SIMPSON PARK MOUNTAINS G-E-M RESOURCES AREA

(GRA NO. NV-07)

TECHNICAL REPORT

(WSAs NV 060-428)

Contract YA-553-RFP2-1054

Prepared By

Great Basin GEM Joint Venture
251 Ralston Street
Reno, Nevada 89503

For

Bureau of Land Management
Denver Service Center
Building 50, Mailroom
Denver Federal Center
Denver, Colorado 80295

Final Report

May 6, 1983

TABLE OF CONTENTS

Table of Contents cont.

Table of Contents cont.

Table of Contents cont.

Page

LIST OF ILLUSTRATIONS

ATTACHMENTS
(At End of Report)

EXECUTIVE SUMMARY

The Simpson Park Range Geology-Energy-Minerals (GEM) Resource Area (GRA) is in Eureka and Lander Counties, about 30 miles northeast of Austin, which is in Lander County. There is one Wilderness Study Area (WSA), NV 060-428, which lies across the Eureka-Lander County line.

In the northern part of the WSA the rocks exposed are nearly all about 500 million years old. They belong to two different sedimentary geological units that were originally deposited essentially simultaneously 50 miles or more apart, but later one was superimposed above the other by movement on a very extensive, more-or-less-flat thrust fault. Long after the thrust faulting, a granite body was intruded into these rocks a few miles north of the WSA and perhaps also at places within the WSA though no such bodies are exposed. Mineralizing solutions from the known body formed metallic mineral deposits in the sediments around it. Somewhat similar mineral occurrences are reported throughout the exposed area of the sediments in the WSA. In the southern part of the WSA the surface rocks are volcanic units less than 50 million years old but it is geologically certain that the older sediments and the thrust fault are present beneath the volcanic rocks.

The only mining district in the GRA is the Roberts district, several miles north of the WSA. It has produced a few thousand dollars in lead and zinc. Small reserves of barite are known on the Black Sheep claim group a short distance north of the WSA.

The only patented claims are in the Roberts district. The northern part of the GRA, including the northern three miles of the WSA, is almost solidly covered by unpatented claims that are probably located primarily for barite but are reported to also have potential for large low-grade gold deposits. Oil and gas leases cover the valley and lower mountain slopes of the WSA. There are no geothermal leases in the WSA. There are no sodium and potassium leases in the WSA, and no material sites.

All of WSA NV 060-428 is classified as moderately favorable for disseminated gold deposits, with a low level of confidence. The entire WSA is classified as having low favorability for uranium, with a low level of confidence and very low favorability for thorium with a very low level of confidence. Much of the north end of the WSA -- several square miles -- is classified as highly favorable for barite resources, with a high level of confidence. The remainder of the north half of the WSA is classified as moderately favorable for barite with a moderate level of confidence, and two very small areas in the south half are classified as having low favorability for barite with a low level of confidence. The remainder of the south half of the WSA is classified as having low favorability for nonmetallic minerals, with a low level of confidence. There is very low favorability for oil and gas with moderate confidence. There is low

favorability with a low confidence level for geothermal in the Grass Valley range front area, but not in the mountains. The entire WSA is classified as having very low favorability for sodium and potassium, with a high level of confidence.

It is recommended that a strong effort be made to get information on geology, mineralization and alteration in the WSA from mining companies.

I. INTRODUCTION

The Simpson Park G-E-M Resources Area (GRA No. NV-07) contains approximately 170,000 acres (670 sq km) and includes the following Wilderness Study Area (WSA):

WSA Name	WSA Number
Simpson Park	NV 060-428

The GRA is located in Nevada in the Bureau of Land Management's (BLM) Shoshone/Eureka Resource Area, Battle Mountain district. Figure 1 is an index map showing the location of the GRA. The area encompassed is near 39°45' north latitude, 116°38' west longitude and includes the following townships:

T 24 N, R 48,49 E
T 23 N, R 47,48 E
T 22 N, R 47,48 E
T 21 N, R 47,48 E
T 20 N, R 47,48 E

The areas of the WSA are on the following U. S. Geological Survey topographic maps:

15-minute:

Walti Hot Springs
Ackerman Canyon

The nearest town is Austin which is located about 30 miles southwest of the GRA. Access to the area is via U. S. Highway 50 to the south. Access within the area is along unimproved dirt roads and light duty roads throughout the GRA.

Figure 2 outlines the boundaries of the GRA and the WSA on a topographic base at a scale of 1:250,000.

Figure 3 is a geologic map of the GRA and vicinity, also at 1:250,000. At the end of the report, following the Land Classification Maps, is a geologic time scale showing the various geologic eras, periods and epochs by name as they are used in the text, with the corresponding age in years. This is so that the reader who is not familiar with geologic time subdivisions will have a comprehensive reference for the geochronology of events.

This GRA Report is one of fifty-five reports on the Geology-Energy-Minerals potential of Wilderness Study Areas in the Basin and Range province, prepared for the Bureau of Land Management by the Great Basin GEM Joint Venture.

The principals of the Venture are Arthur Baker III, G. Martin Booth III, and Dennis P. Bryan. The study is principally a literature search supplemented by information provided by claim owners, other individuals with knowledge of some areas, and both specific and general experience of the authors. Brief field verification work was conducted on approximately 25 percent of the WSAs covered by the study.

The WSA in this GRA was not field checked.

One original copy of background data specifically applicable to this GEM Resource Area Report has been provided to the BLM as the GRA File. In the GRA File are items such as letters from or notes on telephone conversations with claim owners in the GRA or the WSA, plots of areas of Land Classification for Mineral Resources on maps at larger scale than those that accompany this report if such were made, original compilations of mining claim distribution, any copies of journal articles or other documents that were acquired during the research, and other notes as are deemed applicable by the authors.

As a part of the contract that resulted in this report, a background document was also written: Geological Environments of Energy and Mineral Resources. A copy of this document is included in the GRA File to this GRA Report. There are some geological environments that are known to be favorable for certain kinds of mineral deposits, while other environments are known to be much less favorable. In many instances conclusions as to the favorability of areas for the accumulation of mineral resources, drawn in these GRA Reports, have been influenced by the geology of the areas, regardless of whether occurrences of valuable minerals are known to be present. This document is provided to give the reader some understanding of at least the most important aspects of geological environments that were in the minds of the authors when they wrote these reports.

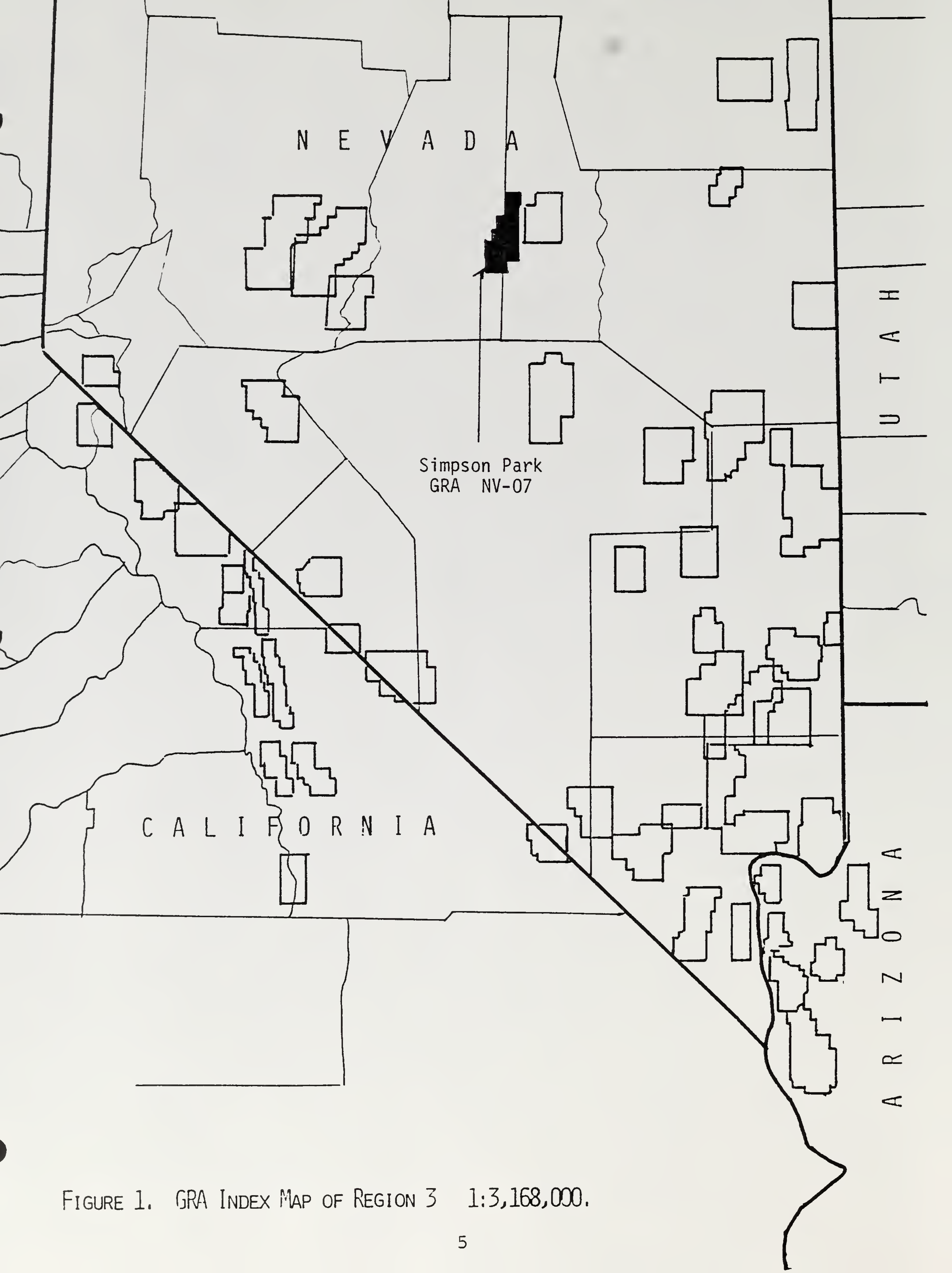
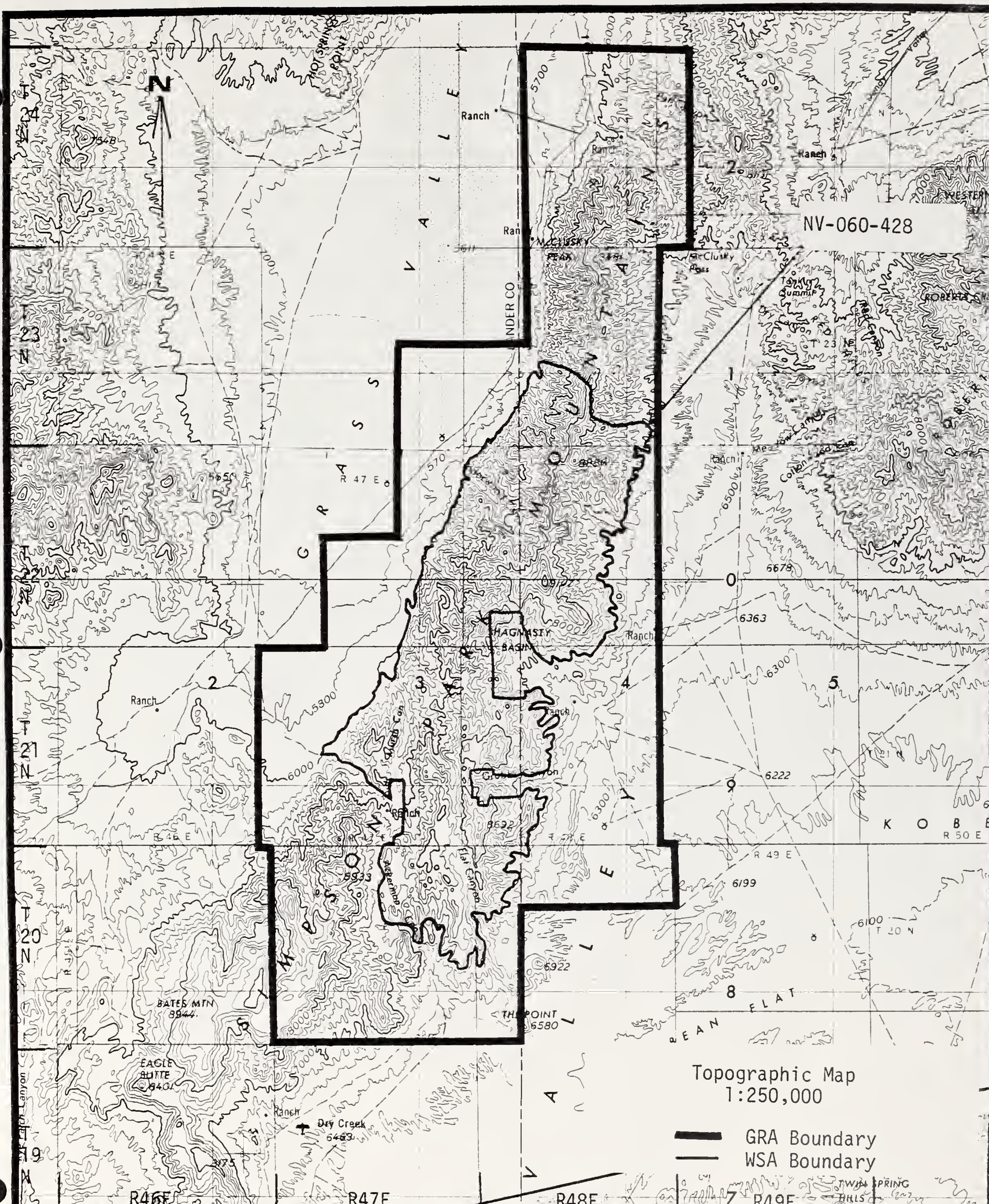


