Mineral Resources of the South Reveille Wilderness Study Area, Nye County, Nevada

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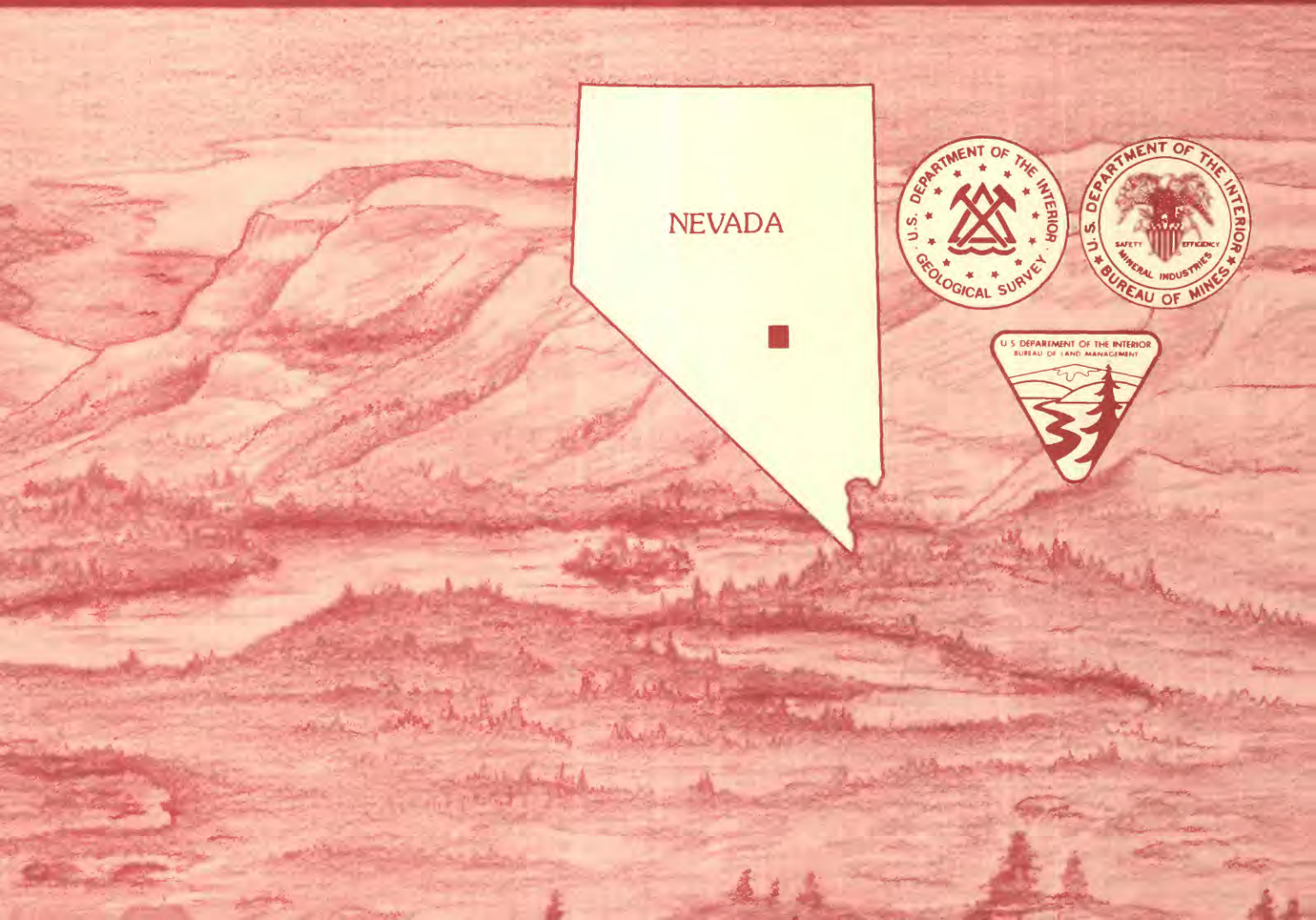

Chapter C

Mineral Resources of the South Reveille Wilderness Study Area, Nye County, Nevada

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U.S. GEOLOGICAL SURVEY BULLETIN 1731–C
MINERAL RESOURCES OF WILDERNESS STUDY AREAS: CENTRAL NEVADA

DEPARTMENT OF THE INTERIOR
DONALD PAUL HODEL, Secretary

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STUDIES RELATED TO WILDERNESS

Bureau of Land Management Wilderness Study Area

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine the mineral values, if any, that may be present. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral survey of part of the South Reveille (NV-060-112) Wilderness Study Area, Nye County, Nevada.

CONTENTS

FIGURES

Mineral Resources of the South Reveille Wilderness Study Area, Nye County, Nevada

By Michael F. Diggles, James A. Saunders, David A. Ponce, *and* Elizabeth A. Rochette
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SUMMARY

Abstract

At the request of the U.S. Bureau of Land Management, 33,000 acres of the South Reveille Wilderness Study Area in the southern part of the Reveille Range in south-central Nevada were studied. In this report, the area studied is referred to as "the wilderness study area", or simply "the study area." Rhyolitic tuff and quartz latite intrusive rocks are the dominant rock types. There has been no mining within the wilderness study area; however, several mining camps, including Reveille and New Reveille in the Reveille mining district, lie close-by to the north. Near the southern boundary of the study area, a 30-ft shaft was sunk in a low-grade gold- and silver-bearing quartz vein. No resources were identified in the study area.

