BLUEBELL/GOSHUTE PEAK G-E-M

RESOURCES AREA

(GRA NO. NV-02)

TECHNICAL REPORT

(WSAS NV 010-027 AND 010-033)

Contract YA-553-RFP2-1054

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Final Report

May 6, 1983

TABLE OF CONTENTS

Table of Contents cont.

Table of Contents cont.

Page

Table of Contents cont.

Page

LIST OF ILLUSTRATIONS

ATTACHMENTS
(At End of Report)

EXECUTIVE SUMMARY

The Bluebell/Goshute Peak Geology-Energy-Minerals (GEM) Resource Area (GRA) is a few miles west of Wendover, in southeastern Elko County, Nevada. There are two Wilderness Study Areas (WSAs), NV 010-027 and 010-033.

The rocks in most of the GRA are sediments, mostly limestones or related rocks, 250 million to 550 million years old. There are no intrusive rocks, but a couple of miles north of the GRA is a granitic body about 150 million years old. There are small areas on the east side of the WSAs in which volcanic rocks about 20 million years old have been mapped.

The GRA contains two small mining districts: the Decoy district at the west edge of WSA NV 010-027, which produced a substantial but unknown tonnage of manganese ore near the end of World War I, and the Ferguson Spring district at the east edge of WSA NV 010-033 which has produced small quantities of copper and silver. In WSA NV 010-027 there is an area of about one square mile in which there are exposed rocks that elsewhere are known to contain phosphate ore.

The only patented claims in the GRA are in the Ferguson Spring district, well away from the WSAs. Unpatented claims are in four general areas. Near the northeast corner of WSA NV 010-027 is a large cluster, some of which apparently lie within the WSA. In the southwest corner of WSA NV 010-027 and the northwest corner of WSA NV 010-033 are 50 or more claims in both WSAs; and three miles to the north is a scattering of claims, some of which are in WSA NV 010-027. On the east side of WSA NV 010-033 there are claims in and south of the Ferguson Spring district, some of which lie within the WSA. Another group several miles north of the district lies just outside the WSA.

Oil and gas leases cover the WSAs only along the edges near the valley areas. There are no Federal geothermal leases.

There are no sodium and potassium leases in the WSAs, and no material sites.

A small area of WSA NV 010-027 around the Decoy district is classified as highly favorable for metallic mineral resources, with a moderate level of confidence. Two small areas in the northeast and southwest corners are classified as moderately favorable for metallic resources with a low level of confidence; and the remainder is classified as having low favorability with a very low level of confidence and very low favorability for thorium with a very low level of confidence. The entire WSA is classified as having low favorability for uranium, with a low level of confidence. A small area in the north-central part of the WSA is classified as having moderate favorability for phosphates, with a low level of confidence. Parts of the eastern and western edges

of the WSA have moderate favorability for sand and gravel, with a moderate level of confidence. The remainder of the WSA has moderate favorability for limestone and dolomite resources, with a moderate level of confidence.

The geologic environment does not indicate favorability for oil and gas accumulation. There is low favorability for geothermal resources along the western mountain fronts of the WSA, but not within the main part of the range. There is a low confidence level for both oil and gas and geothermal resources.

The WSA has no potential for sodium and potassium, or for coal, oil shale or tar sands.

A small area in the northwest corner and a very small part of the eastern edge of WSA NV 010-033 have moderate favorability for metallic mineral resources, with a low level of confidence. A strip along the southern part of the east edge of the WSA has moderate favorability for metallic minerals with moderate confidence, while the remainder of the WSA has low favorability with very low confidence. The entire WSA has low favorability for uranium, with a low level of confidence and very low favorability for thorium, with a very low confidence level. A narrow, irregular strip along the west edge of the WSA has moderate favorability for sand and gravel, with a moderate level of confidence. The remainder of the WSA has moderate favorability for limestone and dolomite resources, with a moderate level of confidence.

The geologic environment does not indicate favorability for oil and gas accumulation. There is low favorability for geothermal resources along the western mountain fronts of the WSA, but not within the main part of the range. There is a low confidence level for both oil and gas and geothermal resources

The WSA has no potential for sodium and potassium, or for coal, oil shale or tar sands.

The distribution of known mineral occurrences, exclusively around the edges of the mountains, leads to the conclusion that the interior of the mountains and the WSAs has been inadequately prospected. Reconnaissance and geochemical sampling to determine if there are unknown mineralized or altered areas is recommended.

I. INTRODUCTION

The Bluebell/Goshute Peak G-E-M Resources Area (GRA No. NV-02) contains approximately 280,000 acres (1,100 sq km) and includes the following Wilderness Study Areas (WSAs):

WSA Name	WSA Number
Bluebell	NV-010-027
Goshute Peak	NV-010-033

The GRA is located in Nevada in the Bureau of Land Management's (BLM) Wells Resource Area, Elko district. Figure 1 is an index map showing the location of the GRA. The area encompassed is near 40°40' north latitude, 114°15' west longitude and includes the following townships:

T 34 N, R 67-69 E	T 33 N, R 67-69 E
T 32 N, R 67-69 E	T 31 N, R 67-69 E
T 30 N, R 67-69 E	T 29 N, R 67-69 E

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

7.5-minute:

West Morris Basin	Pilot
Morgan Pass	Ola
Lion Spring	Spring Gulch
Ferguson Mountains	White Horse Pass

The nearest town is Wendover which is located about eight miles east of the GRA. Access to the area is via U.S. Highway 50 A to the south and southeast, and Interstate 40 to the north and northeast. Access within the area is via unimproved light duty and dirt roads around the edges of the GRA.

Figure 2 outlines the boundaries of the GRA and the WSAs 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.

None of the WSAs in this GRA were field checked.

One original copy of bakcground 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: Geolgoical 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.

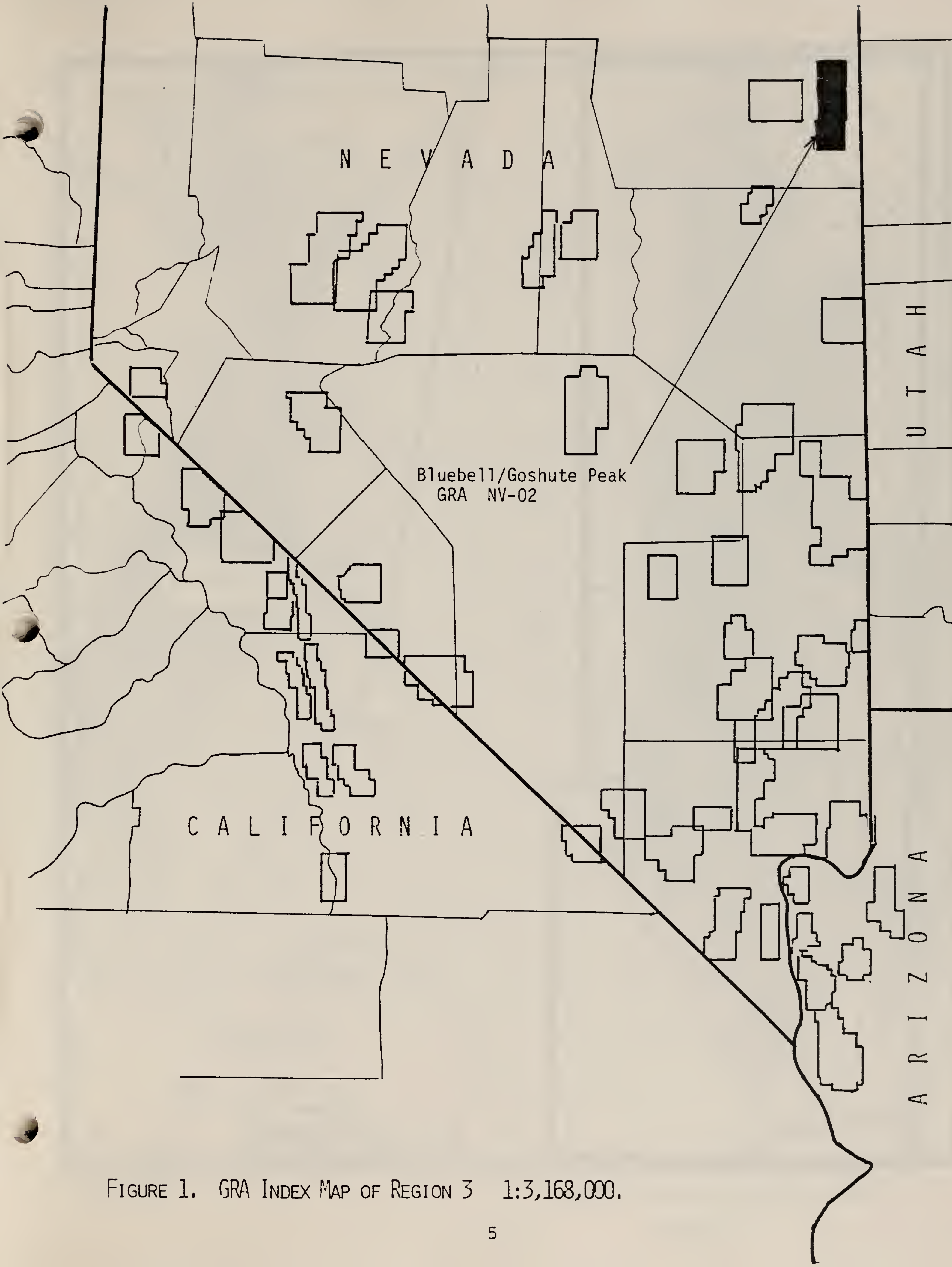
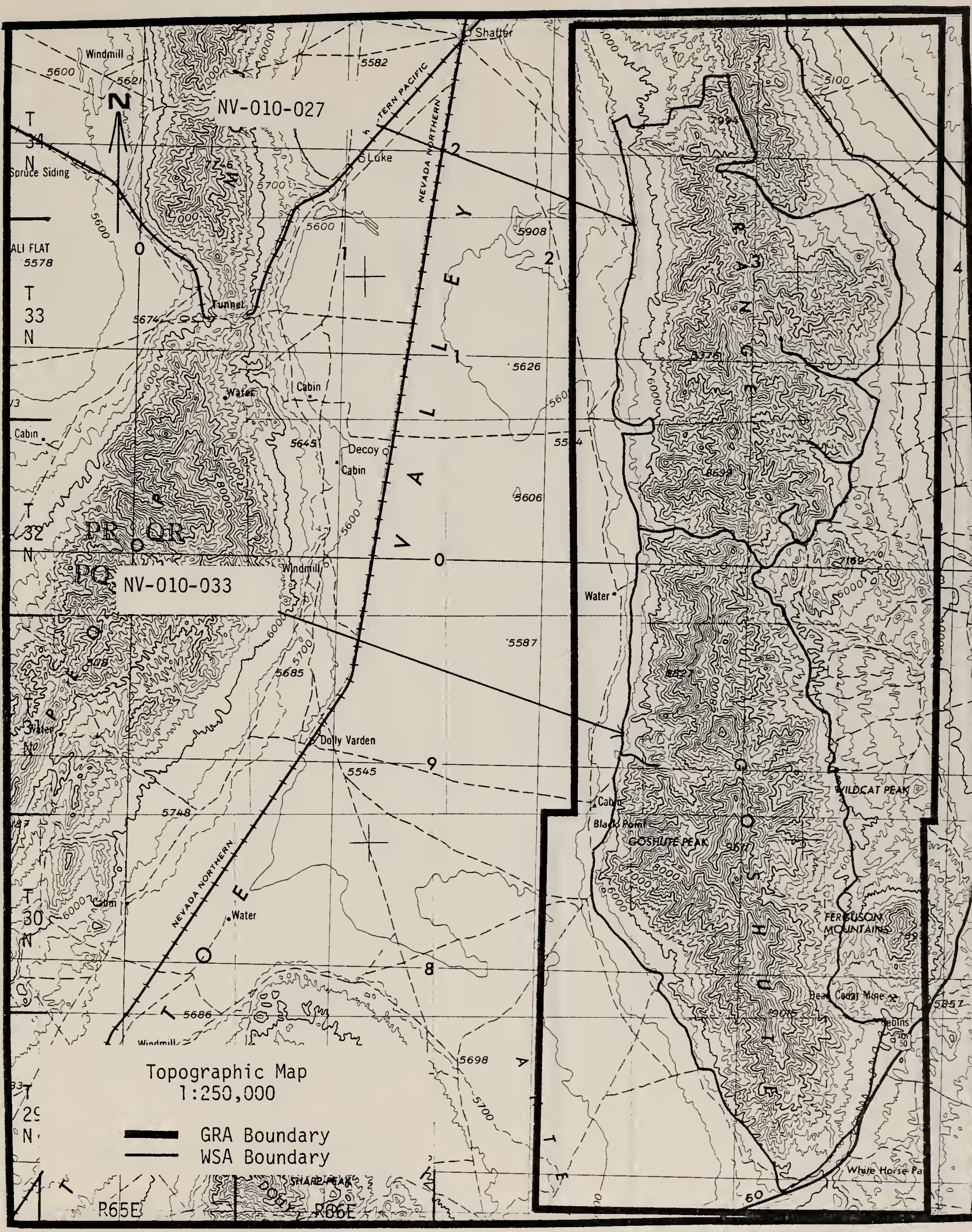