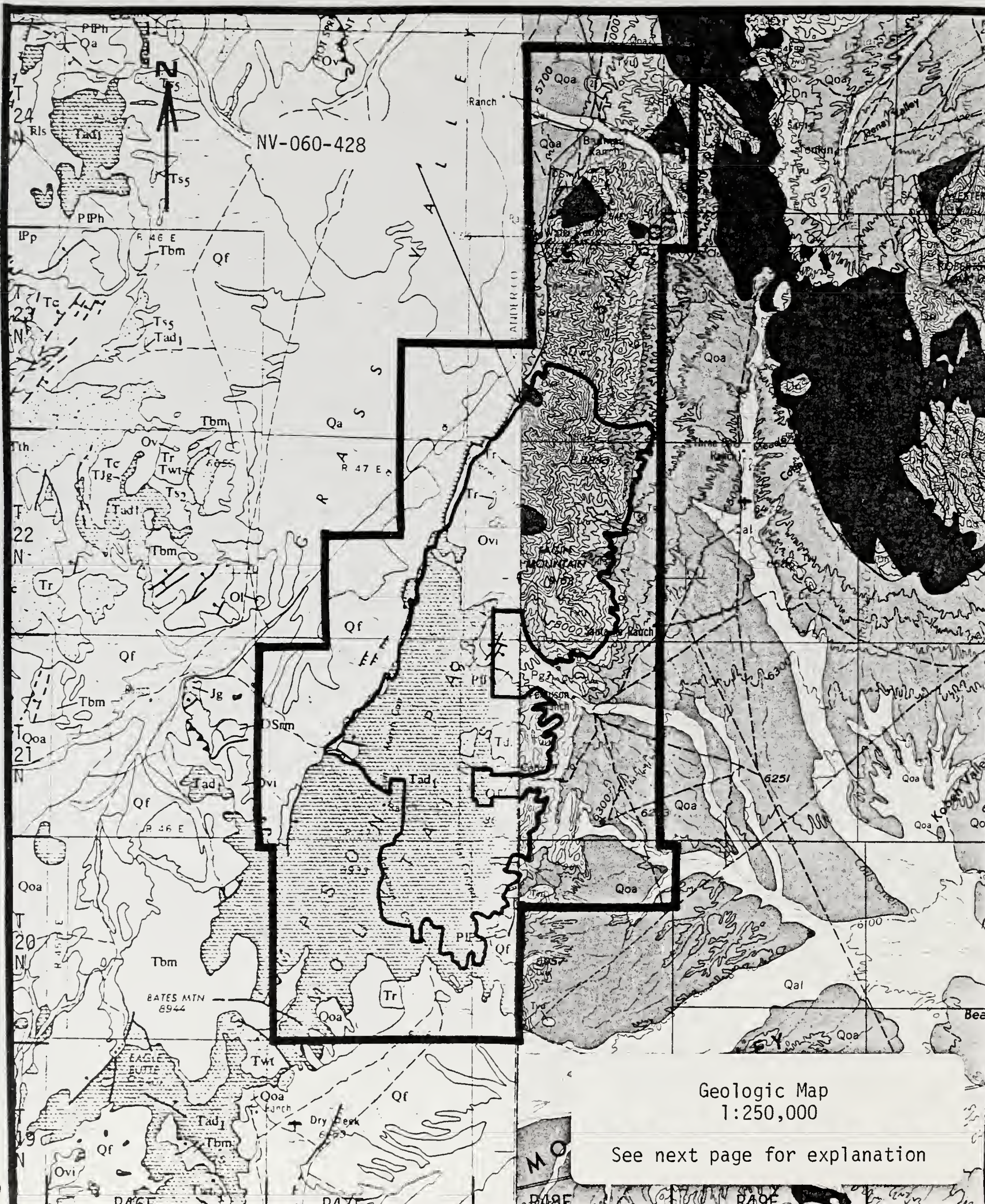
FIGURE 1. GRA INDEX MAP OF REGION 3 1:3,168,000.



Millett Sheet

Simpson Park GRA NV-07

Figure 2



Roberts, Montgomery and Lehner (1967); Stewart and McKee (1977)

Simpson Park GRA NV-07

Figure 3

EXPLANATION

QUATERNARY

Qal — Alluvium

Qp — Playa deposits

Qs — Sinter deposits

Qoa — Older alluvium

Qvu — Volcanic rocks, undivided

QUATERNARY / TERTIARY

QTsu — Sedimentary deposits, undivided

QTvu — Volcanic rocks, undivided

TERTIARY

Tg — Gravels

Tvu — Volcanic rocks, undivided

TERTIARY / CRETACEOUS

ir — Intrusive rocks
Includes Jurassic, Cretaceous, and Tertiary rocks

CRETACEOUS

Kn — Newark Canyon Formation

JURASSIC(?) AND CRETACEOUS(?)

KJv — Volcanic rocks
Includes porphyritic rocks of Permian(?) age in Dry Hills.

MAJOR ANGULAR UNCONFORMITY

OVERLAP ASSEMBLAGE
(CLASTIC ROCKS)

PERMIAN

Pg — Garden Valley Formation
Queried where doubtful

Pc — Carbon Ridge Formation

PENNSYLVANIAN OR PERMIAN

PPb — Brock Canyon Formation

PENNSYLVANIAN

Pe — Ely Limestone

Ely Limestone

Md

Diamond Peak Formation

Mc

Chainman Shale

Mu

Sedimentary rocks, undivided

In the Eureka area includes Chainman and Diamond Peak Formations and may include at the base the Mississippian Joana Limestone. In the northern part of the county, includes unnamed conglomerate and the Mississippian and Pennsylvanian Tonka Formation of Dott (1955). Queried where doubtful.

MISSISSIPPIAN

ANTLER OROGENY

PRE-OROGENIC ROCKS

WESTERN ASSEMBLAGE (SILICEOUS AND VOLCANIC ROCKS)

Dwu

Sedimentary rocks, undivided

DSwu

Sedimentary rocks, undivided

May include beds partly equivalent to the Vinini Formation in Tuscarora Mountains, Pine Valley, and Fish Creek Range.

Swu

Sedimentary rocks, undivided

Mapped only in the southern Cortez Mountains (Fourmile Canyon Formation).

SOwu

Sedimentary rocks, undivided

In part equivalent to Valmy and Vinini Formations. Mapped only in Simpson Park and Tuscarora Mountains.

Ova

Valmy Formation

Ov

Vinini Formation

EASTERN ASSEMBLAGE (CARBONATE ROCKS)

Dd

Devils Gate Limestone

May include the Devonian and Mississippian Pilot Shale at the top

Dn

Nevada Formation

In Monitor Range includes Rabbit Hill Limestone.

Deu

Sedimentary rocks, undivided

Includes the Wenban Limestone and Pilot Shale in the Cortez area.

DEVONIAN

Sl

Lone Mountain Dolomite

Sr

Roberts Mountains Formation

SILURIAN

SOeu

Sedimentary rocks, undivided

Mapped only in the Mahogany Hills. Includes Hanson Creek and Roberts Mountains Formations, and Lone Mountain Dolomite.

Middle (?) and Upper Ordovician

Oh

Hanson Creek Formation

Middle Ordovician

Oe

Eureka Quartzite

Ou

Sedimentary rocks, undivided

Mapped only in the Eureka district. Includes the Pogonip Group, Eureka Quartzite, and Hanson Creek Formation.

ORDOVICIAN

Sedimentary rocks, undivided

Mapped only in the southern Cortez Mountains (Fourmile Canyon Formation).

