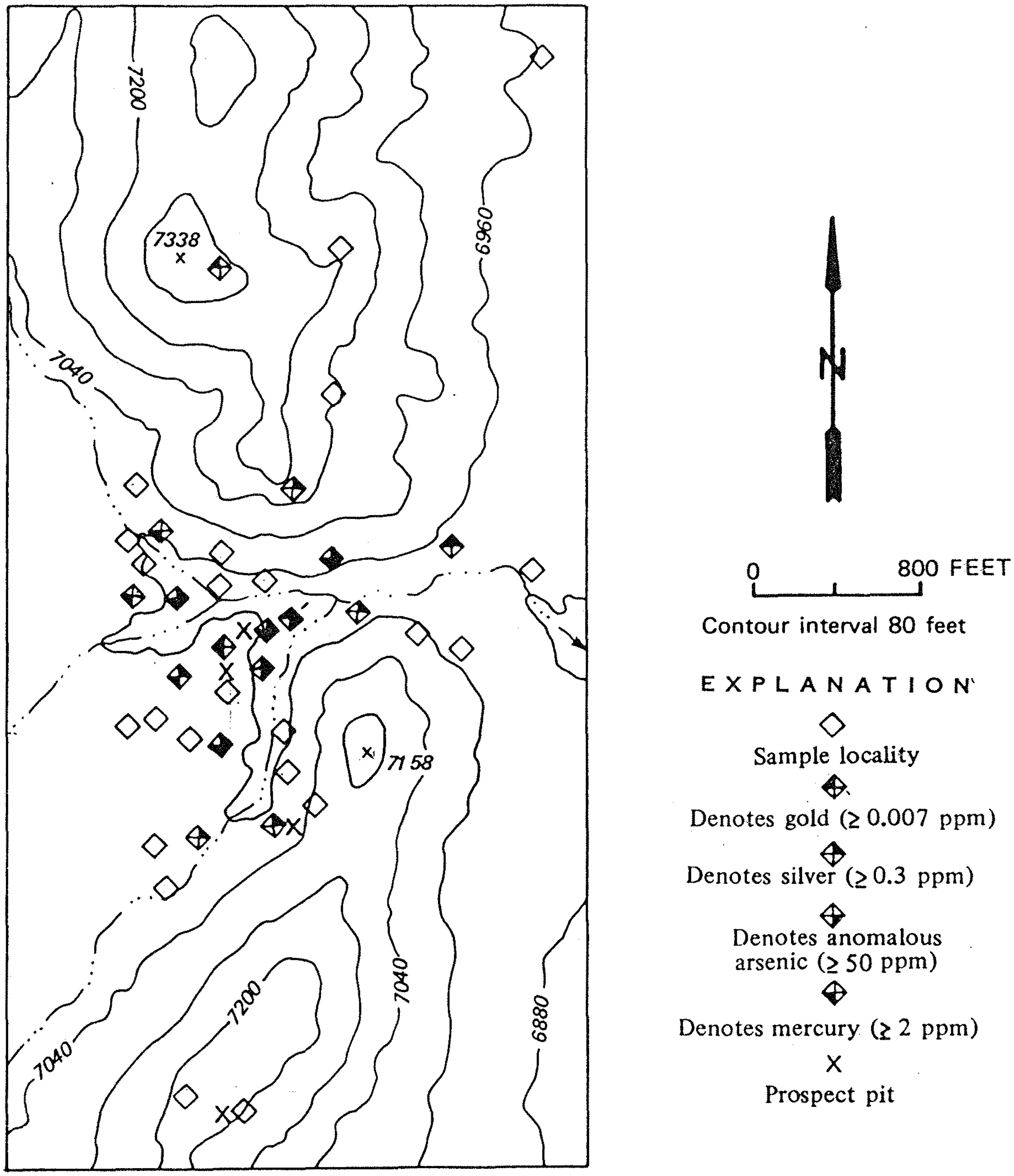

FIGURE 6. – Sample locations, Limestone Spring area

RECOMMENDATIONS FOR FURTHER WORK

The south part of the Antelope Wilderness Study Area warrants additional work. The areas underlain by Paleozoic rocks and by altered, brecciated volcanic rocks could be sampled and mapped in much more detail. Those areas determined to contain anomalous concentrations of gold, silver, arsenic, mercury, thallium, or antimony should be resampled (both rock chip and soil) on a closely-spaced grid system. Areas with favorable results from resampling should be followed up by a drilling program.

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