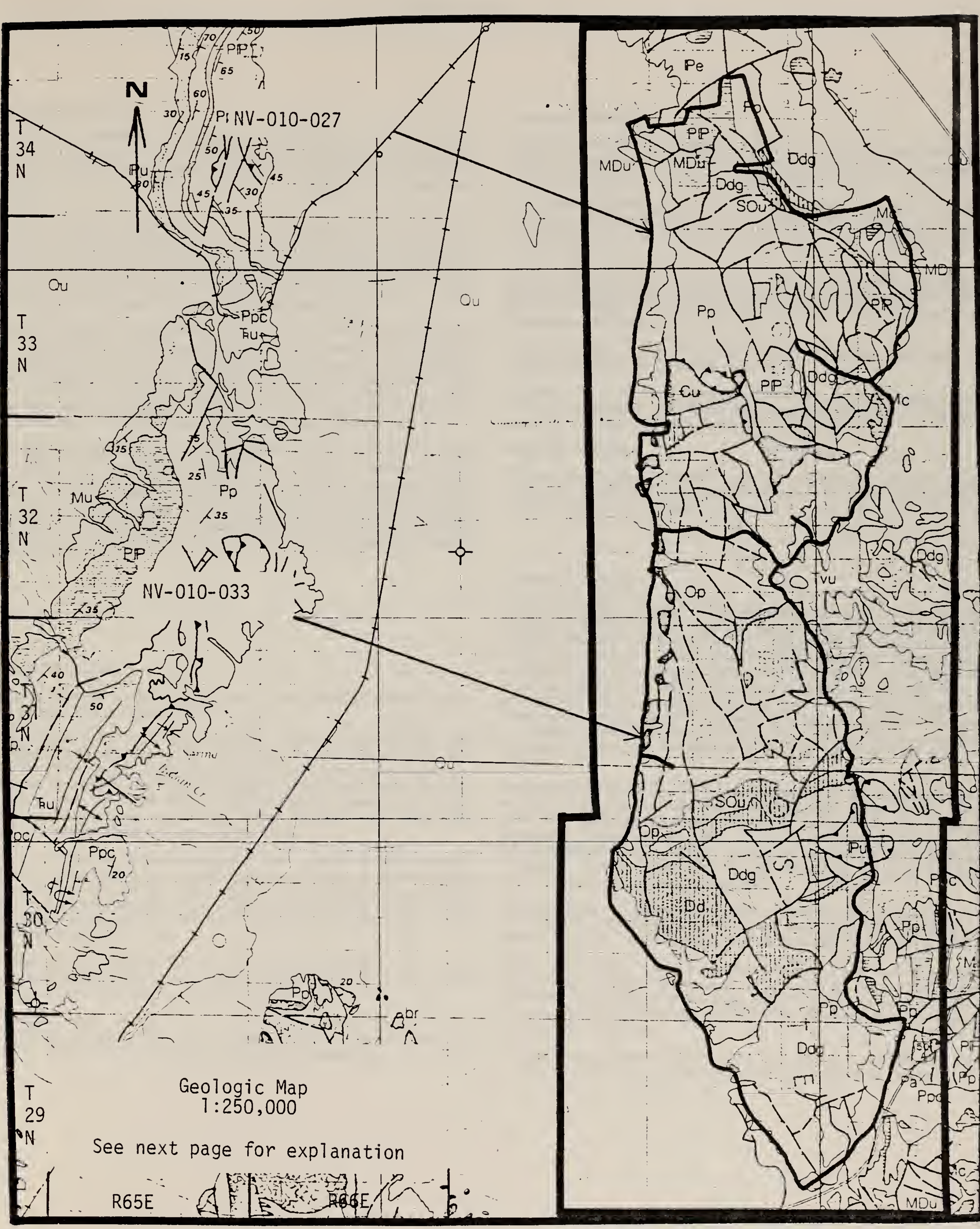
FIGURE 1. GRA INDEX MAP OF REGION 3 1:3,168,000.



Elko Sheet

Bluebell/Goshute Peak GRA NV-02

Figure 2



Howard (1978)

Bluebell/Goshute Peak GRA NV-02

Figure 3

Cenozoic Sediments

Quaternary, Undifferentiated (Qu): *Includes all sedimentary rocks and surface exposures of recent playa deposits, dune sands, lake beds, shoreline deposits and younger as well as certain older exposures of gravels and other alluvium associated with pediments and mountain streams.*

Tertiary Younger Sediments (Tys): *Sedimenetary rocks of Miocene and Pliocene age including older lake beds of the Muddy Creek Formation and Panaca Formation in Lincoln and Clark Counties; the Muddy Creek Formation in Southwestern Utah; pre-Quaternary sediments in the White River Valley; and sediments associated with ash-flow tuffs near Antelope Summit in White Pine County.*

Tertiary Sediments, Undifferentiated (Tsu): *Primarily Miocene and upper Oligocene deposits including tuffaceous sediments interbedded with ash flow tuffs, the Horse Camp Formation and various unidentified tuffs, tuffaceous shales and diatomites in Nye County; intravolcanic tuffaceous and clastic sedimentary rocks in Lincoln and Nye Counties; and conglomerates and limestones of uncertain age in the Conger-Confusion Ranges and the Cricket Mountains of Utah.*

Tertiary Older Sediments (Tos): *Includes the Sheep Pass Formation in Lincoln and Nye Counties; the Gilmore Gulch Formation in Nye County; unnamed lacustrine limestones in southern Lincoln County; older gravels, conglomerates, tuffaceous and clastic sedimentary rocks, limestones, cherts, claystones, silts, carbonaceous shales and oil shales in Elko County; and older limestones of the Illipah area and the Kinsey Canyon Formation of the Schell Creek and Grant Ranges in White Pine County.*

Cenozoic Volcanics

Quaternary Basalt (Qb): *Basalt, andesite and latite of Quaternary or late Tertiary age in Nye County.*

Tertiary Basalt (Tb): *Intermediate and basaltic lavas including the Fortification Basalt Member of the Muddy Creek Formation in Clark County; basalt flows, basaltic cinder, tuff and lava cones which are included in parts of the Banbury Formation and latite flows in Elko County; basalt flows and dikes in Lincoln County; andesite and basalt flows of various ages in North Central Nevada; and basalt and basaltic andesite flows in Southwestern Utah.*

Tertiary Volcanics, Undifferentiated (Tvu): *Early to late Tertiary volcanic rocks ranging in composition from silicic to intermediate; primarily rhyolites, dacites, quartz latite flows, ignimbrites and pyroclastics of widespread occurrence. These rocks are listed under various subdivisions in Elko, Lincoln, and Nye Counties; North Central Nevada and Southwestern Utah.*

Tertiary Older Volcanics (Tov): *Pre-Miocene volcanic rocks lithologically similar to Tertiary Volcanics, Undifferentiated (Tvu). Listed under various subdivisions in Nye County.*

Intrusives (TKJi): *Occurred from mid-Jurassic through late Tertiary. Widespread intrusions ranging in composition from granitic through gabbroic and in texture from holocrystalline to porphyritic.*

Mesozoic Sediments

Tertiary-Cretaceous Sediments (TKsu): *Continental sediments consisting of fanglomerates, clastics, tuffs and limestones. Includes the Gale Hills Formation and the Overton Fanglomerate.*

Cretaceous Sediments (Ks): *Chiefly non-marine siltstone, shale, conglomerate and limestone. Includes lower Gale Hills Formation, Thumb Formation, Baseline Sandstone, Willow Tank and Newark Canyon Formations.*

Jurassic (Ju): *Eolian cross-bedded sandstone in Utah, volcanically derived sediments, ash flows and basic lava flows in northern Elko County. Includes Navajo Sandstone, Aztec Sandstone, Frenchie Creek Formation and Bayer Ranch Formation.*