S[illegible]

Sedimentary rocks, undivided

In p[illegible] equivalent to Valmy and Vinini Formations. Ma[illegible] only in Simpson Park and Tuscarora Mountains.

Ova

Valmy Formation

Ov

Vinini Formation

Sr

Roberts Mountains Formation

SOeu

Sedimentary rocks, undivided

Mapped only in the Mahogany Hills. Includes Hanson Creek and Roberts Mountains Formations, and Lone Mountain Dolomite.

ORDOVICIAN

Middle(?) and Upper Ordovician

Oh

Hanson Creek Formation

Middle Ordovician

Oe

Eureka Quartzite

Ou

Sedimentary rocks, undivided

Mapped only in the Eureka district. Includes the Pogonip Group, Eureka Quartzite, and Hanson Creek Formation.

Lower and Middle Ordovician

Op

Pogonip Group

Includes Goodwin Limestone, Ninemile Formation, and Antelope Valley Limestone.

CAMBRIAN

Middle and Upper Cambrian

Ꞓh

Hamburg Dolomite

Ꞓu

Sedimentary rocks, undivided

Includes in descending order: Windfall Formation, Dunderberg Shale, Hamburg Dolomite, Secret Canyon Shale, Geddes Limestone, Eldorado Dolomite, Pioche Shale, and Prospect Mountain Quartzite

Contact

Dashed where approximately located or where gradational

D

U

Fault

Dashed where approximately located; dotted where concealed. U, *upthrown side,* D, *downthrown side; queried where doubtful*

Thrust fault

Dashed where approximately located; sawteeth on upper plate

x 54F42

Fossil locality

Descriptions of fossils are given in text under Fossil Data. Fossils are listed within their appropriate assemblages and time periods in order of decreasing age.

II. GEOLOGY

The Simpson Park GRA lies in the Basin and Range province in southeastern Lander and southwestern Eureka Counties. The study area includes much of the Simpson Park Mountains, a northeast-trending fault block composed mostly of upper plate western assemblage Paleozoic clastic units transported eastward by the Roberts Mountains thrust. The Keystone window of eastern assemblage rocks located in the Gund (Walti) Ranch area is one of the exceptions. Thick Lower Tertiary volcanic units cover much of the southern portion of the study area, masking older rocks.

Basin and Range normal faulting, responsible for much of the present day topography, occurred subsequent to volcanism sometime during Miocene-Pliocene time. An extensive range front fault along the northwestern margin of the Simpson Park Mountains was formed at this time.

1. PHYSIOGRAPHY

The Simpson Park GRA lies in the Basin and Range province in southeastern Lander and southwestern Eureka counties. The study area includes most of the Simpson Park Mountains, a northeast trending structurally complex block composed largely of western assemblage rocks of the Vinini Formation and unnamed Ordovician and Silurian units. WSA 060-428, located in the center of the GRA, extends from Ackerman Canyon in the south to about four miles south of McClusky Peak in the north.

Drainage of the range is internal with the western side of the Simpson Park Mountains draining into Grass Valley and the eastern side discharging into Monitor Valley.

Elevations along the crest of the range average about 8,500 feet with the highest point of 9,163 feet at Fagin Mountain. Valley elevations range from about 5,700 feet in Grass Valley on the west to 6,300 feet in Monitor Valley on the east.

2. ROCK UNITS

The oldest rock unit in the Simpson Park GRA is the Ordovician Vinini Formation, which consists principally of chert and shale overlain by quartzite, shale, sandstone and some limestone. Coeval with the Vinini Formation is the Ordovician Valmy Formation. The Valmy Formation contains thick-bedded to massive vitreous quartzite interbedded with chert and black shale. Both of the above rock units are upper plate rocks of the Roberts Mountain thrust. In Eureka County in several locations, the Vinini and Valmy Formations along with other Ordovician and Silurian unnamed western assemblage rocks, have been combined into a mappable unit labeled SOwu (Roberts and others, 1967).

Near the Gund Ranch on the west flank of the Simpson Park Mountains in Eureka County, Roberts and others (1967) mapped a small area of Silurian and Devonian eastern assemblage rocks which may in part be equivalent to the Vinini Formation. The Devonian Nevada Formation also crops out in this area. This rock unit is equivalent to the Sevy Dolomite and Simonson Dolomite plus a part of the lower Guilmette Formation.

The Pennsylvanian-Permian Antler sequence, the next youngest rock unit, crops out along the Eureka-Lander County border. The following formations listed from bottom to top are included in the Antler Sequence: the Battle Formation (conglomerate, sandstone, shale and limestone); Antler Peak Limestone, and Edna Mountain Formation (calcareous sandstone, conglomerate and limestone). This rock unit was tentatively mapped as Permian Garden Valley Formation, part of the Overlap Assemblage of Roberts and others, (1967).

The lower Cretaceous Newark Canyon Formation is the next youngest rock unit and consists mainly of silt, shale and sandstone with some conglomerate and fresh-water limestone.

A stock near the Roberts mining district in the Keystone window area was emplaced sometime during Late Mesozoic-Early Tertiary time. This rock is largely granodiorite and commonly contains phenocrysts of plagioclase, hornblend, and biotite in a finely granular groundmass.

Tertiary volcanics in Eureka County have been mapped as an undivided rock unit by Roberts and others (1967). In Lander County, Stewart and Mckee (1977) mapped several Tertiary volcanic units. The oldest and most widespread volcanic unit is composed of andesite and dacite flows and shallow intrusives deposited sometime in the Early Oligocene. Porphyritic dacite to quartz latite shallow intrusives have been mapped in the area north of Grobb Canyon, and shallow rhyolite intrusives crop out west of the mouth of Ackerman Canyon.

Thick deposits of poorly sorted gravels, consisting of Paleozoic welded tuff and quartz monzonite fragments, were deposited during the late Tertiary, and occur along the east margin of the Simpson Park Mountains.

3. STRUCTURAL GEOLOGY AND TECTONICS

Except for windows of eastern assemblage rocks, such as the Keystone window in the Gund Ranch area, the Simpson Park Mountains are made up largely of upper plate western assemblage clastic units transported eastward by the Roberts Mountains thrust. Most of the tectonic movement on the Roberts Mountains thrust occurred during the Antler Orogeny in Late Devonian-Early Mississippian time (Smith and Ketner, 1968). Gilluly and Gates (1965) estimate at least 55 miles of tectonic transport along the thrust while Roberts and others (1958) suggest the transport may be as much as 90 miles.

The overlap assemblage, of which the Battle Formation is the basal unit, contains two unconformities -- one at the base of the Late Pennsylvanian-Early Permian Antler Peak Limestone and one at the base of the Late Permian Edna Mountain Formation. These unconformities possibly indicate times of uplift within the Antler orogenic belt.

The Lower Cretaceous Newark Canyon Formation which crops out several miles east of Bauman Ranch, is a continental clastic unit and was probably a local deposit within a generally uplifted area (Armstrong, 1968).

Basin and Range structures responsible for the present-day topography probably began to develop in Late Miocene or Early Pliocene. A range front fault bounds the western flank of the Simpson Park Mountains in the northern part of the GRA. Range front faults that may exist on the eastern flank in this area have been masked by thick deposits of Late Tertiary gravel (Roberts and others, 1967). The western range front slopes more gradually towards the valley floor in the southern portion of the study area.

4. PALEONTOLOGY

The dominant lithologies within the Simpson Park GRA are rhyolite flows, andesites, and felsic to intermediate intrusives unsuited for the preservation of paleontological resources. The only area with potential for paleontological resources is the Shagnasty basin, where fusulinids have been recorded from the Late Permian (Guadalupian) part of the Battle Formation (Roberts, 1964), and marine megainvertebrates (corals, brachiopods, bryozoa, mollusks, etc.) from the Pennsylvanian-Permian Antler Peak Limestone (Silberling and Roberts, 1962).

5. HISTORICAL GEOLOGY

During the early Paleozoic a thick sequence of eastern facies carbonate rocks was deposited in the area. During the Antler Orogeny western facies siliceous and volcanic rocks ranging in age from Cambrian to Devonian were emplaced from the west along the Roberts Mountains thrust. Two unconformities in the overlying Late Pennsylvanian and Late Permian strata indicate times of uplift within the Antler orogenic belt.

By Cretaceous time the area was generally uplifted and continental clastic deposits such as the Newark Canyon Formation were laid down. During the Late Cretaceous intrusives were emplaced in the Keystone window area.

During the Early Oligocene and overlapping the time of emplacement of younger shallow intrusives, flows and breccias of andesite and dacite were deposited.

Basin and Range faulting which formed much of the present-day topography began to develop in Late Miocene-Early Pliocene. Thick sequences of gravel derived from the erosion of the newly formed range accumulated on the flank of the Simpson Park Mountains.

III. ENERGY AND MINERAL RESOURCES

A. METALLIC MINERAL RESOURCES

1. Known Mineral Deposits

The only known metallic mineral deposits are in the Roberts district in the north end of the GRA. Here the Keystone mine is known to have produced a few tons each of lead and zinc, with a little silver valued in all at a few thousands of dollars.

2. Known Prospects, Mineral Occurrences and Mineralized Areas

The literature has no report of prospects, mineral occurrences or mineralized areas within WSA NV 060-428.

The northern end of the WSA and most of the width of the Simpson Park Range for several miles northward to the Roberts district is essentially solidly covered with unpatented claims. Glen Atwood of NL Baroid says they are located principally for barite occurrences, but there is also potential for gold (see notes in GRA file).

3. Mining Claims

As mentioned above, the north end of the WSA and the country to the north is essentially solidly covered with unpatented claims which were located primarily for barite but also have potential for gold deposits.

4. Mineral Deposit Types

If there are gold deposits in the GRA and the WSA, it is highly likely that they are low-grade disseminated Carlin-type deposits at some depth below the surface in eastern assemblage rocks. Somewhat less likely are deposits of similar or different type that may be present in the western assemblage rocks exposed at the surface.

5. Mineral Economics

Carlin-type gold deposits, if present, would have to either lie at relatively shallow depth so they could be mined by open pit methods as are all such deposits presently being mined, or else would have to have relatively high grade in order to stand the cost of underground mining.

The major use of gold is for storing wealth. It is no longer used for coinage because of monetary problems, but many gold "coins" are struck each year for sale simply as known quantities of gold that the buyer can keep or dispose of relatively easily. The greatest other use of gold is in jewelry, another form of stored wealth. In recent years industrial applications have become increasingly important, especially as a conductor in electronic instrumentation. In the United States and some other countries gold is measured in troy ounces that weigh 31.1 grams -- twelve of which make one troy pound. Annual world production is about 40 million ounces per year, of which the United States produces somewhat more than one million ounces, less than one-fourth of its consumption, while the Republic of South Africa is by far the largest producer at more than 20 million ounces per year. World production is expected to increase through the 1980s. For many years the price was fixed by the United States at $35 per ounce, but after deregulation the price rose to a high of more than $800 per ounce and then dropped to the neighborhood of $400 per ounce. At the end of 1982 the price was $460.50 per ounce.

