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MINERAL RESOURCE POTENTIAL OF THE COXCOMB MOUNTAINS WILDERNESS STUDY AREA (CDCA-328), SAN BERNARDINO AND RIVERSIDE COUNTIES, CALIFORNIA

SUMMARY REPORT

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STUDIES RELATED TO WILDERNESS

Bureau of Land Management Wilderness Study Areas

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine their mineral resource potential. 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 the Coxcomb Mountains Wilderness Study Area (CDCA-328), California Desert Conservation Area, Riverside and San Bernardino Counties, California.

SUMMARY

Geologic, geochemical, geophysical, and mineral surveys within the Coxcomb Mountains Wilderness Study Area in southeastern California define several areas with low to moderate potential for base and precious metals. Inferred subeconomic resources of gold at the Moser mine (area IIa) are estimated at 150,000 tons averaging 1.7 ppm Au. The remainder of the study area has low potential for other mineral and energy resources including radioactive minerals and geothermal resources. Oil, gas, and coal resources are not present within the wilderness study area.

INTRODUCTION

The Coxcomb Mountains Wilderness Study Area (CDCA-328) is located in the Mojave Desert of southeastern California approximately 154 mi east of Los Angeles, Calif., and 148 mi southwest of Las Vegas, Nev. The wilderness study area encompasses approximately 46,000 acres bounded by the Joshua Tree National Monument on the west, State Highway 62 on the north, and service roads for the Colorado River Aqueduct on the east and south. This area includes the eastern Pinto Mountains and much of the Coxcomb Mountains except for the area within the Joshua Tree National Monument (fig. 1). Elevations within the wilderness study area vary from 1,200 ft along the southwest boundary to 3,290 ft along the crest of the Coxcomb Mountains. The climate is arid with an average rainfall of approximately 3 in. per year.

The U.S. Geological Survey (USGS) and the U.S. Bureau of Mines (USBM) have completed mineral surveys of the Coxcomb Mountains Wilderness Study Area to assess the mineral resource potential. The USGS conducted geologic, geochemical, and geophysical investigations to determine the controls and extent of known mineralization as a guide to undiscovered mineralized areas. The USBM described and sampled the known mines and mineral prospects.

GEOLOGY, GEOCHEMISTRY, AND GEOPHYSICS PERTAINING TO MINERAL RESOURCE ASSESSMENT

Geology

Previous geologic studies in and adjacent to the Coxcomb Mountains Wilderness Study Area by Miller (1944), Hope (1966), Greene (1968), and Calzia (1982) indicate that the wilderness study area is underlain by metaigneous and metasedimentary rocks of Jurassic and (or) older age intruded by granitic rocks of Late Jurassic to Late Cretaceous age. The metamorphic and granitic rocks are overlain by volcanic and sedimentary deposits of Tertiary and Quaternary age.

Metaigneous rocks are mapped in the northern half of the wilderness study area. These rocks include porphyritic quartz monzonite in the central Pinto Mountains that grades eastward to quartz monzodiorite in the eastern Pinto and southern Sheep Hole Mountains and to biotite amphibole monzogranite as well as quartz monzodiorite in the Coxcomb Mountains. Many mafic xenoliths and a few pendants of schist are found in the quartz monzodiorite in the Pinto Mountains. Metavolcanic rocks of andesitic composition are found in the western and southern Pinto Mountains outside of the wilderness study area. These metavolcanic rocks may be older than the quartz monzodiorite, but the contact relations between these rocks are not known.

Metasedimentary rocks are mapped in and adjacent to the wilderness study area. These rocks, the McCoy Mountains Formation of Miller (1944), include metasiltstone and fine-grained metasandstone with lenses of pebble conglomerate and metalimestone. Metasedimentary rocks in the southern Coxcomb Mountains were folded at least twice and are metamorphosed to the greenschist facies. The relative age of the metaigneous rocks in the Pinto, Sheep Hole, and Coxcomb Mountains and the McCoy Mountains Formation is not known.