Jurassic-Triassic (J₸u): *Includes Nugget and Aztec Sandstones and Chinle Formation of southern Nevada.*

Triassic (₸u): *Shallow marine sedimentary rocks including Chinle, Shinarump, Thaynes and Moenkopi Formations in the west and continental to shallow marine sediments in the east.*

Mesozoic Volcanics

Tertiary-Cretaceous Volcanics (TKvu): *Occur in Lincoln County where it covers wide areas of the Clover, Del Mar, Wilson Creek, White Rock and Mahogany Mountains.*

Paleozoic Sediments

Permian, Undifferentiated (Pu): *Shallow marine intertidal and continental sediments. Includes Gerster Formation, Plympton Formation, Kaibab Limestone, Pequop Formation, Coconino Sandstone, Arcturus Formation, Rieptown Formation, Rib Hill Sandstone, Riepe Springs Formation, Carbon Ridge Formation and Loray Limestone. With the exception of parts of White Pine County, local symbols are used to identify all Permian outcrops. In White Pine County, local symbols are used except for the Park City Group which is grouped with the Arcturus and Rib Hill Sandstones (Par). To avoid confusion, non-standard symbol used for Permian in Utah has been replaced with the standard "P".*

Pennsylvanian-Permian (PPu): *Marine sandstone and limestone (dolomatized in places). Includes Rib Hill Sandstone, Riepe Spring Limestone and Ferguson Mountain Formation in southern Elko County; Strathearn Formation, Buckskin Mountain Formation, Beacon Flat Formation and Carlin Canyon Formation in Eureka County; Pablo Formation in Nye County; and Oquirrh Formation or group in Utah. Local symbols are used where possible.*

Pennsylvanian, Undifferentiated (Pu): *Includes Ely Limestone, Moleen and Tomera Formations. To avoid confusion, the non-standard symbol used for Pennsylvanian in Utah has been replaced by "P".*

Mississippian Upper (Mu): *Includes Diamond Peak and Bird Spring Formations, Callville Limestone, Scotty Wash Formation, Ochre Mountain Limestone and Manning Canyon Shale in parts of Clark County. Chainman Shale is combined with Diamond Peak Formation in some parts of Utah.*

Mississippian, Chainman Shale (Mc): *Includes Mountain City Formation in Elko County and Eleana Formation in Nye County.*

Mississippian, Lower (Ml): *Includes Monte Cristo and Rogers Spring Limestones in Clark County; Joana, Mercury and Bristol Pass Limestones in Lincoln County; and Joana Limestone elsewhere.*

Mississippian-Devonian, Undfiferentiated (MDu): *Includes Rogers Spring Limestone and Muddy Peak Limestone in parts of Clark County; Joana Limestone and Pilot Shale in Elko County; Pilot Shale, Joana Limestone, Chainman Shale and Diamond Peak Formation in Eureka and White Pine Counties.*

Mississippian-Devonian, Pilot Shale (MDp): *Shown in combination with other Mississippian Formations in Clark, Elko, parts of Lincoln, Eureka and White Pine Counties.*

Devonian-Cambrian, Undifferentiated (DSO€u): *Undivided limestone and dolomite occurring in Lincoln County.*

Devonian-Ordovician, Undifferentiated (DSOu): *Dolomites in Elko and Nye Counties.*

Devonian, Upper (Du): *Primarily Devils Gate and Guilmette Formations. Also includes Sevy and Simonson dolomites in parts of White Pine County. Contains Guilmette, Devils Gate, Simonson and Sevy in Elko County under the heading of* Dgd. *Local symbols used where possible.*

Simonson Dolomite (Dsi): *Alternating light to dark gray fine to coarse grained dolomite. Included with other Silurian and Devonian sediments in North Central Nevada and parts of Utah. Grouped with Sevy Dolomite in parts of Clark, Elko, Eureka, Nye, and White Pine Counties.*

Sevy Dolomite (Dse): *Very light colored, dense, distinctly bedded unfossiliferous dolomite. Combined with other Devonian and Silurian sediments in parts of North Central Nevada and Utah and with the Simonson Dolomite in parts of Clark, Elko, Eureka, Nye and White Pine Counties.*

Sevy and Simonson Dolomites, combined (Dun): *Also includes the Sultan and Muddy Peak Limestones in Clark County; Nevada Formation in Elko County; Devils Gate Formation in Eureka County; Nevada Formation, Woodpecker Limestone, Oxyolk Canyon Sandstone and Rabbit Hill Formation in Nye County; Nevada Formation and Devils Gate Formation in Eureka County and the Nevada Formation in White Pine County. Local symbols are used where possible.*

Devonian, Western Facies (Dw): *A portion of the western allochthonous assemblage. Includes Woodruff Formation and Slavern Chert in Eureka County and silicious siltstone in the Cockalorum Wash area of Nye County.*

Silurian, Undifferentiated (Su): *Includes Lone Mountain and Laketown Dolomites throughout the mapping area, the Elder Sandstone and Fourmile Canyon formation in Eureka County, and the Roberts Mountain formation in Nye County. In White Pine County, the Silurian deposits are grouped with the upper Ordovician sediments under the heading of Silurian-Ordovician, Undifferentiated* (SOu).

Upper Ordovician, Undifferentiated (Oupu): *Includes Ely Springs and Fish Haven Dolomites and the Hanson Creek Formation. Local symbols are used where possible. Listed as Ordovician, Undifferentiated* (Ou) *in parts of North Central Nevada. In Clark County, Ely Springs Dolomite has been divided from the rest of* Oep *by the author. The Eureka Quartzite and Pogonip Group are grouped with Silurian sediments under the heading Silurian-Ordovician, Undifferentiated* (SOu) *in Elko County.*

Ordovician, Eureka Quartzite (Oe): *Light colored vitreous quartzite and hard sandstone. Also includes the Swan Peak Quartzite in parts of Utah. In Clark County, the Eureka Quartzite has been separated from* Oep *by the author. In parts of North Central Nevada, the Eureka Quartzite has been grouped with other Ordovician sediments under the heading of* Ou. *In White Pine County, the Eureka Quartzite has been grouped with the Pogonip Group under the heading of*

Ordovician, Pogonip Group (Op): *Limestone, silty limestone, shale and interformational conglomerates. In Clark County, the Pogonip Group has been separated from* Oep *by the author. Includes the Garden City Limesione in parts of Utah. In White Pine County, the Pogonip Group is grouped the Eureka Quartzite under the heading of* Ol.

Ordovician, Undifferentiated (Ou): *Includes the Pogonip Group, Ely Springs Dolomite, Eureka Quartzite and Comus Formation in North Central Nevada.*

Ordovician, Vinini Formation (Ovi): *Part of the western allochthonous assemblage. Includes Valmi Formation in parts of North Central Nevada. Local symbols are used where possible.*

Cambrian-Ordovician, Undifferentiated (O€u): *Occurs in Elko, Eureka, Nye and White Pine Counties as shale and limestone and is usually so identified when metamorphosed to phyllite. Includes the Tennessee Mountain Formation in Elko County, Board Canyon, Sequence in North Central Nevada, Windfall Formation in Nye County and the lower Ordovician and post-Dunderberg Shale in the Schell Creek Range of White Pine County. In some parts of Nye County,* O€u *is metamorphosed to slate and marble instead of phyllite.*

Cambrian, Upper and Middle (€u): *Primarily limestones, dolomites, shales and quartzites. Includes Edgemont and Peak Limestones in Elko County; Highland Peak formation, Patterson Pass Shale, Pole Canyon Limestone, Chisholm Shale and Lyndon Limestone member of the Chisholm Shale in Lincoln County; Harmony Formation, Preble Formation, Pioche Shale, Eldorado Dolomitee, Geddes Limestone, Secret Canyon, Hamberg, Dole and Dunderberg Shales, Windfall Formation, and Scott Canyon Formation in North Central Nevada; Windfall Formation, Dunderberg Shale, Tybo Shale and Lincoln Park Formation in Nye County; Notch Peak Formation, Dunderberg Shale, Orr Formation, Weeks Formation, Marjum Formation, Wheeler Shale, Swasey Formation, Whirlwind Formation, Dome Limestone, Howell Formation and Tatow Formation in Utah; and Corset Spring Shale, Notch Peak Limestone, Dunderberg Shale and Windfall Limestone in White Pine County. Metamorphosed to schist in Elko County.*

Cambrian, Lower (€pmp): *Primarily Prospect Mountain Dolomite and Pioche Shale. Also includes Tapeats Sandstone, Wood Canyon Formation, Lyndon Limestone, Chisholm Shale and Carrera Formation in Clark County; Sterling Quartzite and Wood Canyon Formation in parts of Lincoln County; Busby Quartzite in the Gold Hill area of Utah and the Stella Lake Quartzite in White Pine County.*

Precambrian

Precambrian Sediments (p€s): *Includes the Johnnie Formation, Sterling Quartzite and some metamorphics in Clark County; Johnnie Formation and lower units of Prospect Mountain Quartzite in Lincoln County; McCoy Creek Group in Elko County; and the McCoy Creek Group excluding the Stella Lake Quartzite in White Pine County.*

Precambrian Intrusives (p€i): *Includes the Gold Butte Granite in Clark County and other undifferentiated igneous and metamorphic rocks, primarily granites and pegmatites.*

II. GEOLOGY

The Bluebell/Goshute Peak GRA lies in the Basin and Range province in eastern Elko County about ten miles west of Wendover. The study area includes WSA NV 010-027 which covers the southern Toana Range and WSA NV 010-033 which covers the northern Goshute Mountains.

The north-south-trending Toana Range and Goshute Mountains are a continuous fault block of Paleozoic sediments that have been thrusted and normal faulted. These rocks have been locally intruded by Jurassic quartz monzonite bodies and overlain by mid-Tertiary volcanics.

It should be noted that very little information concerning this area has been published, hence the lithological and structural descriptions in this report are very generalized.

1. PHYSIOGRAPHY

The Bluebell/Goshute Peak GRA lies in the Basin and Range province in eastern Elko County about eight miles west of Wendover. WSA 010-027 covers the southern half of the Toana Range. WSA 010-033 adjacent to the south includes the northern Goshute Mountains. The study area is bounded on the north by Interstate 80 and on the east and south by U. S. Highway 50 A.

The northern Goshute Mountains and the southern Toana Range are a continuous fault-bounded block of Paleozoic sediments that have been faulted, thrusted, and locally overlain by Tertiary volcanics.

The topography is rugged with elevations along the crest of the range averaging about 8,000 feet, while the adjacent valleys have elevations of about 5,500 feet.