B. NONMETALLIC MINERAL RESOURCES

1. Known Mineral Deposits

On the Black Sheep claim group a short distance north of the northern boundary of the WSA, rather small barite reserves are indicated by drilling (Keith Papke, personal communication, January 5, 1983).

2. Known Prospects, Mineral Occurrences and Mineralized Areas

NL Baroid has claims in several sections in the north end of WSA NV 060-428, and did drilling or trenching in several of them during 1982. This work was done for barite, and barite was exposed by it, although the size and quality of exposures is not known (see notes on conversation with Glen Atwood in GRA file). Mr. Atwood also stated that occurrences of barite in the southern part of the WSA are known to NL Baroid.

3. Mining Claims, Leases and Material Sites

Apparently all the unpatented claims in the northern part of the GRA were located for barite. The numerous claims in the northern part of the WSA, many of them belonging to NL Baroid, were located for barite.

4. Mineral Deposit Types

The nature of the barite occurrences is not known. The rocks are siliceous western assemblage Ordovician sediments (Roberts and others, 1967; Stewart and McKee, 1977), and such sediments contain about 55 percent of the bedded barite deposits in northern Nevada (Keith Papke, personal communication, January 5, 1983).

5. Mineral Economics

If bedded deposits of barite are present in the GRA, they could be mined and processed with standard techniques, and the highway haul to the nearest rail point near Carlin would be no greater than the haul for much of the barite currently being produced.

More than 90 percent of all barite mined is used to make mud for oil and gas well drilling, where the high specific gravity, softness and chemical inertness of the mineral are essential characteristics. Other uses of barite are in barium chemicals that have a wide variety of applications. In recent years the United States has used nearly three million tons of barite annually; usage fluctuates with oil and gas drilling activity. Domestic sources produced about two-thirds of the barite used, with Nevada being by far the largest producer. Most imported barite is used in the states near the Gulf of Mexico, where shipping costs by sea from foreign sources are lower than rail transportation costs from Nevada. Barite consumption in the United States is forecast to be about the same in the year 2000 as it presently is, although this will depend largely on oil and gas drilling activity and the forecast may be greatly in error. Domestic production is expected to continue to satisfy about two-thirds of the demand. The price for crude barite is about $25 per ton, while crushed and ground barite ready for use as drilling mud is about $50 per ton.

C. ENERGY RESOURCES

Uranium and Thorium Resources

1. Known Mineral Deposits

There are no known uranium or thorium deposits in the WSA or GRA.

2. Known Prospects, Mineral Occurrences and Mineralized Areas

There are no known uranium or thorium occurrences in the WSA or GRA.

3. Mining Claims

There are numerous unpatented claims in the northern part of the WSA and the GRA. However, it is unknown whether any of these are for uranium or thorium.

4. Mineral Deposit Types

Uranium and thorium deposit types cannot be discussed due to the lack of occurrences of these elements in the WSA or GRA.

5. Mineral Economics

Uranium and thorium appear to be of little value in the GRA or WSA due to the lack of occurrences of these elements.

Uranium in its enriched form is used primarily as fuel for nuclear reactors, with lesser amounts being used in the manufacture of atomic weapons and materials which are used for medical radiation treatments. Annual western world production of uranium concentrates totaled approximately 57,000 tons in 1981, and the United States was responsible for about 30 percent of this total, making the United States the largest single producer of uranium (American Bureau of Metal Statistics, 1982). The United States ranks second behind Australia in uranium resources based on a production cost of $25/pound or less. United States uranium demand is growing at a much slower rate than was forecast in the late 1970s, because the number of new reactors scheduled for construction has declined sharply since the accident at the Three Mile Island Nuclear Plant in March, 1979. Current and future supplies were seen to exceed future demand by a significant margin and spot prices of uranium fell from $40/pound to $25/pound from January, 1980 to January, 1981 (Mining Journal, July 24, 1981). At present the outlook for the United States uranium industry is bleak. Low prices and overproduction in the industry have resulted in the closures of numerous uranium mines and mills and reduced production at properties which have remained in operation. The price of uranium at the end of 1982 was $19.75/pound of concentrate.

Oil and Gas Resources

There are no known oil and gas deposits or oil seeps in the GRA or bordering areas, although Depco Inc. drilled the Silver State Federal 33-18 (#1 on the Oil and Gas Mineral Occurrence and Land Classification Map) to 9,120 feet in 1981. There were no oil or gas shows reported in this well (Nevada Bureau of Mines and Geology, 1982; Nevada Bureau of Mines and Geology Oil and Gas Files, 1982).

Oil and gas leases cover the valley areas and part of the mountainous portions as well in the GRA.

Oil deposits being developed and explored for in Nevada are anticipated to be of structural and/or stratigraphic trap type within the Paleozoic or Tertiary sedimentary or volcanic strata. It is currently economical to truck production from the existing oil fields in remote Railroad Valley to Nevada or out-of-state refineries.

Geothermal Resources

1. Known Geothermal Deposits

There is one geothermal deposit, Walti Hot Springs (#1 on the Geothermal Occurrences and Land Classification Map) in the GRA. This hot spring area has measured flows of at least 400 gpm of water with temperatures of up to 163.4°F. The thermal water is currently being used for space heating, and has recently been under study for electrical power generation (Geothermal Development Associates, 1980).

2. Known Prospects, Geothermal Occurrences and Thermal Areas

There are no other geothermal manifestations in the GRA aside from Walti Hot Springs, but in Grass Valley to the west there is Little Hot Springs (#2) and an unnamed hot spring (#3). On the east side of the Simpson Park Mountains, 14 miles from the WSA there are the 105°-108°F Bartine Hot Springs (#4) and the warm Bartine Ranch well (#5) (Garside and Schilling, 1979).

3. Geothermal Leases

Federal geothermal leases are present in three sections at an unnamed spring (#3) in Grass Valley.

4. Geothermal Deposit Types

The Walti Hot Springs are presently depositing silicious sinter in the main spring area. The estimated reservoir temperature is 179°F (Garside and Schilling, 1979; Mariner and others, 1974). Recent mapping indicates that nineteen thermal springs are present over a one-half square mile area. The highest temperature recorded is 162.4°F at the main spring orifice which is cut into the hot spring deposit. Photogeologic and field mapping shows northwest-trending faults extending from the mountains, through the hot spring area, and beyond into the valley playa. A northeasterly set of faults may also be present in the hot spring structural system (Geothermal Development Associates, 1980).

Geothermal resources are hot water and/or steam which occurs in subsurface reservoirs or at the surface as springs. The temperature of a resource may be about 70°F (or just above average ambient air temperature) to well above 400°F in the Basin and Range province.

The reservoirs may be individual faults, intricate fault-fracture systems, or rock units having intergranular permeability -- or a combination of these. Deep-seated normal faults are believed to be the main conduits for the thermal waters rising from thousands of feet below in the earth's crust.

The higher temperature and larger capacity resources in the Basin and Range are generally hydrothermal convective systems. The lower temperature reservoirs may be individual faults bearing thermal water or lower pressured, permeable rock units fed by faults or fault systems. Reservoirs are present from the surface to over 10,000 feet in depth.

5. Mineral Economics

The Walti Hot Springs are currently being utilized by the Gund Ranch for space heating. Expansion of the direct utilization of the thermal waters is planned. A study has been completed that indicates low-temperature electrical power generation may be possible if drilling finds a sufficient reservoir temperature and good flow. Present electrical requirements are met by diesel powered generators.

Geothermal resources are utilized in the form of hot water or steam normally captured by means of drilling wells to a depth of a few feet to over 10,000 feet in depth. The fluid temperature, sustained flow rate and water chemistry characteristics of a geothermal reservoir determine the depth to which it will be economically feasible to drill and develop each site.

Higher temperature resources (agove 350°F) are currently being used to generate electrical power in Utah and Claifornia, and in a number of foreign countries. As fuel costs rise and technology improves, the lower temperature limit for power will decrease appreciably -- especially for remote sites.

All thermal waters can be beneficially used in some way, including fish farming (68°F), warm water for year-round mining in cold climates (86°F), residential space heating (122°F), greenhouses by space heating (176°F), drying of vegetables (212°F), extraction of salts by evaporation and crystallization (266°F), and drying of diatomaceous earth (338°F).

Unlike most mineral commodities remoteness of resource location is not a drawback. Domestic and commercial use of natural thermal springs and shallow wells in the Basin and Range Province is an historical fact for over 100 years.

Development and maintenance of a resource for beneficial use may mean no dollars or hundreds of millions of dollars, depending on the resource characteristics, the end use and the intensity or level of use.

D. OTHER GEOLOGICAL RESOURCES

No other geological resources are known in WSA NV 060-428. There is no potential for coal, nor for oil shale.

E. STRATEGIC AND CRITICAL MINERALS AND METALS

A list of strategic and critical minerals and metals provided by the BLM was used as a guideline for the discussion of strategic and critical materials in this report.

The Stockpile Report to the Congress, October 1981 - March 1982, states that the term "strategic and critical materials" refers to materials that would be needed to supply the industrial, military and essential civilian needs of the United States during a national emergency and are not found or produced in the United States in sufficient quantities to meet such need. The report does not define a distinction between strategic and critical minerals.

There is no known favorability for any strategic or critical minerals or metals in WSA NV 060-428.

IV. LAND CLASSIFICATION FOR G-E-M RESOURCES POTENTIAL

The maps at 1:250,000 by Roberts and others (1967) and Stewart and McKee (1977) provide coarse geological background as is required by the small scale of the maps; we found no more detailed mapping. There is virtually no published data on mineralization occurrences in the WSA. Everything we could learn came from either private sources or the Nevada Bureau of Mines and Geology, and it is very clear that there is much more information in private hands that we did not acquire. One company told us it knew of "several" barite occurrences in the southern part of the WSA and was going to send us at least non-specific locations for these, but the information did not arrive. The quantity of geological information available is low, though its quality is good for the scale at which it is presented. The quantity of information concerning mineralization and alteration occurrences is very low, though the quality of what we have is high. The level of confidence in the available geological and mineralization data is very low, because we have so little and we are almost certain that at least one and probably more companies have detailed geological and geochemical information about the WSA.