The metaigneous and metasedimentary rocks are intruded by the Coxcomb Granodiorite of Miller (1944). Calzia (1982) has subdivided the Coxcomb Granodiorite into four facies that include (oldest to youngest): biotite-hornblende granodiorite, porphyritic biotite granodiorite to monzogranite, and biotite-muscovite monzogranite. The fourth facies of porphyritic biotite granodiorite is intruded by the monzogranite unit and is in fault contact with the porphyritic granodiorite to monzogranite unit. Major-element geochemistry suggests that the porphyritic granodiorite unit crystallized from a more "primitive" magma and may be older than the other three facies. Intrusive contacts that prove this relation are not known.

The Coxcomb Granodiorite is Cretaceous in age. This age assignment is based on K-Ar dates from the monzogranite and biotite-hornblende granodiorite facies (Calzia, 1982) and new Pb/U isotopic data from the southernmost granodiorite facies (E. DeWitt, written commun., 1983).

Olivine basalt flows and volcaniclastic deposits of Tertiary(?) and Quaternary age are interbedded with tilted fanglomerate deposits in the Joshua Tree National Monument west of the Coxcomb Mountains. The fanglomerate deposits are overlain by alluvial and eolian deposits of Quaternary age. Playa deposits and a single outcrop of the Bishop ash are interbedded with the alluvial deposits.

The rocks within the Coxcomb Mountains Wilderness Study Area are broken into large blocks by northwest-, northeast-, and east-trending faults. The northwest-trending faults generally are the oldest and are cut by northeast-trending faults in the Coxcomb and eastern Pinto Mountains. Northwest-trending faults terminate within an east-trending valley in the eastern Pinto Mountains. This valley is alined with a large east-trending fault mapped by Hope (1966) west of the wilderness study area and is probably fault controlled. A large east-trending topographic low in the central Coxcomb Mountains is probably located along a fault. Here the northwest-trending faults cross the east-west structure with no apparent offset. Most of the mineralization in the wilderness study area is located along faults and joints that trend N. 10°-30° W. and N. 70° W. to east-west.

Geochemistry

A reconnaissance geochemical study of the Coxcomb Mountains Wilderness Study Area identified several areas of anomalous base- (Cu, Pb, Zn, Mo) and (or) precious- (Au, Ag) metal mineralization. Anomalous concentrations of various elements within these areas are defined by Kilburn and others (1983). The sample media consisted of rocks, stream sediments, and heavy-mineral concentrates from stream sediments. A total of 114 stream-sediment and 82 concentrate samples were gathered from active alluvium in selected drainages throughout the study area. Twenty rock samples were collected from outcrop areas of observed alteration and from mine dumps and adits to determine mineral suites and trace-element signatures of mineralized systems.

The samples were processed in the sample-preparation laboratories prior to analysis. All processed samples were analyzed by a six-step semiquantitative emission spectrographic method (Grimes and Marranzino, 1968) for 31 elements.

Spectrographic analysis of the nonmagnetic fraction of the heavy-mineral concentrates provided the most useful data in evaluating the mineral potential of the wilderness study area. This medium, which contains the sulfide minerals and their oxidation products, showed a greater contrast in metal concentrations than did the stream sediments (McCarthy and Lovering, 1978). Removal of the rock-forming silicates from the concentrates tends to enhance anomalous areas that may remain hidden in the stream-sediment samples.

Geophysics

Geophysical investigations in the Coxcomb Mountains Wilderness Study Area included aeromagnetic and gravity surveys. Three separate total field intensity aeromagnetic surveys were combined to cover the wilderness study area. Two of the surveys form east-west elongate rectangles between lats $33^{\circ}55'$ and $34^{\circ}00'$ and between lats $34^{\circ}00'$ and $34^{\circ}05'$, respectively. They were flown in an east-west direction at a constant nominal elevation of 1,000 ft above the ground surface. Flight lines were spaced approximately 0.5 mi apart with north-south tie lines every 10 mi. The third survey covers the southernmost part of the wilderness study area and was flown in sections over this area in a north-northwest direction. Two sections were flown at constant elevations of 1,900 ft and 2,900 ft above sea level, respectively, and a third section was flown at elevations which tilt from 2,000 ft on the north-northwest to 1,000 ft on the south-southeast.