Field work and geochemical sampling revealed one mineralized area that lies astride the southern boundary of the study area. Most of the mineralized area has low mineral resource potential for gold and silver in vein deposits, except for the central core, which has moderate resource potential for the same metals.

Character and Setting

The study area includes approximately 33,000 acres in a mountainous part of the southern half of the Reveille Range in south-central Nevada (fig. 1). The elevation ranges from 8,910 ft at Reveille Peak to about 5,160 ft along the eastern boundary of the study area. Because the climate in the region is semiarid, stream channels are characteristically dry and littered with unconsolidated silt- to boulder-sized material. The Reveille Range, a north-northwest-trending uplifted fault block within the Basin and Range physiographic province, is bounded by the Reveille Valley graben on the west and by the Railroad Valley graben on the east. Rocks exposed in the range consist of Paleozoic (505 to 245 million years before present (Ma)) sedimentary strata and Tertiary (26.1 to 3.8 Ma) tuff and basalts (see Geologic Time Chart, last page of report). The study area contains only Tertiary rocks.

Identified Mineral Resources and Mineral Resource Potential

A single mineralized area was identified in the study area. This area is located within the southernmost 2 mi^2 of the Reveille Range, mostly within the study area. It is defined by a gold- and silver-bearing quartz vein, highly fractured and bleached rhyolite, and a 3,000-ft-long by 1,800-ft-wide area of iron-stained rhyolite containing low concentrations of arsenic, an element commonly associated with gold in this geologic environment. The southern 2 mi^2 of the Reveille Range has moderate resource potential for gold and silver. The surrounding 6 mi^2 have low resource potential for the same metals.

INTRODUCTION

Location and Physiography

The South Reveille Wilderness Study Area (NV-060-112) covers approximately 106,000 acres, of which the U.S. Geological Survey and the U.S. Bureau of Mines were asked to study 33,000 acres in the southern half of the Reveille Range in southern Nye County,

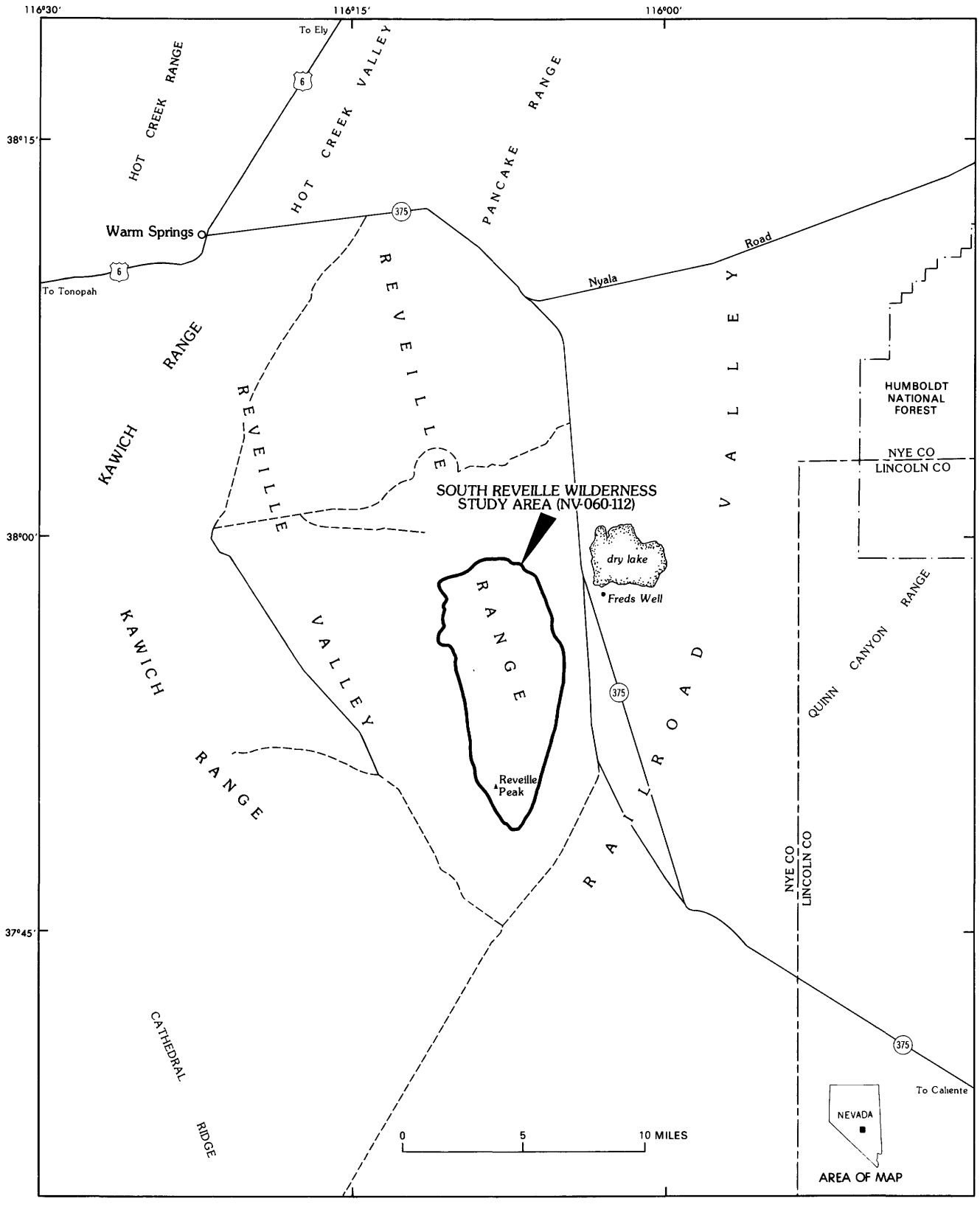


Figure 1. Index map showing location of the South Reveille (NV-060-112) Wilderness Study Area, Nye County, Nevada.