Land classification areas are numbered starting with the number 1 in each category of resources. Metallic mineral land classification areas have the prefix M, e.g., M1-4D. Uranium and thorium areas have the prefix U. Nonmetallic mineral areas have the prefix N. Oil and gas areas have the prefix OG. Geothermal areas have the prefix G. Sodium and potassium areas have the prefix S. The saleable resources are classified under the nonmetallic mineral resource section. Both the Classification Scheme, numbers 1 through 4, and the Level of Confidence Scheme, letters A, B, C, and D, as supplied by the BLM are included as attachments to this report. These schemes were used as strict guidelines in developing the mineral classification areas used in this report.

Land classifications have been made here only for the areas that encompass segments of the WSA. Where data outside a WSA has been used in establishing a classification area within a WSA, then at least a part of the surrounding area may also be included for clarification. The classified areas are shown on the 1:250,000 mylars or the prints of those that accompany each copy of this report.

In connection with nonmetallic mineral classification, it should be noted that in all instances areas mapped as alluvium are classified as having moderate favorability for sand and gravel, with moderate confidence, since alluvium is by definition sand and gravel. All areas mapped as principally limestone or dolomite have a similar classification since these rocks are usable for cement or lime production. All areas mapped as other rock, if they do not have specific reason for a different classification, are classified as having low favorability, with low confidence, for nonmetallic mineral potential, since any mineral material can at least be used in construction applications.

1. LOCATABLE RESOURCES

a. Metallic Minerals

WSA NV 060-428

M1-3B. This land classification covers the entire WSA. From the regional geology it is clear that the entire WSA is underlain by the Roberts Mountain thrust fault, and beneath this by eastern assemblage Lower Paleozoic rocks. The eastern assemblage rocks are the most common hosts for Carlin-type disseminated gold deposits, and immediately below the Roberts Mountain thrust is the most common structural setting for such deposits. The rocks above the thrust fault can also host gold deposits. Thus, both the favorable rock type and the favorable structural situation are present throughout the area. The presence of barite, some of it in veins, at presently unknown locations (see notes on talk with Mr. Atwood, in GRA file), indicates that there has been hydrothermal activity at least at some places in the WSA. In the southern part of the WSA north of Grubbs Canyon, Tertiary intrusive bodies (Steward and McKee, 1977) may have been the source of hydrothermal solutions. Thus, the general geological environment, plus the mineralization indicated by barite occurrences, are the reasons for the classification as moderately favorable for gold resources. The level of confidence is low because the potential sites for such resources, in or under the Roberts Mountain thrust fault, cannot be seen because of the overlying rocks.

b. Uranium and Thorium

WSA NV 060-428

U1-2B. This land classification covers virtually all of WSA NV 060-428 and most of the northeastern and southwestern parts of the GRA. These areas are covered by Tertiary andesites, tuffs and rhyolitic intrusives and lower Paleozoic sediments. The area has low favorability at a low confidence level for fracture-filling uranium deposits. The ash flow tuffs and rhyolites are possible sources of uranium which could be mobilized by ground water and deposited in fractures in these or other rock types.

Three stream sediment samples, collected northwest and south of the WSA, and derived from Tertiary volcanics, had anomalous uranium concentrations (greater than 10 ppm); and four ground-water samples in the northern part of the

GRA had greater than 5 ppb uranium (Wagoner, 1978), indicating that the volcanics in the WSA may be sources of uranium.

The area has very low favorability with very low confidence for thorium deposits due to the apparent lack of granitic or pegmatitic source rocks.

U2-2B. This land classification covers areas along the western, eastern and southern borders of the GRA which are covered by Quaternary alluvium. These areas have low favorability with low confidence for epigenetic sandstone-type uranium deposits. Tertiary tuffs and rhyolites in the Simpson Park Range are possible uranium source rocks. Ground water could mobilize uranium from these rocks and deposit it in reducing zones in the alluvium adjacent to the source areas.

The area has very low favorability with very low confidence for thorium due to the apparent lack of suitable source rocks.

c. Nonmetallic Minerals

WSA NV 060-428

N1-4D. This classification area covers the northernmost two or three miles of the WSA. Just outside the WSA boundary there is a drilled barite deposit on the Black Sheep claim group that has at least small reserves (Keith Papke, personal communication January 5, 1983). Within the WSA there are known barite occurrences drilled or trenched by NL Baroid in 1982 (see Glen Atwood notes in GRA file). The known presence of reserves and occurrences is the reason for the classification as highly favorable for barite, and the high level of confidence for this classification.

N2-3C. This classification area covers most of the remainder of the northern half of the WSA. In it the rocks are the western assemblage Ordovician rocks that are known to be favorable for bedded barite deposits (Keith Papke personal communication January 5, 1983), and in which barite occurrences are reported by Glen Atwood (see notes in GRA file). The favorable geologic environment and the presence of barite occurrences are the reasons for the classification as moderately favorable for barite resources, and the moderate level of confidence.

N3-2B. This is a very small area of about one square mile adjacent to the reentrant in the eastern boundary of the WSA at Shagnasty Canyon. Here the western assemblage Ordovician rocks are exposed. The presence of the rocks favorable for barite is the reason for the low level of favorability, but the absence of any knowledge of barite occurrences is the reason for the low level of confidence.

N4-2B. This is another very small classification area at the southwestern point of the WSA. Ordovician western assemblage rocks are exposed here, and the rationale for the classification and level of confidence is the same as for N3-2B.

N5-2B. This classification area covers most of the southern half of the WSA. In it only Tertiary volcanic and intrusives rocks are exposed and no nonmetallic mineral occurrences are known. However, any mineral material can become an economic nonmetallic mineral if someone can develop a use that takes advantage of its particular chemical or physical characteristics. This is the reason for the low favorability and low level of confidence in the classification.

2. LEASABLE RESOURCES

a. Oil and Gas

WSA NV 060-428

OG1-1C. The WSA is underlain by the Simpson Park Mountains horst block. The core is largely of Ordovocian and Silurian rocks which are much older than known source rocks for oil and gas in Nevada. Tertiary age volcanics and gravels cover the Paleozoics over an extensive area in the remaining parts of the WSA. The presence of source and reservoir horizons is thought to be slight at best, and there is an absence of likely structural trap conditions.

The oil and gas leases present are believed to be extensions of valley leasing positions which probably go too far into the mountains.

b. Geothermal

WSA NV 060-428

G1-2A. This classification covers the narrow range front part of the WSA on the Grass Valley side. The Walti Hot Springs structural control is by means of range front faults and faults which pass from the range northwesterly through Walti. This area is on the same mountain front and only four miles to the south of the hot springs. A number of leases were filed for in this classification area, but there are no leases now.

G2-1A. The known thermal springs in this region are restricted to the valleys. The geologic environment does not indicate favorability for the presence of geothermal resources in the mountain areas of the WSA.

c. Sodium and Potassium

S1-1D. The WSA has no known potential for sodium or potassium, and there is no geological reason to expect such potential, so the entire WSA is classified as having very low favorability with high confidence for sodium and potassium. No land classification map for sodium and potassium is presented with this report.

3. SALEABLE RESOURCES

Saleable resources were considered in connection with nonemtallic minerals.

V. RECOMMENDATIONS FOR ADDITIONAL WORK

A strong effort should be made to acquire from mining companies information concerning geology, mineralization and alteration in the WSA. This may require sending someone to Denver or elsewhere to view data. Time and money constraints permitted us to make only a cursory effort at getting such information.

VI. REFERENCES AND SELECTED BIBLIOGRAPHY

Armstrong, R. L., 1968, The Sevier orogenic belt in Nevada and Utah: Geol. Soc. America Bull., v. 79, p. 429-458.

Atwood, Glen, 1983, Notes on telephone conversation; in GRA file.

Garside, L. J., 1973, Radioactive mineral occurrences in Nevada: Nevada Bur. of Mines and Geol. Bull. 81.

Garside, L. J., and Schilling, J. H., 1979, Thermal waters of Nevada: Nevada Bur. of Mines and Geol. Bull. 91.

Geothermal Development Associates, 1980, Feasibility of using low temperature geothermal resources for electrical power generation at the Gund Research and Demonstration Ranch, Nevada: Unpublished report prepared for the Agricultural Experiment Station, College of Agruculture, University of Nevada-Reno.

Gilluly, J. and Gates, O., 1965, Tectonic and igneous geology of the northern Shoshone Range, Nevada, with sections on gravity in Crescent Valley by Donald Plouff and economic geology by K. B. Ketner: U. S. Geol. Survey Prof. Paper 465.

Johnson, J. G., 1965, Lower Devonian stratigraphy and correlation, northern Simpson Park Range, Nevada: Canadian Petroleum Geology Bull., v. 13, no. 3, p. 365-381.

Mariner, R. H., Rapp, J. B., Willey, L. M., and Presser, T. S., 1974, Chemical composition and estimated minimum thermal reservoir temperatures of the principal hot springs of northern and central Nevada: U. S. Geol. Survey open-file report.

Nevada Bureau of Mines and Geology, 1982, List of wells drilled for oil and gas 1 January 1977 through the present (November 8, 1982): Nevada Bur. of Mines and Geol. List L-4.

Nevada Bureau of Mines and Geology Oil and Gas Files, 1982.

Roberts, R. J., 1964, Stratigraphy and structure of the Antler Peak quadrangle, Humboldt and Lander Counties, Nevada: U. S. Geol. Survey Prof. Paper 459-A, 93 p.

Roberts, R. J., Hotz, P. E., Gilluly, J., and Ferguson, H. G., 1958, Paleozoic rocks of north-central Nevada: Am. Assoc. Petroleum Geologists Bull., v. 42, no. 12, p. 2813-2857.

Roberts, R. J., Montgomery, K. M., and Lehner, R. E., 1967, Geology and mineral resources of Eureka County, Nevada: Nevada Bur. Mines Bull. 64. Best available geology for the eastern part of the GRA.

Silberling, N. J., and Roberts, R. J., 1962, Pre-Tertiary stratigraphy and structure of northwestern Nevada: Geol. Soc. America Spec. Paper 72, 58 p.