New gravity data collected by the U.S. Geological Survey were merged with other available gravity data. Much of the new data was acquired either along surveyed profiles around the periphery of the range, or with the aid of helicopter in the more inaccessible parts of the range.

An elongate, east- to southeast-trending zone of low aeromagnetic anomaly values (aeromagnetic low) extends from the Pinto Mountains into the northwest corner of the wilderness study area. The aeromagnetic low is probably caused by the destruction of magnetite in the underlying igneous rocks. Destruction of the magnetite is indicated by the bleached appearance of the igneous rocks and their low measured magnetic susceptibilities. The aeromagnetic low coincides with most of the mines and prospects in the Dale mining district (fig. 2, no. 7) and may indicate a zone of gold mineralization and associated alteration.

Other aeromagnetic lows in the central part of the wilderness study area correlate with exposures of the McCoy Mountains Formation. Measured magnetic susceptibilities demonstrate that these metasedimentary rocks are nearly nonmagnetic relative to the low and moderate magnetizations of surrounding igneous rocks. An aeromagnetic low south of the wilderness study area can be explained by the presence of these nonmagnetic metasedimentary rocks.

Most of the igneous rocks within the wilderness study area produce rather small aeromagnetic anomalies consistent with low magnetization. Two igneous units, however, coincide with broad aeromagnetic highs of moderate amplitude. These include the porphyritic quartz monzodiorite unit in the western part of the wilderness study area and the biotite-hornblende granodiorite unit in the southern Coxcomb Mountains.

Large positive aeromagnetic anomalies over iron deposits in the Eagle Mountains southwest of the wilderness study area extend about halfway across the alluvial valley between the Eagle and Coxcomb Mountains before being abruptly truncated. This truncation suggests the presence of a major structural break between the Coxcomb and Eagle Mountains with either large vertical or horizontal displacement and implies that the iron deposits do not extend into the wilderness study area.

Gravity data from the Coxcomb Mountains Wilderness Study Area indicate a general increase in Bouguer gravity values from north to south. Positive anomalies coincide with mapped outcrops of metasedimentary rocks of the McCoy Mountains Formation. A steep east- to northeast-trending gravity gradient near the south boundary of the wilderness study area coincides with the contact between metasedimentary rocks to the south and igneous rocks to the north.

Gravity gradients along the west side of the Coxcomb Mountains and a large negative gravity anomaly in the Pinto Basin suggest that a major fault trends along the west edge of the range. This structure, which truncates the east-trending aeromagnetic anomaly from the Eagle Mountains, may form the boundary between the pronounced east-west structural grain in ranges to the west and the northwest-trending structural grain in the Coxcomb and other desert ranges to the east.

MINES, MINING DISTRICTS, AND MINERALIZATION

Several mines and mining districts are located in and adjacent to the Coxcomb Mountains Wilderness Study Area. These include the Moser (fig. 2, no. 1), Iron Age (no. 2), Snowflake (no. 3), Last Chance (no. 4), Erwin (no. 5), and Eagle Mountain (no. 6) mines as well as the Dale mining district (no. 7). Numerous prospect pits and trenches contain anomalous concentrations of base (Cu-Pb-Zn) and (or) precious (Au and Ag) metals, barium, and radioactive (U and (or) Th) deposits. In addition, several shallow wells were drilled by private companies to measure geothermal gradients in alluvial valleys north and east of the wilderness study area. These mines and mineral deposits are critical to an understanding of the mineral potential of the wilderness study area. The mines and mineralization are briefly described in this section. An assessment of the resource potential of the wilderness study area based on these deposits is described in the last section. Oil, gas, and coal resources are not indicated within the wilderness study area.