about 70 mi east of Tonopah, Nevada (fig. 1). Throughout this report, "wilderness study area" and "study area" refer only to the smaller area in which surveys were conducted. The study area is approximately 12 mi long and 5 mi wide. Its eastern, southern, and western boundaries coincide with the base of the Reveille Range. The northern boundary extends across the range about 3.5 mi north of Fang Ridge (fig. 2). The highest elevation in the study area is Reveille Peak at 8,910 ft (fig. 1); the lowest elevation is about 5,160 ft on the eastern boundary of the study area. Topography is rugged and mountainous. State Highway 375, beginning at Warm Springs about 25 mi to the northwest, runs parallel to and about 1 mi east of the eastern boundary of the study area. County-maintained gravel roads extend around the western and southern boundaries of the study area (fig. 1). Unmarked, unmaintained jeep trails branching from the county roads provide access to the base of the mountains. The Reveille Range, a north-northwest-trending uplifted fault block of the Basin and Range physiographic province, is bounded by the Reveille Valley graben on the west and by the Railroad Valley graben on the east. Exposed rocks in the range consist of Paleozoic sedimentary strata and Tertiary tuffs and basalts.

Procedures and Sources of Data

In 1984, the U.S. Geological Survey and the U.S. Bureau of Mines conducted field work as part of a mineral resource investigation of the South Reveille Wilderness Study Area. The U.S. Geological Survey compiled existing geologic maps, mapped additional geologic detail where necessary, and conducted regional geophysical and geochemical surveys.

The U.S. Bureau of Mines sampled altered and mineralized rocks in and near the wilderness study area. Prior to the field work, published and unpublished reports and U.S. Bureau of Mines files were searched for data pertinent to the geology and mining history of the wilderness study area. U.S. Bureau of Land Management files and Nye County records were also searched for mining claim, oil and gas, and geothermal lease information.

Field studies conducted by the U.S. Bureau of Mines included a search for potentially mineralized areas and examination of the only known prospect near the study area, a 30-foot-deep shaft about 500 ft south of the southern study area boundary (fig. 2). A total of 42 stream-sediment, 42 random chip, 8 continuous chip, 3 select, and 3 panned-concentrate samples were collected by the U.S. Bureau of Mines (Neubert, 1985). All samples were analyzed for gold and silver by the fire-assay inductively coupled plasma technique and for 40 elements, including antimony, barium, cadmium, cobalt, chromium, copper, gold, iron, lead, lithium, magnesium, manganese, molybdenum, nickel, platinum, silver, tin, titanium, vanadium, and zinc by semiquantitative optical emission spectrography. Selected samples were analysed for arsenic and antimony by atomic absorption and for uranium by fluorimetry.

Previous geologic studies pertinent to the South study area consist of the following: (1) a geologic and mineral resources report of southern Nye County, map scale 1:250,000 (Cornwall, 1972); (2) the most recent work, a reconnaissance geologic map of the northern Kawich and southern Reveille ranges, 1:62,500 scale (Gardner and others, 1980); and (3) a report and map of the nearby Nellis Air Force base at a scale of 1:125,000 (Ekren and others, 1971).

Acknowledgments

F.J. Kleinhampl provided geological advice during field work. Much assistance in the field was made possible by appointments based on recommendations of the National Association of Geology Teachers (NAGT). Students employed by the U.S. Geological Survey through the program were D.E. Clemens, Richard Graff, and E.A. Rochette. Others who provided assistance in the field were R.J. Fairfield, Jr., V.E. Langenheim, Donald Plouff, R.E. Tucker, and J.P. Tysl. J.T. Nash reviewed the geochemical interpretations in this report. R.F. Kness, C.M. Martin, and R.A. Welsh assisted with the U.S. Bureau of Mines field work.

APPRAISAL OF IDENTIFIED RESOURCES

By John T. Neubert, U.S. Bureau of Mines

Mining and Mineral Exploration History

There has been no apparent mining within the study area, but the Reveille mining district lies about 2 mi to the northwest and claim groups in that district extend across the northern boundary of the study area. The Reveille district was established in 1866, and mines within the district have been worked intermittently since that time. Most production occurred prior to 1920, by which time 8,261 tons of ore worth $610,982 were produced (Kral, 1951). Kleinhampl and Ziony (1984) indicated that the district has yielded at least $749,000 worth of ore. The district produced mostly silver, lead, and minor amounts of antimony, copper, and gold.

The study area is underlain by Tertiary rocks, whereas Paleozoic sedimentary rocks and Tertiary volcanic rocks crop out in the Reveille mining district. Most of the mineral deposits in the district are associated with Paleozoic strata or are near their contact with Tertiary rhyolitic tuff. Mineral occurrences are concentrated along the contacts with the sedimentary and volcanic rocks, and in faults within the Paleozoic and Tertiary rocks, with some replacement of sedimentary rocks in favorable beds (Kral, 1951).