Drainage from the western flanks of the ranges discharges into Steptoe Valley and streams on the eastern side flow into the Great Salt Lake Desert.

2. ROCK UNITS

The oldest rock units in the study area are an undivided sequence of Upper-Middle Cambrian limestones, dolomites, shales and quartzites. These rocks are overlain by the Ordovician Pogonip Group which consists mainly of thin-bedded detrital limestone interbedded with flat-pebble conglomerate. This unit crops out over a large area in the Goshute Mountains. The Ordovician Pogonip Group has been locally grouped with the Ordovician-Silurian Eureka Quartzite.

The next youngest unit is an undivided sequence of Upper Devonian carbonates that includes the Devils Gate Limestone and the Guilmette Formation, an even-bedded dark-gray sublithographic limestone.

The Mississippian-Devonian Pilot Shale and Joana Limestone have been grouped together as the next youngest mappable unit by Terra Scan (Howard, 1978). This unit is overlain by the Mississippian Chainman Shale which in turn is overlain by undifferentiated Pennsylvanian sediments that include the Ely Limestone.

Pennsylvanian-Permian undifferentiated marine limestone and sandstone of the Rib Hill Sandstone, Riepe Spring Limestone and Ferguson Mountain Formation were deposited next. This sequence of rocks may have phosphatic beds in a small part of the GRA.

Just north of the study area a granodiorite intrusive body, called the Silver Zone Pass Pluton by Pilger (1972), was emplaced during the Jurassic.

Undifferentiated Tertiary volcanics consisting primarily of rhyolites, dacites, quartz latite flows, ignimbrites and pyroclastics were the last units deposited except for Quaternary alluvium in the valleys.

3. STRUCTURAL GEOLOGY AND TECTONICS

The most prominent structures in the Bluebell/Goshute Peak GRA are the intersecting normal faults which have created a "mosaic effect" of fault-bounded blocks of Paleozoic sediments.

Based on cross sectional information compiled and edited by Howard (1978) for the Terra Scan Group, the northern Goshute Mountains are bounded on the west by high angle range front faults and on the east by low-angle thrust faults. Steep normal faults transect the low-angle faults, indicating that they were formed subsequent to thrusting. The age of thrusting in eastern Nevada has not been agreed upon. Hose and Blake (1976) indicate that the thrusting can be dated no closer than post-Middle Jurassic to pre-Oligocene, whereas other geologists (Armstrong, 1972; Coney, 1974) consider the movement to be at least in part, if not entirely, Middle or Late Tertiary in age.

4. PALEONTOLOGY

The major fossiliferous unit within the Bluebell/Goshute Peak GRA is the Ely Limestone, which contains a rich coral fauna and abundant brachiopods, mollusks and bryozoa. Rugose corals have been collected from Wildcat Peak in addition to typical

shallow water invertebrates. Although no localities are known from outcrops of the Guilmette Formation (or equivalent) from within the GRA, there is a high probability of paleontological resources from that unit. Given the lithologies of the other Paleozoic units and their distribution, it is possible that paleontological resources may be unevenly distributed throughout the area of the GRA, especially the western margin of the Goshute Range.

In the north and eastern part of the GRA small areas of Miocene lacustrine sediments are potential localities for nonmarine mollusks and mammalian fossils, although none are recorded from within the GRA.

5. HISTORICAL GEOLOGY

Throughout the Paleozoic marine sediments of the eastern carbonate facies were deposited in the area.

Tectonic movements may have started in Middle Jurassic time in eastern Nevada. The Silver Zone Pass Pluton was emplaced at this time north of the GRA. Volcanism began during the mid-Tertiary with the extrusion of rhyolitic to intermediate volcanic units which crop out in the east central part of the GRA.

Tertiary Basin and Range tectonism consisted of crustal extension that produced the present day block-faulted basins and ranges (Stewart, 1980) subsequent to volcanism. Extensional faulting commenced about seventeen million years ago during the Miocene.

III. ENERGY AND MINERAL RESOURCES

A. METALLIC MINERAL RESOURCES

1. Known Mineral Deposits

In the southwest corner of WSA 010-027 is the Decoy district (#1 on the Metallic Minerals Occurrence and Land Classification Map), which is reported to have shipped a substantial amount of manganese ore in 1917 and 1918 (Granger and others, 1957). The boundary of the WSA has a reentrant here to exclude the known productive part of the district.

Just east of the southern side of WSA NV 010-033 is the Ferguson Spring district (#2), from which there was small production of copper with a little silver in 1917 and the late 1930s (Granger, and others, 1957).

2. Known Prospects, Mineral Occurrences and Mineralized Areas

In WSAs NV 010-027 and 010-033 Steve Brooks (1982) of Elko District BLM office examined alteration on the Derry claims (#3) in Secs. 17, 18, 19, 20, T 32 N, R 68 E (see copy of field report in GRA file). Analyses of the samples are not available at the time of this writing. Samples are described as having gossan, calcite, iron staining, and other evidences of alteration. Richard Kern (1983) of Homestake, which examined the Derry property, says that geochemical sampling gave results interesting for Carlin-type mineralization, but no gold was reported (see notes in GRA file).

Farther north in WSA NV 010-027, close to the Decoy district, Brooks (1982) examined the Politch claims in Sec. 12, T 32 N, R 67 E. He found some iron-stained calcite in sheared zones.

In the north-central part of WSA NV 010-027, Brooks (1982) examined the Blackbird claims (#4) located in Sections 34, 35, T 34 N, R 68 E, and found iron-stained quartzite as float. Homestake examined the Blackbird claims too, and got interesting geochemical results, but no gold (Kern, 1983). A mile or so south in Sec. 10, T 33 N, R 68 E, Brooks (1982) examined an adit symbol shown on the Morgan Pass 7 1/2-minute topographic quadrangle, and concluded it was a spring-opening excavation.

Brooks (1982) examined the GEM and Sleeper claims (#5), and found iron staining and alteration as well as some silicification. They are in WSA NV 010-033 in Secs. 7, 8, 17 and 18, T 29 N, R 69 E, two or three miles south of the Ferguson Springs district.

3. Mining Claims

Patented claims are only in the Ferguson Springs district.

In WSA NV 010-027 claims in the north-central part are the Blackbird claims examined by Brooks, described above.

In the southeast corner of WSA NV 010-027 and the northwest corner of WSA NV 010-033 are the Derry claims, described above. Apparently there are about 50 claims in the group.

In the southeast corner of WSA NV 010-033 unpatented claims are the GEM and Sleeper claims examined by Brooks and described above. Nothing is known of claims in a single quarter section a mile north of Goshute Peak.

4. Mineral Deposit Types

The mineralization in the Decoy district is described by Tingley (1980) as gossan along a N 10°W, 55°SW structure in limestone and another structure N 5°E, 60°SE. The gossan is mostly pyrolusite, yellow brown limonite, and red and brown jasper. The high barium content reported in one of Tingley's analyses, and the presence of jasper, suggest that this is epithermal mineralization. The terrane consists entirely of Paleozoic sediments here, with no Tertiary intrusives known within many miles that might represent a source of epithermal mineralization.

In the Ferguson Spring district ore bodies are described as oxidized replacement bodies in limestone, with the mineralization following bedding and east-west fractures. Limonite, barite and quartz form the gangue. Their occurrence as replacements of limestone suggests they are mesothermal. No intrusives are known nearby.

5. Mineral Economics

Manganese can only be produced profitably, particularly from small underground deposits such as those known at Decoy, during times of unusually high prices -- in most cases when a government buying program is in effect.

Base and precious metal deposits such as those at Ferguson Spring can be mined profitably if they are large and high enough grade. From the descriptions the bodies mined in the past were probably not profitable nor would they be today. However, in this terrane of abundant carbonate rocks, it is possible there may be a Carlin-type disseminated gold deposit that could be mined very profitably by open pit methods. Probably most of the

recent staking in the GRA was directed toward targets of this type.

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.

The major uses of silver are in photographic film, sterlingware, and increasingly in electrical contacts and conductors. It is also widely used for storage of wealth in the form of jewelry, "coins" or bullion. Like gold it is commonly measured in troy ounces, which weigh 31.1 grand grams, twelve of which make one troy pound. World production is about 350 million ounces per year, of which the United States produces about one-tenth, while it uses more than one-third of world production. About two-thirds of all silver is produced as a byproduct in the mining of other metals, so the supply cannot readily adjust to demand. It is a strategic metal. Demand is expected to increase in the next decades because of growing industrial use. At the end of 1982 the price of silver was $11.70 per ounce.

The largest use for copper is in electrical equipment and supplies and in smaller-guage wire where its electrical conductivity is essential. It is also used in large quantities in applications where its corrosion resistance is important -- in housing, brass and bronze, sea-water corrosion resistant alloys and others. It is used also in ammunition, many chemicals, and in applications where its conductivity of heat is important. World production is about 7.5 million metric tons annually, of which the United States produces about 1.5 million tons, nearly sufficient to satisfy domestic demand. Copper is a strategic metal. There are large reserves of copper ore in the world, and the United States has greater reserves

and greater resources than any other country. United States demand is expected to nearly double by the year 2000, but reserves are thought to be sufficient to meet the demand. However, environmental problems of smelting copper may hinder production, and in times of low prices foreign producers tend to maintain full production for political reasons, while domestic producers tend to restrict production for economic reasons. These pressures on the domestic copper industry weaken its competitive capability on the world market. At the end of 1982 the price of copper was 73 cents per pound.

Most manganese is used in the production of iron and steel, both as a desulfurizing and deoxidizing ingredient during processing and also as an alloy component in the finished material. It is also used as an alloying component in aluminum, magnesium and copper. Lesser uses are in dry-cell batteries as manganese oxide, as an oxidizing agent in chemical processes, as a smoke-inhibiting additive to fuel oil, and numerous other applications. The United States consumes about one and one quarter million tons of manganese annually, but produces only about 30 thousand tons. Imports are principally from the Republic of South Africa, France, Brazil and Gabon. United States consumption is forecast to increase to about two million tons by the year 2000 while domestic production continues to be infinitesimal. The price of manganese in ore is a few cents per pound.

B. NONMETALLIC MINERAL RESOURCES

1. Known Mineral Deposits

No nonmetallic mineral deposits are known in either WSA NV 010-027 or WSA NV 010-033.