Mines and mining districts

Moser mine

The Moser mine is located on the eastern flank of the Coxcomb Mountains within the wilderness study area. The main workings consist of more than 1,000 ft of drifts and stopes, numerous pits, and several short adits located along a northwest-trending fault that cuts the McCoy Mountains Formation of Miller (1944) and the biotite-hornblende granodiorite unit. Minerals noted at the main working include quartz (SiO_2), pyrite (FeS_2), arsenopyrite (FeAsS), Cu-silicates, siderite ($FeCO_3$), and psilomelane ($Mn_5O_{10}(Ba_1H_2O)_2$). Twenty-five samples collected by the USBM and USGS in fault zones within and adjacent to the mines indicate anomalous concentrations of Au, Ag, Cu, Pb, Zn, and As. Precious-metal concentrations range from nil to as much as 100 ppm Au and nil to 50 ppm Ag.

Iron Age and Snowflake mines

The Iron Age and Snowflake mines are located in the northeastern Pinto Mountains just west of the wilderness study area. Little is known about these large iron ore bodies. They are associated with the metamorphic assemblage actinolite+chlorite+serpentine in quartz monzonite. Relict textures in the quartz monzonite, primarily orthoclase phenocrysts and rounded quartz grains, as well as the metamorphic assemblage suggest that the iron ore is associated with skarn deposits. No carbonate deposits, however, are known near the mines. High-angle reverse faults further confuse the geologic setting of these mines.

The ore mineral at the Iron Age and Snowflake mines is hematite (Fe_2O_3) replacing magnetite ($FeO \cdot Fe_2O_3$). Wright and others (1953, p. 95) report that assays of 20 samples from the Iron Age mine average 67.27 percent iron, 3.32 percent silica, 0.032 percent sulfur, and 0.6 percent phosphorous. Production at the Iron Age and Snowflake mines exceeded 1.3 million tons from 1964 to 1969.

Last Chance mine

The Last Chance mine is located in the Coxcomb Mountains just within the Joshua Tree National Monument. This mine consists of a single drift along a northwest-trending fault that cuts metaigneous (the biotite-amphibole monzogranite unit) and igneous (the biotite-muscovite monzogranite unit) rocks. An iron-stained quartz vein is located along a north-trending fault that cuts the northwest-trending fault. A shaft follows the quartz vein until the shaft and drift intersect at depth.

The ore minerals at the Last Chance mine are unknown but probably contain gold and (or) silver. A semiquantitative analysis of the quartz vein indicates no anomalous concentrations of precious and base metals. The waste pile at the adit consists of quartz, hematite, limonite ($FeO(OH) \cdot nH_2O$), and calcite (probably secondary).

Erwin mine

The Erwin mine is located south of the wilderness study area along the southeast flank of the Coxcomb Mountains. This mine consists of a single trench dug along a northwest-trending fault that juxtaposes the McCoy Mountains Formation and the biotite-hornblende granodiorite unit. Mineralization includes quartz, Cu-silicates, siderite, hematite, white mica (sericite), and secondary calcite. Spectrographic analyses of rock samples indicate anomalous concentrations of Cu, Ag, and Mo.

Eagle Mountain mine

The Eagle Mountain mine is located 6 mi southwest of the Coxcomb Mountains Wilderness Study Area. The mine, opened in 1948 by Kaiser Steel, consists of two deep open pits in metasedimentary rocks of post-Precambrian and pre-Jurassic age. The ore is located in a series of limestone and dolomite beds that are interbedded with quartzite. The metasediments are intruded by porphyritic quartz monzonite and are folded into a large east-west anticline that extends completely across the Eagle Mountains. The ore zone is exposed for more than 5 mi and continues eastward for approximately 3 mi beneath the valley between the Coxcomb and Eagle Mountains.

The primary ore minerals, magnetite and pyrite, form many replacement lenses and stringers after actinolite-tremolite granofels within the ore zone. Primary ores consist of 42.5 percent Fe, 0.1 percent P, and 1.7 percent S (Dubois and Brummett, 1968, p. 1604). Secondary ore minerals include hematite (martite) after magnetite and limonite-hematite-goethite ($HFeO_2$) mixture after pyrite.