In contrast to the Reveille mining district, no Paleozoic sedimentary rocks crop out in the study area. The depth to Paleozoic strata, if any are present, is unknown, although geophysical data indicate that either they are absent or at great depth.

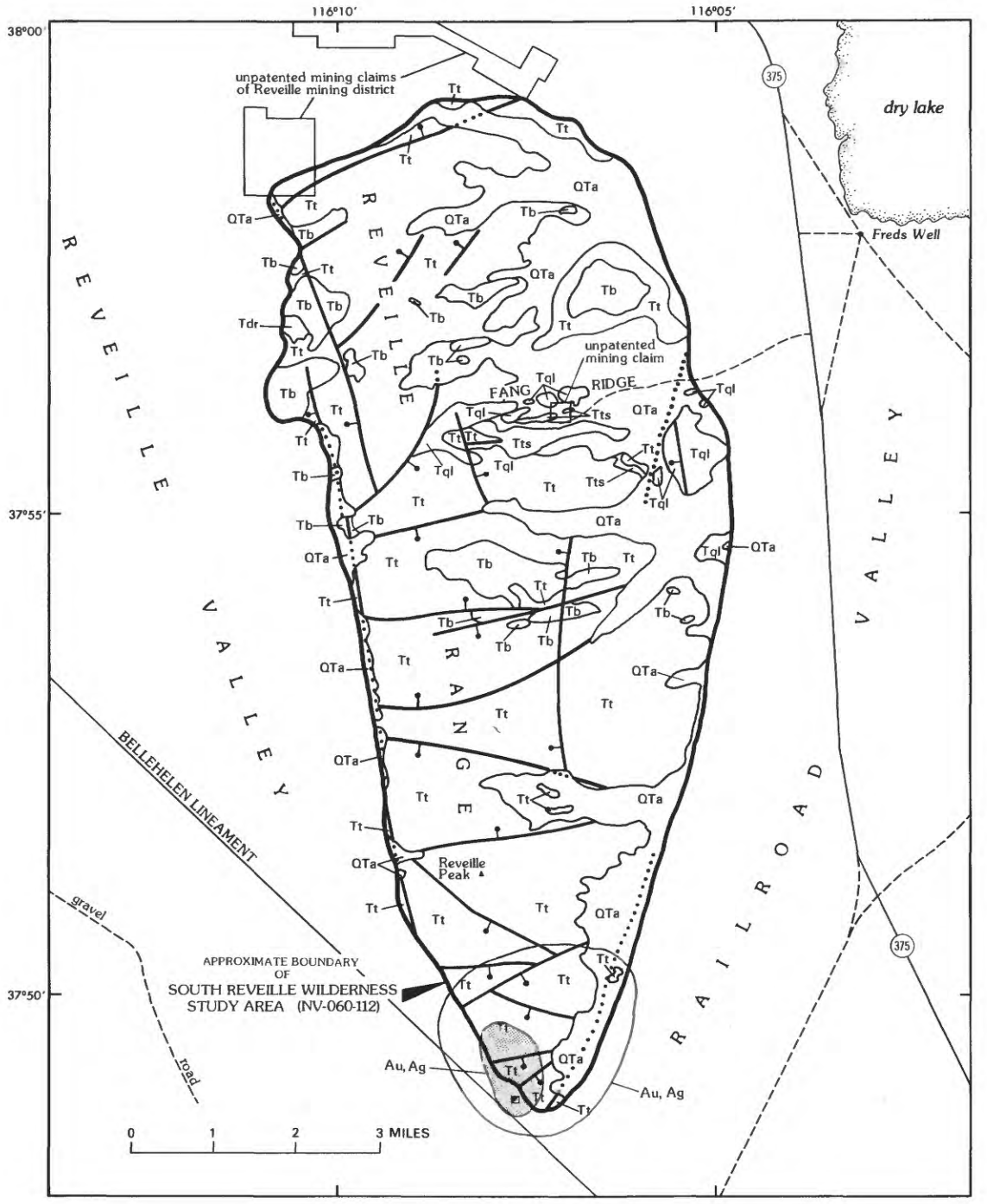


Figure 2. Generalized geologic map showing areas of mineral resource potential in the South Reveille Wilderness Study Area, Nevada.

EXPLANATION

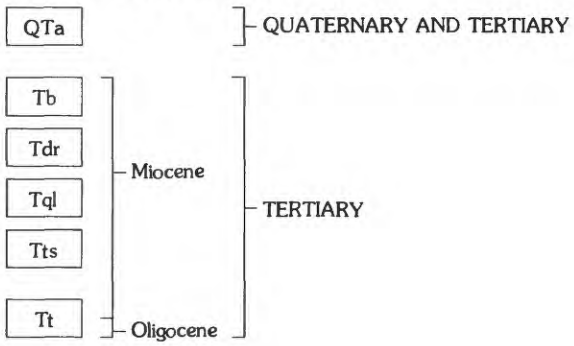
GEOLOGIC TERRANE HAVING MODERATE MINERAL RESOURCE POTENTIAL–certainty level C (M/C). See appendix 1 and figure 3 for definition of levels of mineral resource potential and certainty of assessment.