2. Known Prospects, Mineral Occurrences and Mineralized Areas

In the north-central part of WSA NV 010-027 Hope and Coates (1976) show a single outcrop area, about one square mile in extent of Permian Park City Group rocks. In the southern part of the Pequop Mountains, the next range to the west of the Goshute Range, the Park City Group contains phosphatic beds in the Gerster or Plymouth Formation. The phosphate deposits were formed at the same time as the enclosing sedimentary rocks and are likely to be regionally distributed. Therefore, this exposure of the Park City Group may well have phosphate beds.

Brooks (see notes in GRA File) states that vein barite is known in both the Decoy and Ferguson Springs districts, and has been reported encountered in the railroad tunnel just north of the GRA.

Many of the units of Paleozoic sediments which make up most of both WSAs are limestones and dolomites.

The alluvium around the flanks of the Toano and Goshute Ranges contains sand and gravel.

3. Mining Claims, Leases and Material Sites

No mining claims located for nonmetallic minerals can be identified in either WSA. No mineral leases are in the WSAs. No material sites are known in either WSA.

4. Mineral Deposit Types

Both the phosphatic beds in the Gerster or Plymouth Formation, and the limestones and dolomites in many of the Paleozoic units, are sedimentary formations and thus can be expected to be very extensive except for fault offsets.

The known barite occurrences apparently are in veins that also have other mineralization -- manganese and base metals. It is not known that there are any veins of relatively pure barite, and purity in general is a prerequisite for mining feasibility.

The alluvium around the edges of the ranges contains, by definition, sand and gravel.

5. Mineral Economics

The small size of the outcrop area of Park City Group limits the size of any phosphate deposit that might be present -- it could hardly be more than a mile long. However, if the thickness were great enough and the grade high enough, this could make a respectable-sized ore body one -- worth mining.

Limestone and dolomite, because they are relatively common and hence have a low unit price, must be mined close to where they are processed or used. There are no major population centers close to the Bluebell/Goshute GRA, but low-cost rail transportation is very close, so it is possible that these deposits will be developed to serve the Salt Lake City markets eventually.

The sand and gravel deposits around the edges of the ranges could be mined profitably for use in projects, probably construction, within short distances.

At the present time few vein deposits can compete with bedded deposits of barite because in general the bedded deposits can be mined by open pit while the veins cannot.

The presence of veins suggests the possibility of bedded deposits.

Nearly 90 percent of phosphate rock, both in the United States and elsewhere, is used to make agricultural fertilizers. The remainder is used mostly in detergents, animal feed enrichers and insecticides. United States demand is about 35 million metric tons annually, while production is half again this much with the overage being exported. United States demand is forecast to nearly double by the year 2000, while production will increase to keep well ahead of this demand and continue the export market. In recent years the price for phosphate rock has been about $20 per metric ton.

Pure limestone and dolomite are used principally to produce lime, but some is used as rock for building stone, crushed rock and similar applications. The principal uses of lime are in steel smelting, water purification, as an alkali, in paper and pulp manufacture and sewage treatment. Other uses for lime are in sugar purification, mortar, and as an agricultural soil conditioner. Limestone with certain clay impurities (called cement rock), or purer limestone with clay added, is used to make cement that is mostly consumed in construction. The United States uses about 20 million tons of lime and 85 million tons of cement annually. For both lime and cement the raw material must be mined within a very few miles of the processing plant, because it has a very low value in the form of run-of-mine rock -- two or three dollars per ton. There are numerous lime and cement plants in the United States, and most of them sell most of their product within a 200 mile radius of the plant. Some cement is imported in the form of clinker, which is the kiln-fired rock that is then ground in the United States. In the early 1980s the price F.O.B. plant of both lime and cement is about $40 per ton.

The most common use of sand and gravel is as "aggregate" -- as part of a mixture with cement to form concrete. The second largest use is as road base, or fill. About 97 per cent of all sand and gravel used in the United States is in these applications in the construction industry. The remaining three percent is used for glassmaking, foundry sands, abrasives, filters and similar applications. The United States uses nearly one billion tons of sand and gravel annually, all of it produced domestically except for a very small tonnage of sand that is imported for highly specialized uses. Since construction is by far the greatest user of sand and gravel, the largest production is near sites of intensive construction, usually metropolitan areas. Since sand and gravel are extremely common nearly everywhere, the price is generally very low and mines are very close to the point of consumption -- within a few miles as a rule. However, for some

applications such as high-quality concrete there are quite high specifications for sand and gravel, and acceptable material must be hauled twenty miles and more. Demand for sand and gravel fluctuates with in activity in the construction industry, and is relatively low during the recession of the early 1980s. Demand is expected to increase by about one third by the year 2000. In the early 1980s the price of sand and gravel F.O.B. plant averaged about $2.50 per ton but varied widely depending upon quality and to some extent upon location.

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, Leases and Material Sites

There are numerous claims in the GRA but these are most likely not for uranium or thorium.

4. Deposit Types

Deposit types cannot be discussed due to the lack of uranium and thorium occurrences in the GRA and WSA.

5. Mineral Economics

Uranium and thorium are probably of little economic value in the GRA due to the lack of deposits 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 Shell drilled the Goshute Unit No. 1 (Locality #1 on the Oil and Gas Occurrence and Land Classification Map) to 5,569 feet in 1976 just four miles west of the GRA (Garside and others, 1977). Two miles to the east of the GRA, Western Osage Government No. 1 (#2) drilled to 785(?) feet in 1951, and close by, Last Frontier Oil Company Government No. 1 (#3) went to 1,327 feet in 1953

(Lintz, 1957).

Federal oil and gas leases come at most a mile into the WSAs where they extend into the valley areas.

Oil deposits being developed and explored for in Nevada are anticipated to be of the 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 are no known geothermal deposits in the GRA.

2. Known Prospects, Geothermal Occurrences and Geothermal Areas

   No prospects, occurrences or thermal areas are present in the GRA or immediate vicinity.

3. Oil and Gas Leases

   There are no Federal geothermal leases in the GRA or vicinity.

4. Oil and Gas Deposit Types

   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. Geothermal Economics

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 (above 350°F) are currently being used to generate electrical power in Utah and California, 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 around 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 a 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 010-027 or 010-033. There is no reason to expect coal, oil shale or tar sand resources.

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.

Manganese, which has been produced from the Decoy district in a cherry-stemmed area of WSA NV 010-027, is a strategic and critical metal.

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

The map of Hose and Coats (1976) at 1:100,000 provides good geological coverage of the GRA. The information we have concerning mineralization occurrences comes from several sources, and in general the sources corroborate each others' information. The quantity of geological data available is high, as is its quality. The quantity of data concerning mineralization that we have is high for those occurrences for which we have any data, as is its quality. However, we note that all these occurrences are around the edges of the mountains, as are all of the claims; and neither claims nor occurrences are known within the mountains. We suspect that the interior of the mountains have been inadequately prospected for mineral occurrences and alteration, and therefore conclude that overall the quantity of data we have pertaining to mineralizatin is low and its quality correspondingly low. Our level of confidence in the geological data is high, but our level of confidence in mineralization data is low.

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 WSAs. 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 010-027

M1-3B. This classification area covers a small part of the northeast corner of the WSA. In it are the Blackbird claims, some of which are in the WSA. Homestake reports "interesting" geochemical results from sampling on them (Kern, 1983), and Brooks (1982) found iron-stained quartzite (field notes in GRA file). The geochemical results and the iron-staining evidence of mineralization are the reason for the moderately favorable classification, and since there is no further evidence the level of confidence is low.

M4-3B. This classification area covers a small part of the southwestern corner of the WSA. Here again Homestake reports interesting geochemical results (Kern, 1983), and Brooks (1982) reports gossan, calcite, iron staining and other evidence of alteration (field notes in GRA file). The rationale for the classification and level of confidence are the same as for M1-3B.

M5-4C. This classification area covers a small part of the west edge of the WSA, around the reentrant in which the Decoy district lies. Manganese has been produced from the Decoy district itself, which is the reason for the high favorability for metallic resources. Apparently the district is an extremely small one, which is the reason for only the moderate level of confidence in the classification. There is some question as to how far the sphere of influence of the Decoy production should be extended.

M6-2A. This classification area covers the remainder of the WSA -- most of it. The Paleozoic sediments here (Hope and Coats, 1976) include many units that are known to be favorable for mineralization on a regional scale, and there is a great deal of faulting that can provide structural settings for mineralization. Additionally, there is evidence of mineralization at several points around the periphery of the classification area -- the classification areas just described and M2-3B to the southeast which does not impinge upon WSA NV 010-027. The favorability of rocks and structure and the adjacent mineralization, are the reason for the classification of low favorability, while the absence of direct evidence of mineralization is the reason for the very low level of confidence in this classification.

WSA NV 010-033

M2-3B. This classification area covers a very small part of the eastern edge of the WSA. The rationale for the classification and level of confidence is the same as for M1-3B described above.

M3-3C. This classification area covers a long narrow strip of the east edge of the WSA. In it are the Ferguson Spring district which has produced some copper and silver from one or more small mines, and adjacent mineralized ground. Among the adjacent ground are the Dekalb claims, described by Perry (1983) of Nicor as having jasperoids that geochemical sampling shows contain lead, zinc and silver values (see notes in GRA file). Farther south are the GEM and Sleeper claims, where Brooks (1982) found iron staining, alteration and silicification. The production from well outside the WSA, with the widespread alteration in and immediately adjacent to the WSA, are the reasons for the moderate favorability and the moderate level of confidence.

M4-3B. This classification area covers a small part of the northwestern corner of the WSA adjacent to WSA NV 010-027. The rationale for the classification and level of confidence is given above, under that WSA.

M6-2A. This classification area covers the remainder of the WSA. The rationale for the classification and the level of confidence is given above under WSA NV 010-027.

b. Uranium and Thorium

WSA NV 010-027 and WSA NV 010-033

U1-2B. This land classification covers most of WSA NV 010-027 and WSA NV 010-033 and the southeastern and north-central parts of the GRA. The area is covered mostly by Paleozoic carbonates and clastics with relatively minor amounts of Tertiary volcanics exposed in the east central part of the GRA. This area has low favorability with a low level of confidence for uranium in fracture-filled deposits in the Paleozoic sedimentary rocks or Tertiary volcanics. The Tertiary volcanics may contain uranium which could have been leached by ground water and deposited in faults and fractures in the Paleozoic rocks.

The area has very low favorability with a very low confidence level for thorium deposits due to the apparent lack of granites or pegmatites in the area.

U2-2B. This land classification covers the margins of the WSAs which are covered by Quaternary alluvium. These areas have low favorability with a low confidence level

for uranium in epigenetic sandstone-type deposits. Tertiary tuffs and rhyolites are a possible source of uranium in the area. Ground water could leach uranium from the units and deposit it in reduced zones in the alluvium adjacent to the source areas.