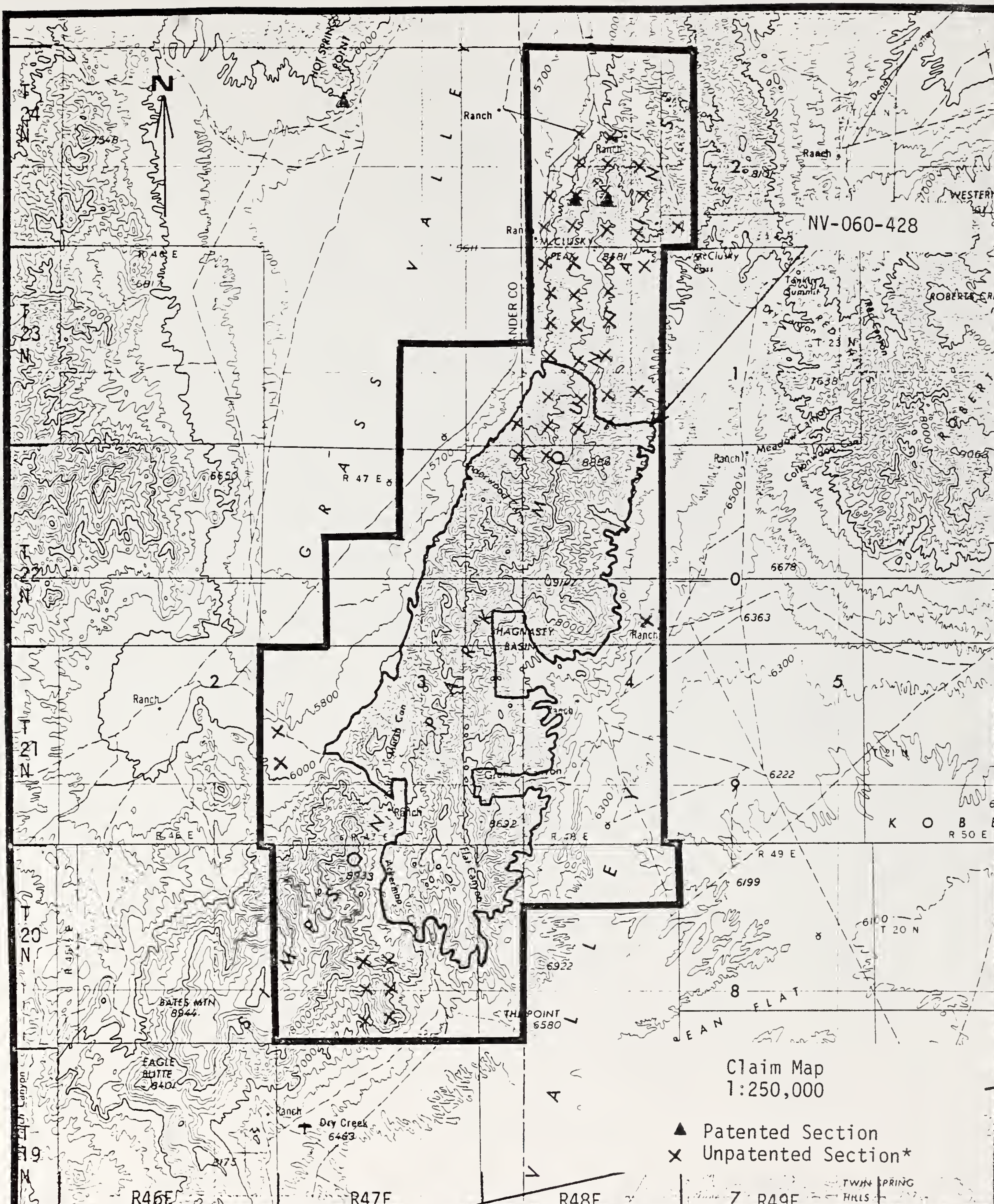
Smith, J. F., Jr., and Ketner, K. B., 1968, Devonian and Mississippian rocks and the date of the Roberts Mountains thrust in the Carlin-Pinon Range area, Nevada: U. S. Geol. Survey Bull. 1251-1.

Stewart, J. H., 1980, Geology of Nevada - a discussion to accompany the geologic map of Nevada: Nevada Bur. of Mines and Geol. Spec. Pub. 4.

Stewart, J. H., and Carlson, J. E., 1978, Geologic map of Nevada: U. S. Geol. Survey in cooperation with Nevada Bur. of Mines and Geology.

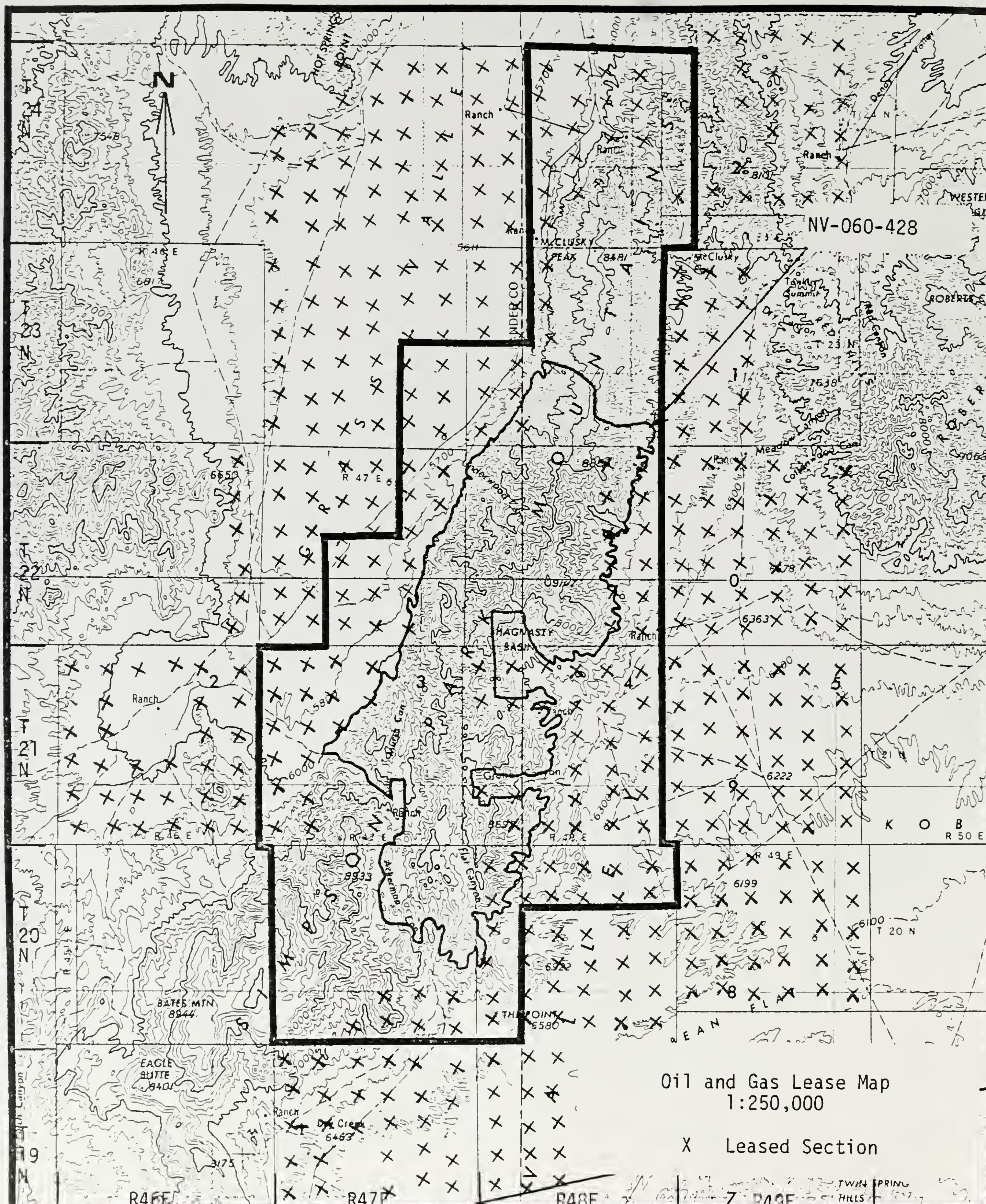
Stewart, J. H., and Mckee, E. H., 1977, Geology and mineral deposits of Lander County, Nevada: Nevada Bur. Mines Bull. 88. Best available geology of the western part of the GRA.

Wagoner, J. L., 1978, Hydrogeochemical and stream sediment reconnaissance basic data report for Millett NTMS quadrangle, Nevada, U. S. DOE Open File Report, GJBX-39(79),84 p.