GEOLOGIC TERRANE HAVING LOW MINERAL RESOURCE POTENTIAL, certainty level B (L/B)

COMMODITIES

Ag Silver
Au Gold

CORRELATION OF MAP UNITS



GEOLOGIC MAP UNITS

QTa Alluvium (Quaternary and Tertiary)
Tb Basalt (Miocene)
Tdr Dacite and Rhyolite (Miocene)
Tql Quartz latite (Miocene)
Tts Tuffaceous sedimentary rocks (Miocene)
Tt Tuff of Reveille Range (Miocene) and Monotony tuff, undivided (Oligocene)

MAP SYMBOLS

CONTACT
FAULT-Dotted where concealed, ball and bar on downthrown side
DIRT ROAD
SHAFT

Figure 2. Continued.

Mines, Prospects, and Mineral Occurrences

One mineralized area at the southern tip of the Reveille Range contains low gold and silver concentrations. The mineralized area lies mostly within the study area. Although all or part of the 3 blocks of mining claims are located within the study area (fig. 2), no workings or surface evidence of mineralization were identified at the claims. Rock suitable for roadfill is present throughout the study area.

Southern Tip of the Reveille Range

The southern 2 mi^2 of the Reveille Range, within and just outside the study area, is mineralized. Features described below that define the mineralized area consist of the following: 1) a silver- and gold-bearing quartz vein, and 2) widespread fracturing and alteration.

A silver- and gold-bearing quartz vein within the mineralized area is exposed in a 30-ft shaft about 500 ft south of the study area (fig. 2). This vein is 3 ft wide, strikes N. 60° W., and dips 85° SW. Selected material from the dump contains 41 parts per million (ppm) antimony, 69 ppm arsenic, 0.071 ppm gold, 230 ppm lead, 25 ppm silver, and 0.06 percent zinc (Neubert, 1985). A chip sample collected at an outcrop of the vein 375 ft southeast of the shaft contains 72 ppm arsenic and 2.3 ppm silver (Neubert, 1985). At the outcrop, the vein consists of quartz pods and stringers with inclusions of rhyolite country rock.

Rhyolite tuff in the mineralized area north of the shaft is highly fractured and bleached and contains partly kaolinized potassium feldspar. The fractures are subparallel and trend north to northeast. Northwest-trending lenses of iron-oxide-stained rhyolite as much as 40 ft wide are also present; some are silicified. The zone of iron-oxide-stained lenses extends from just north of the shaft to 3,000 ft to the north.

The Bellehelen lineament (a major regional structure discussed later in this report), the precious-metal-bearing vein at the shaft, and the iron-oxide-stained lenses and streaks are parallel to subparallel to one another, indicating a possible genetic relationship between structures and mineralization. Many fractures in the mineralized area are oriented 30° to 90° from the general trend of the vein and the Bellehelen lineament.

Low concentrations of Arsenic, a common pathfinder element for gold deposits in the region, are present in the low-grade precious-metal vein at the shaft and in the bleached and fractured rhyolite inside the study area north of the shaft (fig. 2). The area containing low concentrations of arsenic is about 3,000 ft long and 1,800 ft wide and is located within the southernmost 2 mi^2 of the study area. Additionally, one sample from this area contains 0.017 ppm gold (Neubert, 1985).

Industrial Rocks and Minerals

Rhyolite tuff suitable for roadfill, construction, and other industrial uses is present in the study area, but larger, more accessible deposits are available outside the area. The rocks of the study area have no unique industrial or decorative characteristics.

Identified Resources

The southernmost 2 mi^2 of the Reveille Range is a mineralized area. A 3,000-ft-long by 1,800-ft-wide area of highly fractured and bleached rhyolite containing minor gold and silver and low concentrations of arsenic is situated in the mineralized area in the study area.

Rhyolite tuff, sand, and gravel suitable for common construction purposes are present in the study area, but development of these materials is unlikely because similar materials of equal or better quality are abundant closer to existing markets.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

By Michael F. Diggles, James A. Saunders, David A. Ponce, and Elizabeth A. Rochette, U.S. Geological Survey

Geology

Most of the rocks of the South Reveille Wilderness Study Area consist of areally extensive ash-flow tuffs, local hypabyssal rocks, and basalt. Older rocks do not crop out in the study area, but to the north, these tuffs and all other Tertiary rocks overlie and (or) intrude shale, carbonate rocks, and quartzite of Ordovician to Permian age. Hypabyssal quartz-latitic rocks of middle(?) Miocene age intrude the tuff in the study area. The youngest rocks in the study area are olivine basalts that cap several high ridges.

Oligocene Rocks

The most widespread Tertiary unit in southern Nye County is the Monotony Tuff (Cornwall, 1972), a compound cooling unit composed of densely welded devitrified latite tuff that is as much as 1,000 ft thick. In this report, the Monotony Tuff is divided into an upper member, the coarsely devitrified tuff member (equivalent to the tuff of Goblin Knobs of Ekren and others, 1973), and a lower member, the quartz-latite tuff member. In its overall physical appearance, the Monotony Tuff is characterized by abundant large books of biotite and large quartz phenocrysts (Ekren and others, 1971). Pumice fragments are generally inconspicuous. The coarsely devitrified tuff member, an intracaldera facies of the Monotony Tuff, is the oldest exposed rock unit in the study area. The presence of this facies, which is coextensive with more widespread and possibly thicker tuff deposits (tuff of Goblin Knobs) to the north (Ekren and others, 1973), indicates that the Monotony caldera lies partly within the study area. This conclusion is based on the structural interpretation of the region

(Ekren and others, 1973). Ekren and others (1973) described their tuff of Goblin Knobs as a compound cooling unit of densely welded, coarsely devitrified quartz latitic to rhyolitic welded tuff that is about 5,000 ft thick. In general, the coarsely devitrified tuff member is pumice-rich and contains pumice fragments 2-6 in long. This rock type is distinguished from lithologies more typical of the Monotony Tuff by fewer phenocrysts, the presence of sedimentary lithic fragments, a higher alkali feldspar-to-plagioclase ratio, and less biotite (Ekren and others, 1973). The age of the coarsely devitrified tuff member (of the Monotony Tuff) is 26.1 ± 0.7 Ma (Ekren and others, 1973; Kleinhampl and Ziony, 1985).