The area has very low favorability with a very low confidence level for thorium deposits due to the apparent lack of suitable source rocks such as pegmatites.

c. Nonmetallic Minerals

WSA NV 010-027

N1-3B. This classification area covers a small area in the north-central part of the WSA. In it Hope and Coats (1976) mapped sediments of the Permian Park City Group, which in the Pequop Range a few miles to the west, includes the Gerster or Plymouth Formation that has phosphate-bearing beds. Since the phosphate was deposited in the beds at the same time as the beds themselves were deposited -- as part of the sedimentary rocks -- the phosphate is widespread. These formations, or their equivalents under other names, are known to contain phosphate over a large area that includes parts of Mondana, Idaho, Nevada and Utah. Since the phosphate is so widespread, it must be present in the Gerster or Plymouth Formation if they are represented in this outcrop area of the Park City Group and this is the reason for the moderately favorable classification. However, Hope and Coats (1976) do not map the Gerster or Plymouth Formation as such, only the encompassing Park City Group, so there is a possibility that the Formation is not present by reason of nondeposition, faulting out, or some other geological process; this is the reason for the low level of confidence.

N2-3C. This classification area covers small parts of the eastern edge of the WSA. In it Quaternary alluvium is mapped (Hope and Coats, 1976), and by definition alluvium contains sand and gravel, which is the reason for the moderately favorable classification. The level of confidence in this classification is only moderate because the quality of the sand and gravel at any particular site is unknown.

N3-3C. This classification area covers a strip along the west side of the WSA in which Quaternary alluvium is mapped. The rationale for the classification and level of confidence is the same as for N2-3C.

N4-3C. This classification area covers the remainder of the WSA -- most of it. Most of the rocks in it are Paleozoic sedimentary units and many of these are

limestones or dolomites (Hope and Coats, 1976). Both rocks are widely used for the production of lime, cement and other materials. The known presence of these rocks is the reason for the moderately favorable classification. The lack of information as to the quality of the limestone and dolomite is the reason for the only moderate confidence in this classification.

WSA NV 010-033

N3-3C. This classification area covers a narrow strip along the west edge of the WSA in which Quaternary alluvium is mapped. The rationale for the classification and level of confidence is the same as for N2-3C, presented above under WSA NV 010-027.

N4-3C. This classification area covers the remainder of the WSA -- nearly all of it. The rationale for the classification and the level of confidence is given above under WSA NV 010-027.

2. LEASABLE RESOURCES

a. Oil and Gas

WSAS NV 010-027 AND NV 010-033

OG1-1A. This classification covers both WSAs. The WSAs are underlain by a complexly faulted Cambrian through Permian section, in minor areas covered by Quaternary alluvium in the valley areas and a small area of Tertiary age volcanics. The WSA extends less than a mile into the adjacent valleys -- about as far as numerous salient Paleozoic outcrops, thus negating the presence of a good section. The range front faults which separate the complex southern Toana Mountains (WSA 010-027) and the northern Goshute Range (WSA 010-033) from the more prospective intermontane area, appear to be outside of the WSAs.

The Western Osage and Last Frontier wells had reported oil and gas shows -- probably in the Tertiary section.

b. Geothermal

WSAs NV 010-027 and NV 010-033

G1-2A. The WSAs are well within the Basin and Range Province which has hundreds of geothermal resource areas distributed throughout all of Nevada's counties. In most instances the thermal water rises from deep in the crust along the normal faults frequently present along the

mountain fronts and in the valley basins. Sometimes these thermal waters come to the surface as springs, but in numerous cases shallow drilling has intersected thermal water-bearing strata within a few feet of the surface to several thousand feet in depth. This classification incorporates this geologic environment.

G2-1A. The main body of the mountain ranges included in the WSAs are faulted, but much less likely to host geothermal waters at an economic depth. This is especially so in this part of the Basin and Range Province where there are no recorded geothermal resource areas.

c. Sodium and Potassium

WSA NV 010-027 and 010-033

S1-1D. There is no known favorability for sodium and potassium in the WSAs and no geological reason to expect any. Both WSAs are classified in their entirety as having low favorability with high confidence. No classification map for sodium and potassium is presented.

3. SALEABLE RESOURCES

Saleable resources have been considered in connection with nonmetallic minerals.

V. RECOMMENDATIONS FOR ADDITIONAL WORK

Because of the apparent lack of previous prospecting in the interior of the mountains, geological reconnaissance for mineral occurrences is recommended. To supplement this a geochemical survey should be made with at least sampling of sediments in streams and washes all around the edges of the mountains.

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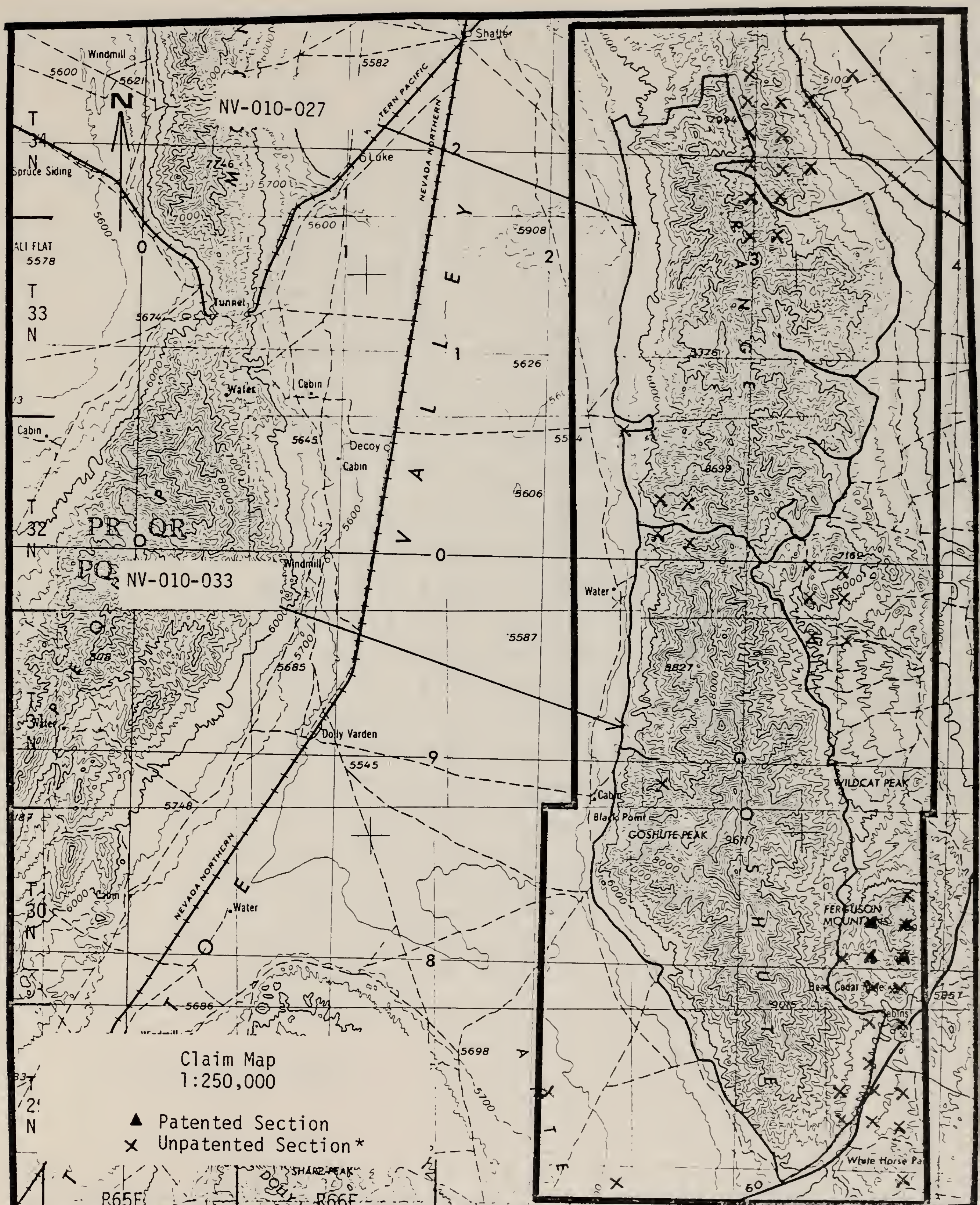
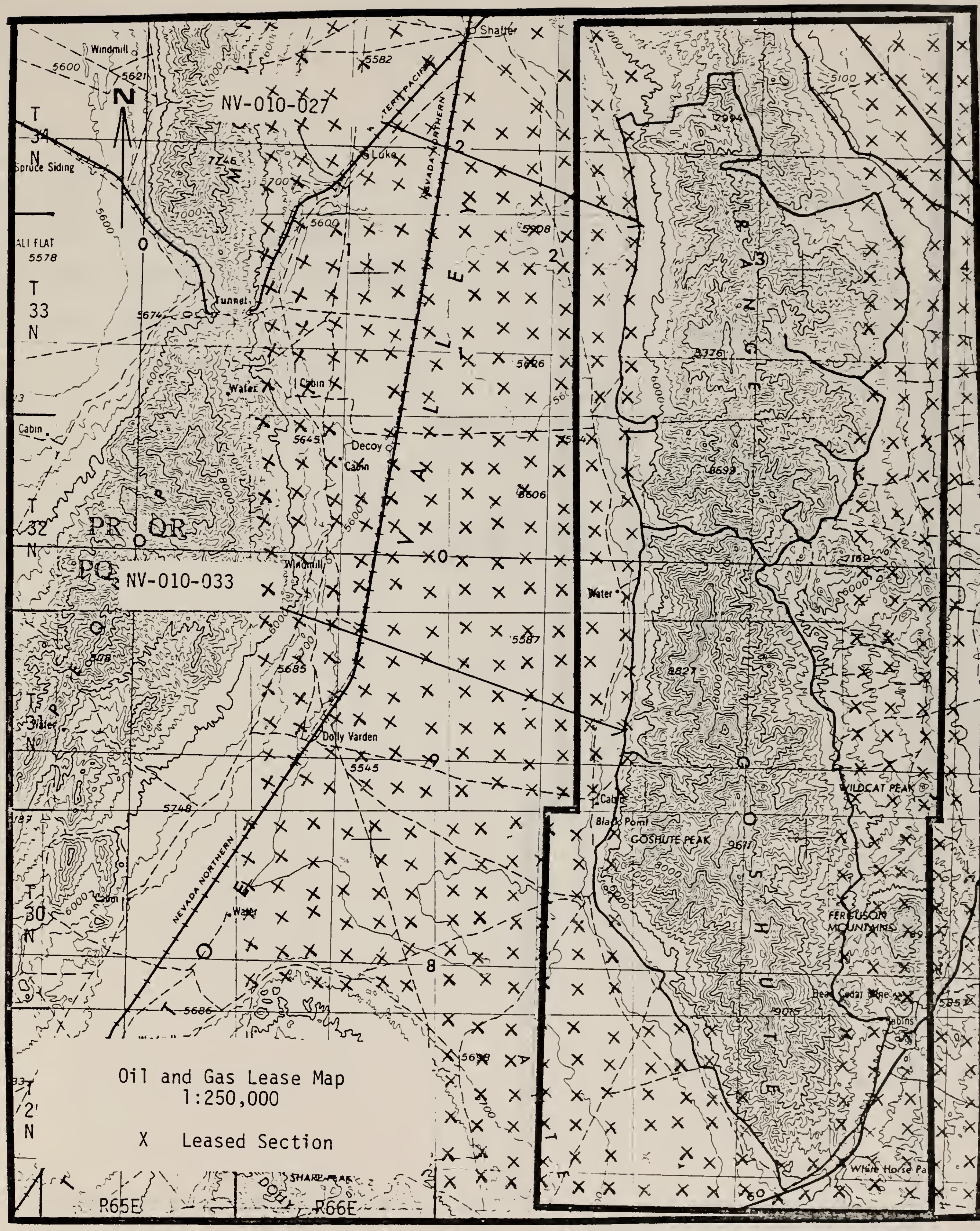