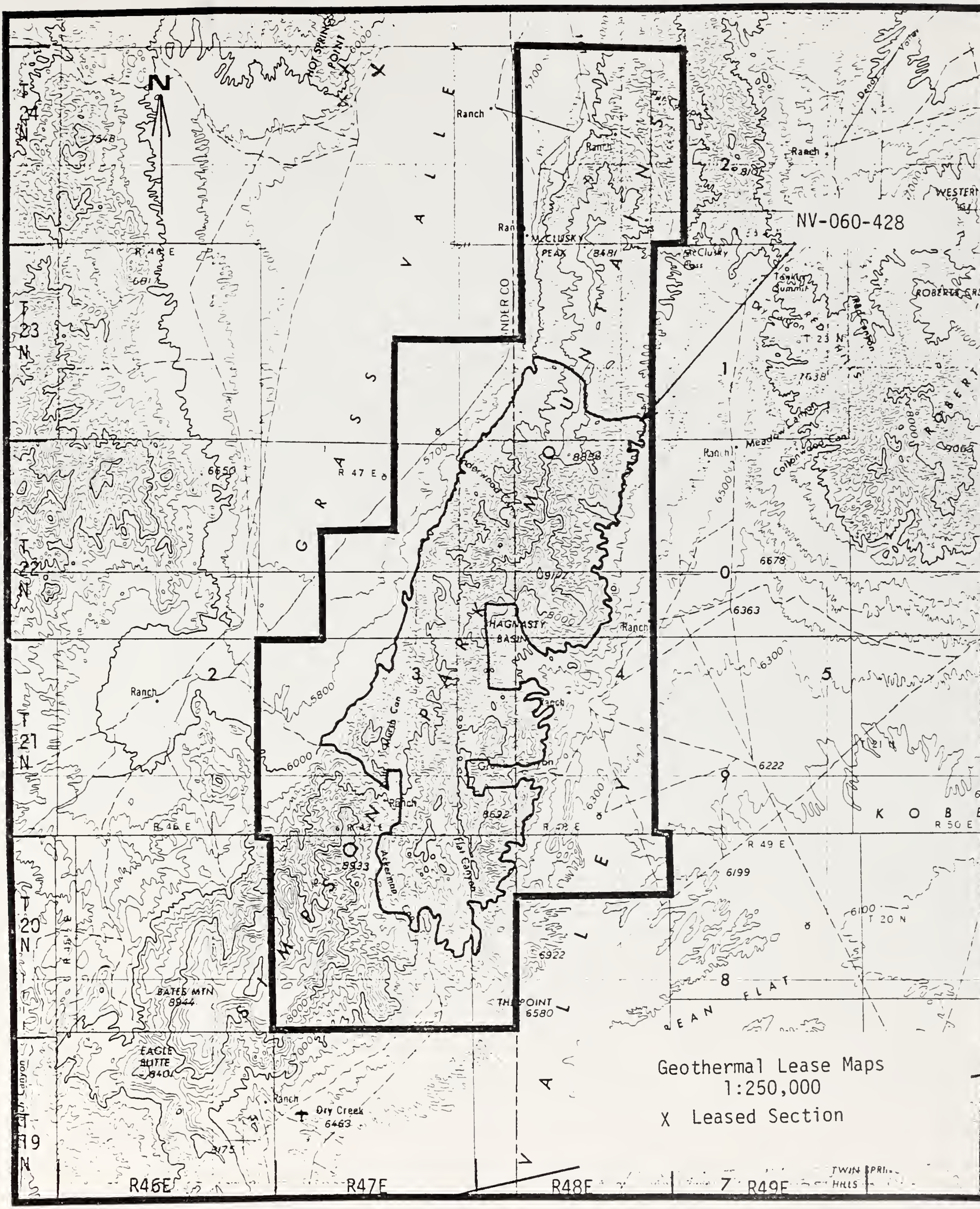


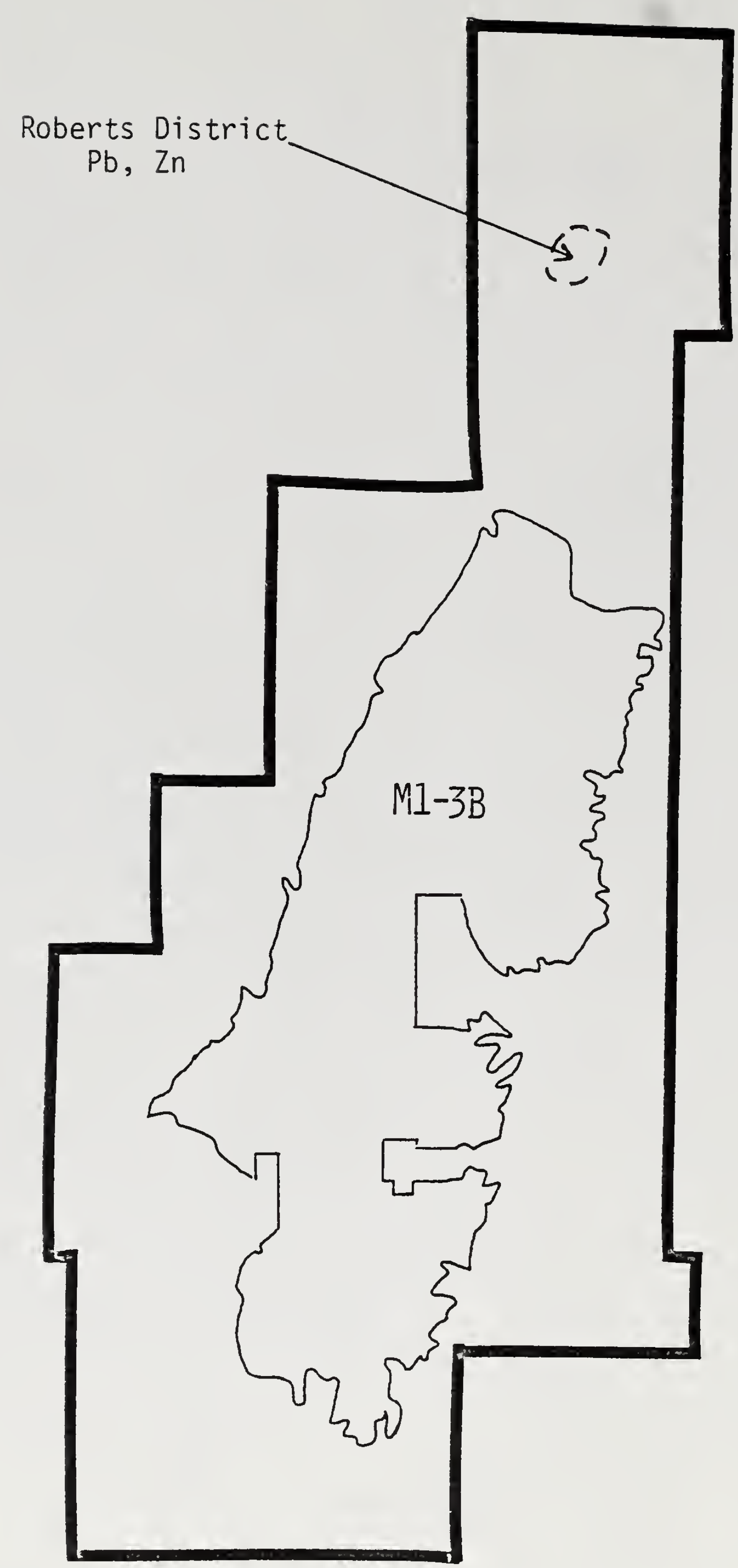
*X denotes one or more claims per section

Simpson Park GRA NV-07



Simpson Park GRA NV-07


NV-060-428
Geothermal Lease Maps
1:250,000
X Leased Section
HOT SPRINGS POINT
GRASS VALLEY
SIMPSON PARK MOUNTAINS
McCLUSKY PEAK
8481
McClusky Pass
Tonkin Summit
ROBERTS
HAGNASTY BASIN
BATES MTN
8944
EAGLE BUTTE
8401
Dry Creek
6463
THE POINT
6580
KOBE
BEAN FLAT
Ranch
T 23 N
T 22 N
T 21 N
T 20 N
T 19 N
R46E
R47E
R48E
R49E