Miocene and Pliocene Rocks

Miocene tuffaceous sedimentary rocks are found within and north of the study area. These rocks consist of thin-bedded, tuffaceous fluvial and lacustrine sandstone and siltstone that are commonly intensely silicified. These strata, totaling as much as 100 ft in their overall thickness, are interbedded with tuff in the Reveille Range and are intruded by quartz latite at Fang Ridge.

The tuff of Reveille Range (Ekren and others, 1973) is as much as 2,000 ft thick within the study area. It is made up of at least two cooling units composed mostly of densely welded, crystal-rich ash-flow tuff containing quartz, plagioclase, and local biotite phenocrysts. A well-defined vitrophyre occurs at the base of the formation. The tuff of Reveille Range is commonly hydrothermally altered at the southern end of the study area. A potassium-argon age of 20.4 ± 0.3 Ma was determined on sanidine from this unit (this report).

Several quartz-latite intrusions are present within and north of the study area. The most conspicuous of these are at Fang Ridge, where the quartz latite is light-gray to buff colored, flow layered, and mildly contorted. The quartz latite's border zones are glassy and its interior is devitrified and coarsely crystalline. A potassium-argon age determination of 18.7 Ma was made on biotite from a sample of the quartz latite collected north of the study area (Ekren and others, 1973).

Extensive Miocene and Pliocene basalt flows cap areas of the west piedmont, west flank, and crest of the Reveille Range. These flows, each associated with a discrete vent, are individually as much as 200 ft thick and consist of black to bluish-gray porphyritic olivine basalt that contains scattered phenocrysts of labradorite. Potassium-argon ages obtained from 12 whole-rock basalt samples indicate that they occur in two age groups with the ranges of 5.8 ± 0.3 to 5.6 ± 0.3 Ma and 3.9 ± 0.2 to 3.87 ± 0.3 Ma (Dohrenwend and others, 1985). Preliminary data indicate that the older basalt may include rocks as young as 5.2 ± 0.1 Ma (M.F. Diggles, unpub. data, 1986). One of the youngest basalt flows conceals one of the range-front faults on the west flank of the study area, thus postdating the uplift of the range at that location. Elsewhere, range-front faults cut the basaltic lava flows.

Structure

Structural features in the Reveille Range consist of folds and associated thrust faults, strike-slip faults, faults related to volcanic activity (such as caldera subsidence) and Basin and Range high-angle faults (Cornwall, 1972). Basin and Range faulting led to the uplift and eastward tilting of the Reveille Range during Miocene and Pliocene time. Faults on the west side of the range are assigned a minimum age of 4.2 Ma on the basis of age dates obtained from unfaulted basaltic lava flows found there.

It is possible that the 350-mi-long northwest-trending Bellehelen lineament truncates the southern end of the Reveille Range where Gardner and others (1980) described a dacitic-andesitic lava field south of the lineament that is apparently downdropped with respect to the Reveille Range. Here the lineament coincides with an apparent fault along which the latest movement postdates the Basin and Range faulting.

Potassium-argon dates obtained from the basalt in the Reveille Range indicate that maximum erosion occurred along the crest and upper flank areas of the range, and that approximate equilibrium existed in midpiedmont areas. Rapid erosion during early phases of range dissection was followed by significantly less erosion (Dohrenwend and others, 1985).

Bleached and iron-stained rocks are common at the southern tip of the Reveille Range, where alteration apparently was concentrated along fracture zones. There, lava flows and domes of intermediate composition characteristically contain feldspar phenocrysts partially altered to kaolinite, and the altered rocks are locally silicified.

Geochemistry

Methods

In 1984, the U.S. Geological Survey collected stream-sediment samples at 26 sites in the study area. The sampling and analytical procedures used and the data obtained appear in Saunders and Siems (1985).

Geochemical analyses of stream-sediment samples reflect the chemistry of the rocks that underlie the drainage basin upstream from the sample site. For this study, we used the nonmagnetic heavy-mineral concentrate derived from stream-sediment samples because this fraction concentrates minerals that may be related to mineralizing processes or accompanying alteration. Therefore, analyses of the concentrates can be used to identify areas with unusual geochemistry.

All samples were analyzed for 31 elements, including antimony, barium, cadmium, cobalt, chromium, copper, gold, iron, lead, magnesium, manganese, molybdenum, nickel, silver, thorium, tin, titanium, tungsten, vanadium, and zinc, using a six-step semiquantitative emission spectrographic method (Grimes and Marranzino, 1968).