*X denotes one or more claims per section

Bluebell/Goshute Peak GRA NV-02



Bluebell/Goshute Peak GRA NV-02

EXPLANATION

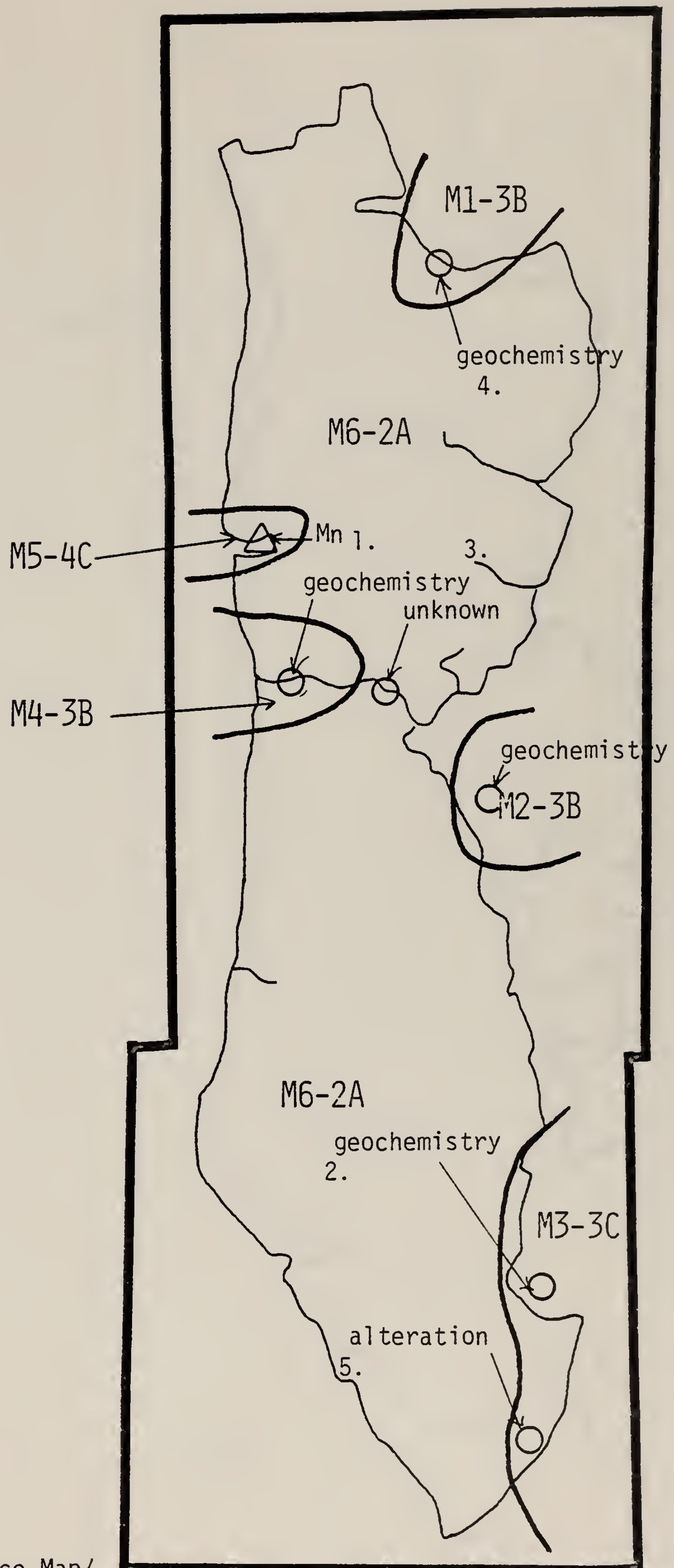
△ Mine, commodity

○ Occurrence, commodity

━ Land Classification Boundary

— WSA Boundary

1. Reference location (see text)



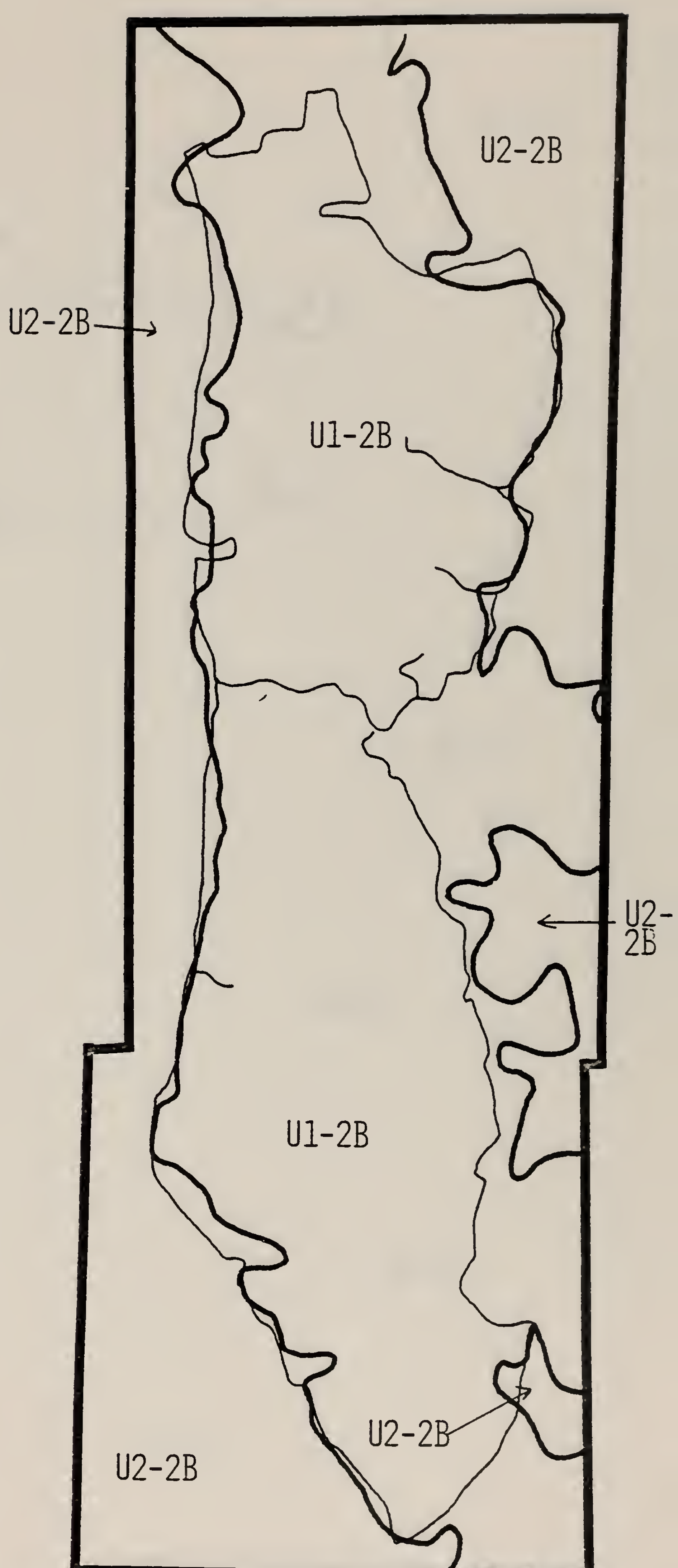
Land Classification - Mineral Occurrence Map/
Metallics