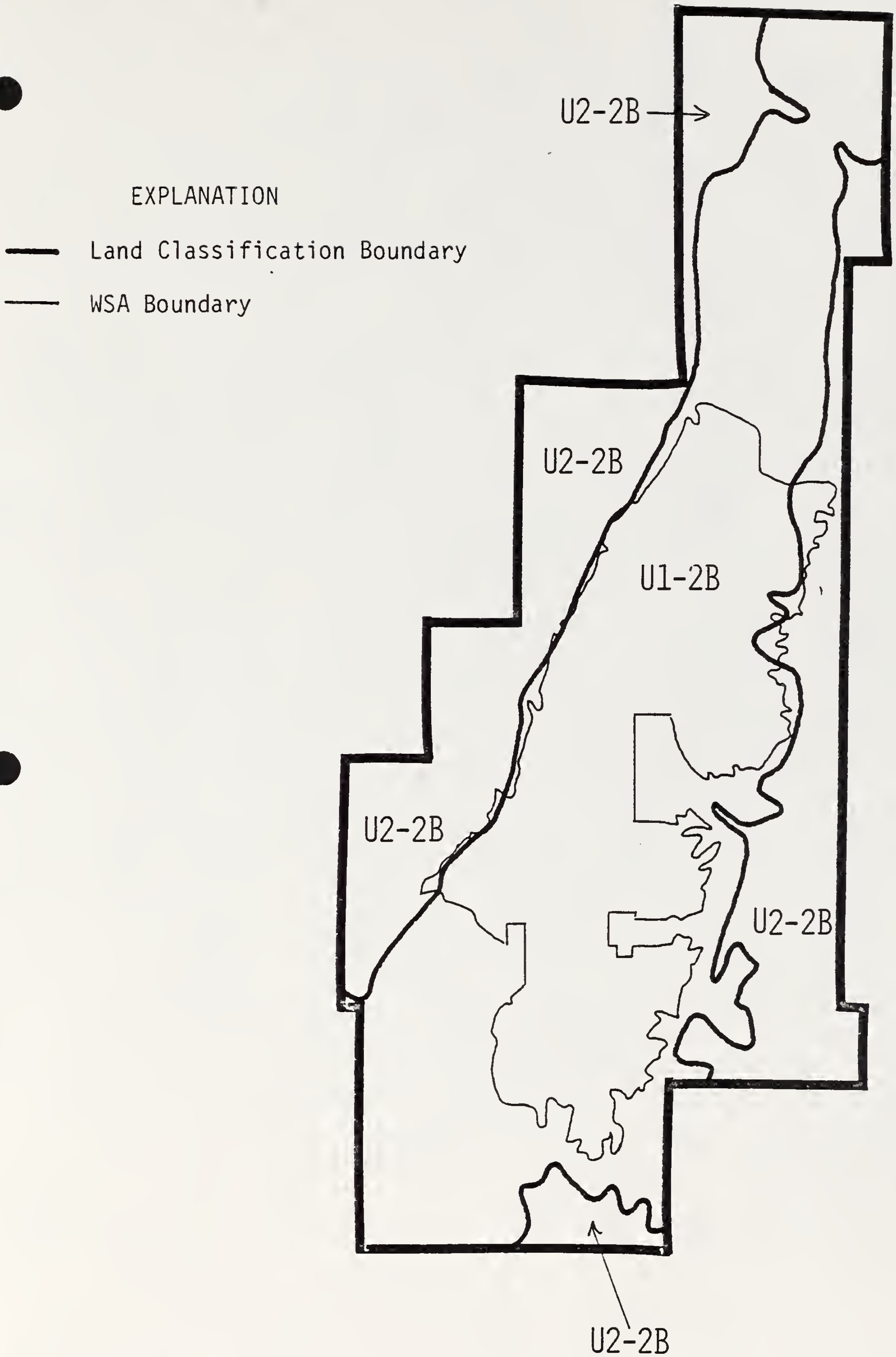
EXPLANATION

- - - - Mining District, commodity

——— Land Classification and WSA boundary

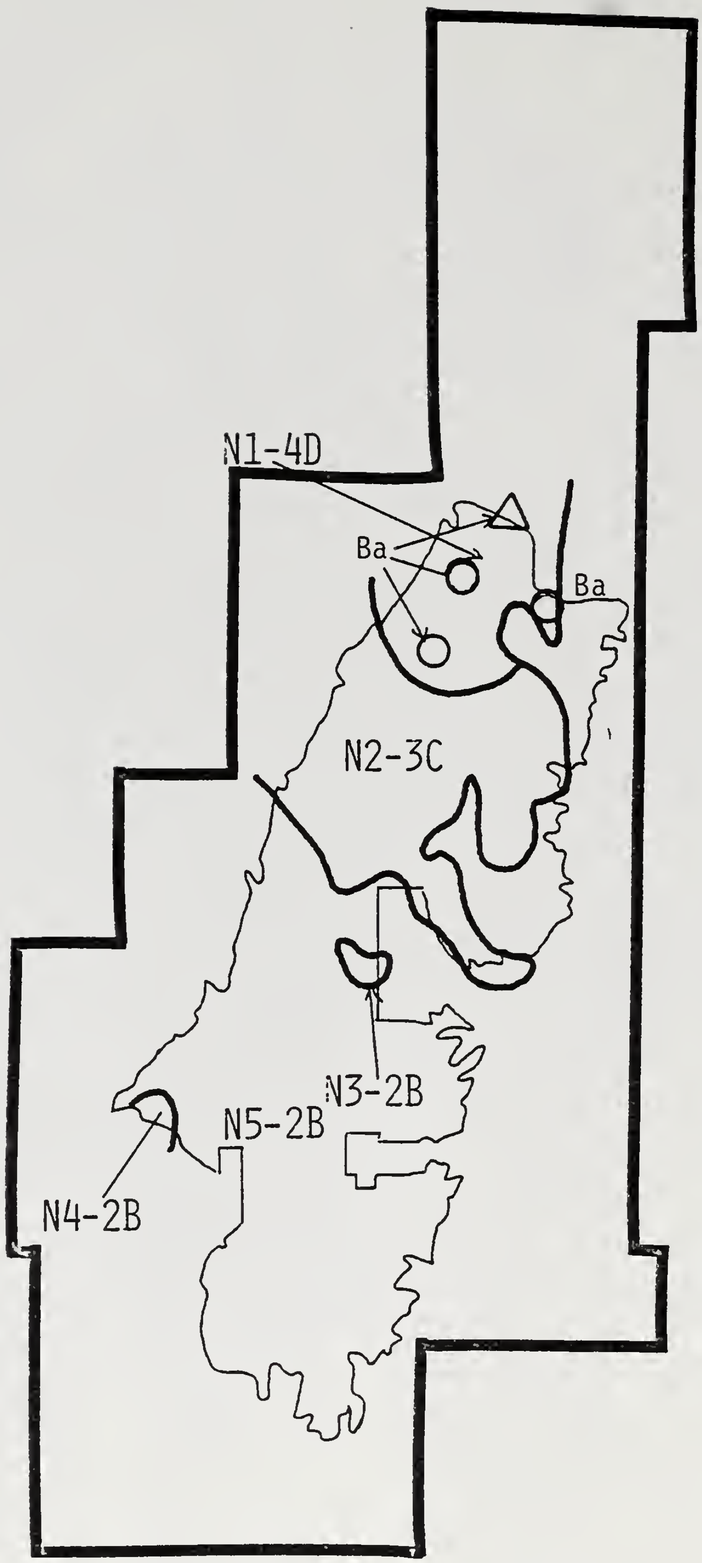
Land Classification - Mineral Occurrence Map/Metallics

Simpson Park GRA NV-07
Scale 1:250,000



Land Classification - Mineral Occurrence Map/Uranium

Simpson Park GRA NV-07
Scale 1:250,000



EXPLANATION

△ Mine, commodity

○ Occurrence, commodity

▬ Land Classification Boundary

— WSA Boundary

Land Classification - Mineral Occurrence Map/Nonmetallics

Simpson Park GRA NV-07
Scale 1:250,000

EXPLANATION

1. Reference location (see text)

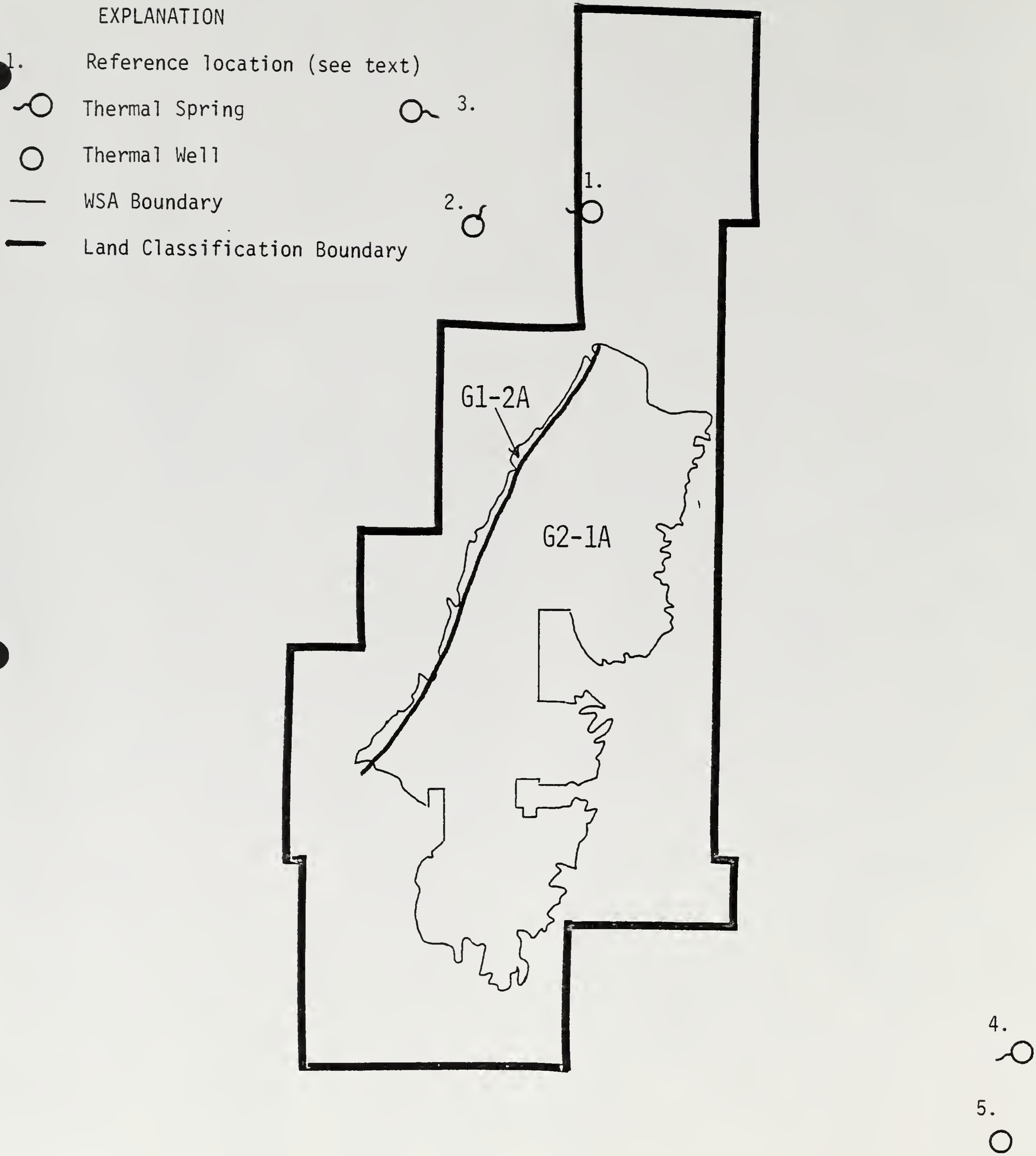
Dry Hole

— WSA and Land Classification Boundary

Land Classification - Mineral Occurrence Map/Oil and Gas

Simpson Park GRA NV-07

Scale 1:250,000



Land Classification - Mineral Occurrence Map/Geothermal

Simpson Park GRA NV-07
Scale 1:250,000

LEVEL OF CONFIDENCE SCHEME

A. THE AVAILABLE DATA ARE EITHER INSUFFICIENT AND/OR CANNOT BE CONSIDERED AS DIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES WITHIN THE RESPECTIVE AREA.

B. THE AVAILABLE DATA PROVIDE INDIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

C. THE AVAILABLE DATA PROVIDE DIRECT EVIDENCE, BUT ARE QUANTITATIVELY MINIMAL TO SUPPORT TO REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

D. THE AVAILABLE DATA PROVIDE ABUNDANT DIRECT AND INDIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

CLASSIFICATION SCHEME

1. THE GEOLOGIC ENVIRONMENT AND THE INFERRED GEOLOGIC PROCESSES DO NOT INDICATE FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

2. THE GEOLOGIC ENVIRONMENT AND THE INFERRED GEOLOGIC PROCESSES INDICATE LOW FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

3. THE GEOLOGIC ENVIRONMENT, THE INFERRED GEOLOGIC PROCESSES, AND THE REPORTED MINERAL OCCURRENCES INDICATE MODERATE FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

4. THE GEOLOGIC ENVIRONMENT, THE INFERRED GEOLOGIC PROCESSES, THE REPORTED MINERAL OCCURRENCES, AND THE KNOWN MINES OR DEPOSITS INDICATE HIGH FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

MAJOR STRATIGRAPHIC AND TIME DIVISIONS IN USE BY THE U.S. GEOLOGICAL SURVEY

Erathem or Era	System or Period	Series or Epoch	Estimated ages of time boundaries in millions of years
Cenozoic	Quaternary	Holocene	
		Pleistocene	2-3 [1]
	Tertiary	Pliocene	12 [1]
		Miocene	26 [2]
		Oligocene	37-38
		Eocene	53-54
		Paleocene	65
Mesozoic	Cretaceous [4]	Upper (Late) Lower (Early)	136
	Jurassic	Upper (Late) Middle (Middle) Lower (Early)	190-195
	Triassic	Upper (Late) Middle (Middle) Lower (Early)	225
Paleozoic	Permian [4]	Upper (Late) Lower (Early)	280
	Carboniferous Systems: Pennsylvanian [4]	Upper (Late) Middle (Middle) Lower (Early)	
	Carboniferous Systems: Mississippian [4]	Upper (Late) Lower (Early)	345
	Devonian	Upper (Late) Middle (Middle) Lower (Early)	395
	Silurian [4]	Upper (Late) Middle (Middle) Lower (Early)	430-440
	Ordovician [4]	Upper (Late) Middle (Middle) Lower (Early)	500
	Cambrian [4]	Upper (Late) Middle (Middle) Lower (Early)	570
Precambrian [4]		Informal subdivisions such as upper, middle, and lower, or upper and lower, or younger and older may be used locally.	3,600+ [3]

[1] Holmes, Arthur, 1965, Principles of physical geology: 2d ed., New York, Ronald Press, p. 360-361, for the Pleistocene and Pliocene; and Obradovich, J. D., 1965, Age of marine Pleistocene of California: Am. Assoc. Petroleum Geologists, v. 49, no. 7, p. 1087, for the Pleistocene of southern California.

[2] Geological Society of London, 1964, The Phanerozoic time-scale; a symposium: Geol. Soc. London, Quart. Jour., v. 120, supp., p. 260-262, for the Miocene through the Cambrian.

[3] Stern, T. W., written commun., 1968, for the Precambrian.

[4] Includes provincial series accepted for use in U.S. Geological Survey reports.

Terms designating time are in parentheses. Informal time terms early, middle, and late may be used for the eras, and for periods where there is no formal subdivision into Early, Middle, and Late, and for epochs. Informal rock terms lower, middle, and upper may be used where there is no formal subdivision of a system or of a series.

GEOLOGIC NAMES COMMITTEE, 1970