Results and Interpretation

Data from U.S. Geological Survey geochemical studies in the adjacent Tonopah 1^{o} by 2^{o} quadrangle, that include analyses of more than 2,000 samples of mineralized rocks from mines and prospects, more than 1,200 samples of stream sediments collected from well-distributed sampling sites, and an equal number of nonmagnetic heavy-mineral concentrates, provide the framework for this geochemical interpretation (Fairfield and others, 1985; Siems and others, 1986). Thus, we interpret the geochemical results from the study area in a regional context by comparison with the typical geochemical signatures expressed in stream sediments derived from known mineral deposits and from mining areas in the region for which we have similar geochemical data. This evaluation is focused on anomalous concentrations of one or more trace elements associated with mineral deposits. In addition, multiple-element associations consistent with standard geochemical principles or elemental suites recognized in known ore deposits in the region are considered to be the most diagnostic and reliable for mineral assessment.

Rock and stream-sediment geochemical data for the study area do not indicate large or significant areas of alteration or anomalous concentrations of minerals. High concentrations of metallic elements were measured in two heavy-mineral concentrate samples: 700 ppm zinc in one and 2,000 ppm lead in another. According to the regional geochemical studies, these are anomalous concentrations. Stream-sediment and rock samples were collected from the Reveille and New Reveille mining camps to the north (Fairfield and others, 1985; Siems and others, 1986). These samples were highly enriched in antimony, arsenic, copper, and silver. However, no samples from within the study area contained these elements.

Geophysics

Aerial Gamma-ray Data

Examination by J.S. Duval (written commun., 1985) of aerial gamma-ray maps, which include composite-color maps (Duval, 1983), provided estimates of concentrations of the radioelements potassium, equivalent uranium, and equivalent thorium. The maps were compiled at a scale of 1:1,000,000 as part of the National Uranium Resource Evaluation program. The study area has a moderate overall radioactivity with concentrations of 2.0 to 2.6 percent potassium, 2.0 to 3.5 ppm equivalent uranium, and 9 to 14 ppm equivalent thorium. There are no uranium or thorium anomalies within or near the study area. A moderate potassium anomaly occurs along the east side of the study area (J.S. Duval written commun., 1985.).

Gravity Data

D.A. Ponce and J.B. Spielman collected gravity data and compiled a regional Bouguer gravity map at a scale of 1:62,500 (D.A. Ponce, unpub. data, 1985). Data coverage is sparse within the study area, particularly along the southern Reveille Range. In the southeast part of the study area, a gravity low of about 2 to 3 milligals (mGal) is associated with a prominent magnetic low. Because data coverage is sparse and the amplitude of the anomaly is small, possible thickening of volcanic rocks or the existence of a caldera cannot be confirmed using gravity data.

Aeromagnetic Data

In 1985, a total intensity aeromagnetic survey was flown at an altitude of 1,000 ft above terrain along east-trending flightlines spaced 0.5 mi apart (U.S. Geological Survey, 1985). Although the nominal flight altitude was 1,000 ft, the actual flight altitude may have varied from about 500 ft to 2,200 ft above the ground surface; but variations in flight altitude do not significantly correlate with magnetic anomalies, indicating that the anomalies are related to rock distribution. A previous aeromagnetic survey was flown at a constant barometric elevation of 8,000 ft above sea level along east-trending flightlines spaced 2 mi apart (Philbin and White, 1965). The low-level and high-level aeromagnetic surveys correlate well, with the low-level survey showing greater detail and enhanced anomaly resolution.

In the central part of the study area, quartz-latite dikes exposed along Fang Ridge are expressed by an elongate east-trending magnetic high.

In the southern part of the Reveille Range, a 3- by 4-mi elliptical magnetic low is probably related to the tuff of the Reveille Range. A large-amplitude magnetic low of about 500 nanoTeslas (nT) is present within the larger circular low and is probably caused by a combination of the tuff being reversely magnetized, the topographic relief, and the abrupt termination of magnetic rocks along a fault. Farther southeast, a 2- by 2-mi sub-circular magnetic low coincides with a poorly defined 2- to 3-mGal gravity low. This magnetic anomaly has an amplitude of about 600 nT and may also be caused by reversely magnetized rocks.

Mineral Resource Potential

The South Reveille Wilderness Study Area is located south of the Reveille mining district where silver and lead were mined. However, the geology of the study area differs from that of the mining district in that there are neither outcrops nor geophysical evidence of Paleozoic rocks, which generally host the metal deposits. The lack of a flat magnetic signature extending south into the study area indicates that the Paleozoic rocks are either absent or are buried at great depths.

In the southern 2 mi^2 of the Reveille Range, a mineralized zone exhibiting widespread alteration and fracturing of the host rocks extends into the study area. A gold- and silver-bearing quartz vein in the mineralized zone is explored by a shaft that is 30-ft deep and is situated about 500 ft south of the study

area boundary. Samples collected from its dump by the U.S. Bureau of Mines contain anomalous concentrations of antimony, gold, lead, silver, and zinc, as well as low concentrations of arsenic. The southern 2 mi^2 of the Reveille Range contain an area of moderate mineral resource potential for gold and silver with a certainty level of C. The surrounding area has low mineral resource potential for the same metals with a certainty level of B. See appendix 1 and figure 3 for definitions of levels of mineral resource potential and certainty of assessment.