Bluebell/Goshute Peak GRA NV-02

Scale 1:250,000

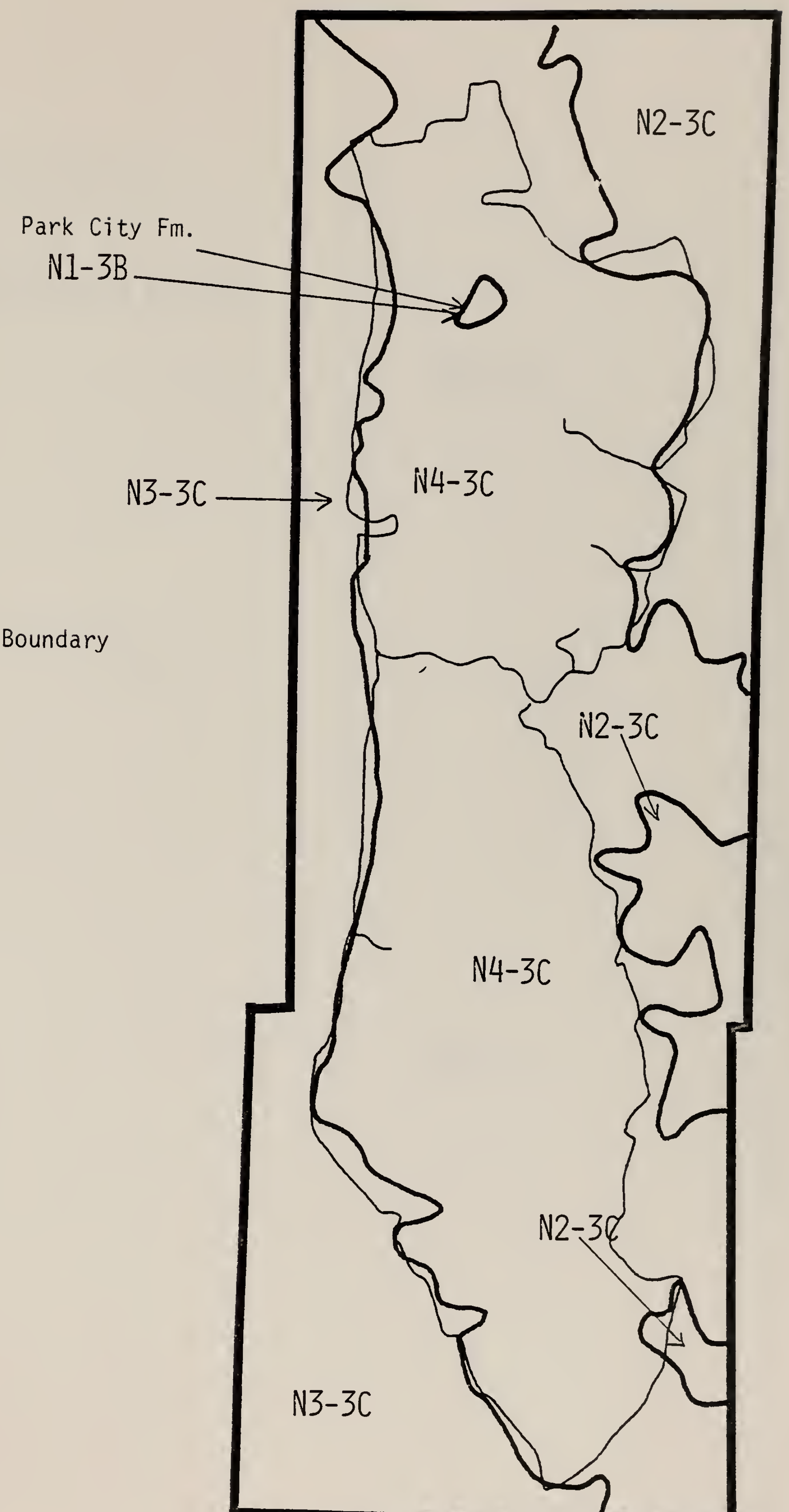
EXPLANATION

(thick line)	Land Classification Boundary
(thin line)	WSA Boundary



Land Classification - Mineral Occurrence Map/
Uranium

Bluebell/Goshute Peak GRA NV-02
Scale 1:250,000



EXPLANATION

Land Classification Boundary

WSA Boundary

Land classification - Mineral Occurrence Map/
Nonmetallics

Bluebell/Goshute Peak GRA NV-02

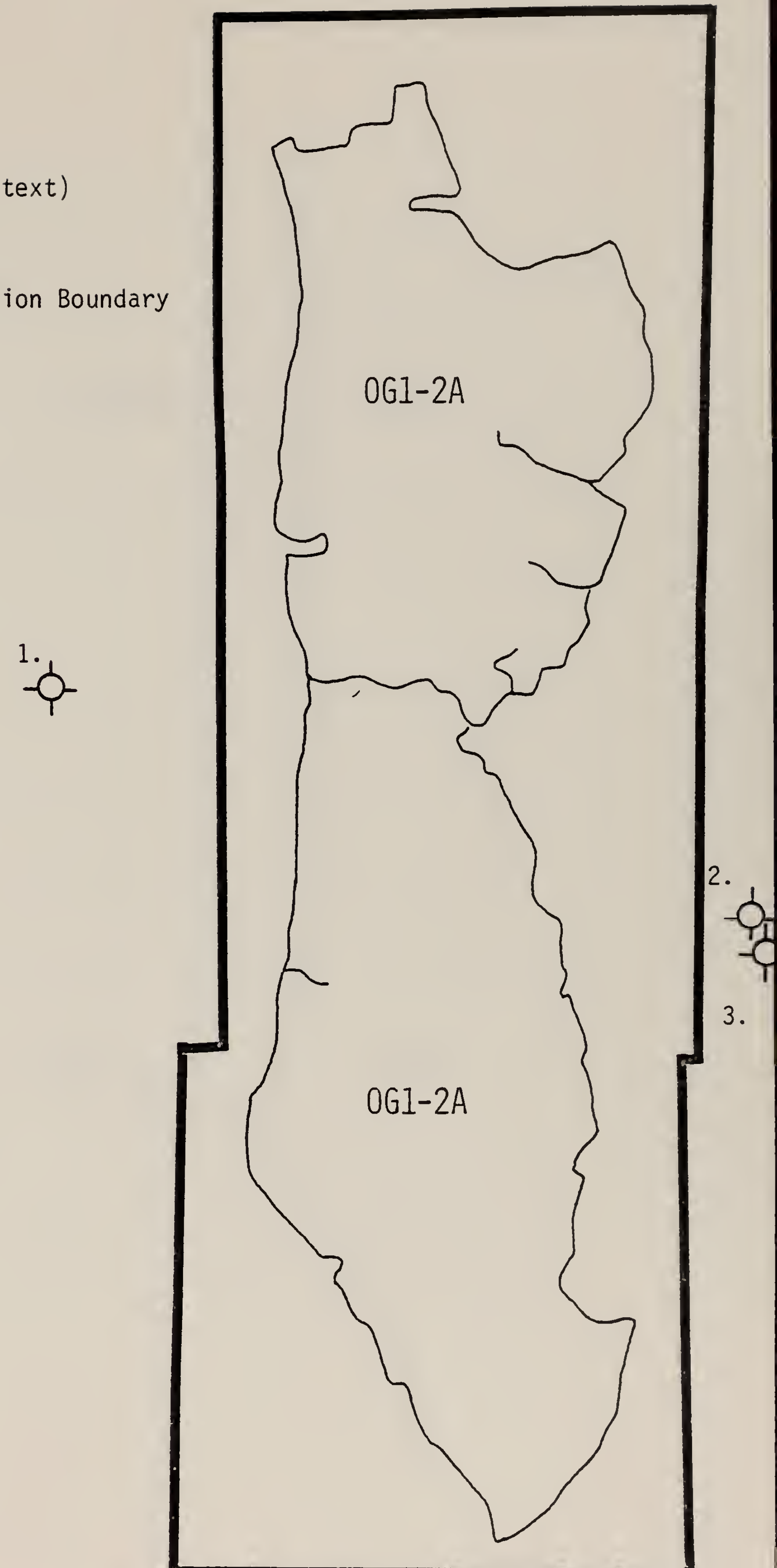
Scale 1:250,000

EXPLANATION

1. Reference location (see text)

Dry Hole

WSA and Land Classification Boundary



Bluebell/Goshute Peak GRA NV-02

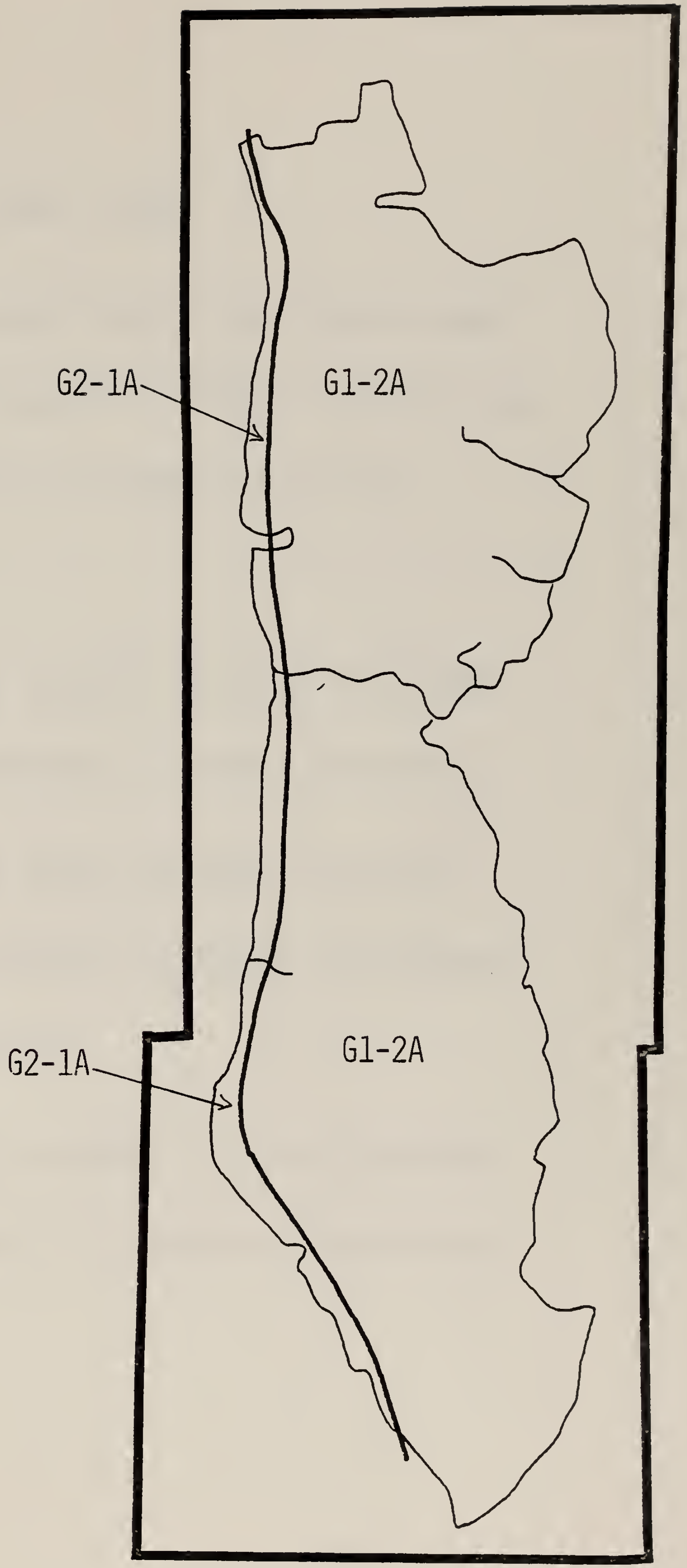
Scale 1:250,000

Land Classification - Mineral Occurrence Map/Oil and Gas

EXPLANATION

—— WSA Boundary

—— Land Classification Boundary



Bluebell/Goshute Peak GRA NV-02

Scale 1:250,000

Land Classification - Mineral Occurrence Map/
Geothermal

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