Nearly all of Railroad Valley and much of Reveille Valley are leased for oil and gas. Some of these leases extend into the northern part of the study area, although the closest producing oil field lies about 55 mi to the north in Railroad Valley. In a report on the petroleum potential of wilderness lands in Nevada, Sandberg (1983) assigned the South Reveille Wilderness Study Area a zero potential for oil and gas because of the thick pile of Tertiary volcanic rocks, including dikes, and because of the study area's proximity to Tertiary calderas in the northern Reveille, Kawich, and Quinn Canyon Ranges.

Geothermal resources are not evident in or near the study area. Although hot springs are present in adjacent ranges, none were observed in the Reveille Range. No current geothermal leases exist in the South Reveille Wilderness Study Area.

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APPENDIX 1. Definition of levels of mineral resource potential and certainty of assessment

Mineral resource potential is defined as the likelihood of the presence of mineral resources in a defined area; it is not a measure of the amount of resources or their profitability.

Mineral resources are concentrations of naturally occurring solid, liquid, or gaseous materials in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible.

Low mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment where the existence of resources is unlikely. This level of potential embraces areas of dispersed mineralized rock as well as areas having few or no indications of mineralization. Assignment of low potential requires specific positive knowledge; it is not used as a catchall for areas where adequate data are lacking.

Moderate mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resource occurrence, where interpretations of data indicate a reasonable chance for resource accumulation, and where an application of genetic and (or) occurrence models indicates favorable ground.

High mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resources, where interpretations of data indicate a high likelihood for resource accumulation, where data support occurrence and (or) genetic models indicating presence of resources, and where evidence indicates that mineral concentration has taken place. Assignment of high resource potential requires positive knowledge that resource-forming processes have been active in at least part of the area; it does not require that occurrences or deposits be identified.

Unknown mineral resource potential is assigned to areas where the level of knowledge is so inadequate that classification of the area as high, moderate, or low would be misleading. The phrase "no mineral resource potential" applies only to a specific resource type in a well-defined area. This phrase is not used if there is the slightest possibility of resource occurrence; it is not appropriate as the summary rating for any area.

Expression of the certainty of the mineral resource assessment incorporates a consideration of (1) the adequacy of the geologic, geochemical, geophysical, and resource data base available at the time of the assessment, (2) the adequacy of the occurrence or the genetic model used as the basis for a specific evaluation, and (3) an evaluation of the likelihood that the expected mineral endowment of the area is, or could be, economically extractable.

Levels of certainty of assessment are denoted by letters, A-D (fig. 3).

A. The available data are not adequate to determine the level of mineral resource potential. Level A is used with an assignment of unknown mineral resource potential.

B. The available data are adequate to suggest the geologic environment and the level of mineral resource potential, but either evidence is insufficient to establish precisely the likelihood of resource occurrence, or occurrence and (or) genetic models are not known well enough for predictive resource assessment.

C. The available data give a good indication of the geologic environment and the level of mineral resource potential, but additional evidence is needed to establish precisely the likelihood of resource occurrence, the activity of resource-forming processes, or available occurrence and (or) genetic models are minimal for predictive applications.

D. The available data clearly define the geologic environment and the level of mineral resource potential, and indicate the activity of resource-forming processes. Key evidence to interpret the presence or absence of specified types of resources is available, and occurrence and (or) genetic models are adequate for predictive resource assessment.

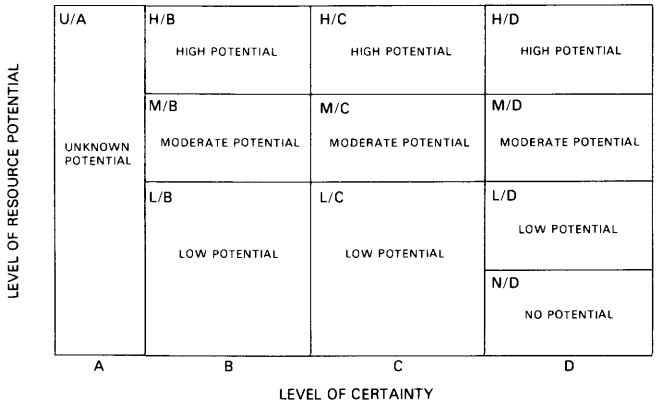

Figure 3. Major elements of mineral resource potential/certainty classification

GEOLOGIC TIME CHART

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

EON	ERA	PERIOD		EPOCH	AGE ESTIMATES OF BOUNDARIES (in Ma)
Phanerozoic	Cenozoic	Quaternary		Holocene	0.010
				Pleistocene	1.7
		Tertiary	Neogene Subperiod	Pliocene	5
				Miocene	24
			Paleogene Subperiod	Oligocene	38
				Eocene	55
				Paleocene	66
	Mesozoic	Cretaceous		Late Early	96 138
		Jurassic		Late Middle Early	205
		Triassic		Late Middle Early	~240
	Paleozoic	Permian		Late Early	290
		Carboniferous Periods	Pennsylvanian	Late Middle Early	~330
			Mississippian	Late Early	360
		Devonian		Late Middle Early	410
		Silurian		Late Middle Early	435
		Ordovician		Late Middle Early	500
		Cambrian		Late Middle Early	~570[1]
Proterozoic	Late Proterozoic				900
	Middle Proterozoic				1600
	Early Proterozoic				2500
Archean	Late Archean				3000
	Middle Archean				3400
	Early Archean				
pre-Archean[2]		(3800?)			4550

[1]Rocks older than 570 Ma also called Precambrian, a time term without specific rank.

[2]Informal time term without specific rank.

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