The secondary ores are of greatest interest at the Eagle Mountain mine because oxidation during formation of the secondary ores removed most of the sulfur from the primary ore allowing the production of a low-sulfur product by magnetic and gravity concentration methods. The mine produces 9 million tons of approximately 35 percent Fe per year with reserves of 350 million tons (Leszcykowski and Causey, 1982, p. 5). Production to date exceeds 100 million tons (Scott and Wilson, 1980, p. 140). The Eagle Mountain mine is scheduled to close in 1986 because of a declining market and increased cost.

Dale mining district

The Dale mining district, located about 2 to 3 mi west of the wilderness study area, includes the Virginia Dale and the Monte Negro districts. The mining district was first prospected in 1884 and continues to be active in the present. Most mines within the Dale mining district are located along quartz veins within diorite, quartz diorite, and andesite of Jurassic and older age. The ores include gold, silver, lead, copper, and iron as well as lesser amounts of manganese and uranium. Larry Vredenburgh (written commun., 1981) reported that approximately 185,000 troy oz of gold was recovered from the most productive mines in the district.

An aeromagnetic low extends southeastward through the Dale mining district into the wilderness study area and across the Pinto Mountains into the Pinto Basin. The aeromagnetic low may be caused by alteration of magnetite to hematite and (or) pyrite during gold mineralization. The Zulu Queen and Outlaw mines, located within the aeromagnetic low on the southern flank of the Pinto Mountains, contain gold-bearing quartz veins in northwest-trending fault zones that cut igneous rocks similar to rocks in the Dale mining district. The close spatial relation between the mines and the aeromagnetic low as well as the geologic similarity of mines within the aeromagnetic low suggest that gold mineralization may extend southeastward from the Dale mining district into the wilderness study area.

Other mineralization

Base- and precious-metal mineralization

In addition to the Moser and Erwin mines, numerous prospect pits are located near the contact between the McCoy Mountains Formation and the biotite-hornblende granodiorite unit. The mineral assemblage and geochemical suite noted in these workings suggest that base- and precious-metal mineralization associated with skarns developed in metalimestone beds near the contact with the granodiorite. The mineral assemblage within the wilderness study area includes scheelite ($CaWO_4$), apatite (CaP_2O_5), gahnite ($ZnAl_2O_4$), monazite (Ce, La, Y, Th) PO_4, and garnet. South of the wilderness study area, the mineral assemblage includes quartz, Cu-silicates, hematite, siderite, white mica (sericite), chlorite, secondary calcite, and locally diopside(?). Spectrographic analyses of heavy-mineral concentrates collected south of the Moser mine and within the wilderness study area disclose anomalous values of W, Mo, Pb, and Bi. Analyses of stream-sediment, heavy-mineral concentrate, and rock samples south of the wilderness study area indicate anomalous concentrations of Mo, Zn, and Pb with varying amounts of Cu, W, and Ag.

Barium

Several barite ($BaSO_4$) veins in quartz monzodiorite were sampled by the USBM in the Bolero group of mines along the northwest boundary of the wilderness study area. These veins are 1.2 ft thick and contain 47.9 percent BaO with minor amounts of gold and silver. Other barite veins are located at the Hot Hell #2 claim north of the Bolero group. The mineralized veins within this claim contain 22.3 percent BaO, as high as 0.12 ppm Au and 20.0 ppm Ag, and magnetite nodules.

Uranium and thorium

Geologic studies in the Coxcomb Mountains were initiated as part of the National Uranium Resource Evaluation (NURE) program to evaluate the uranium (U) and thorium (Th) potential of igneous rocks in this range. Table 1 lists the variation in U and Th concentrations determined from 96 samples collected within the Coxcomb Mountains. These values show an increase of U and Th content with fractionation of the igneous rocks but do not indicate anomalous concentrations of these elements.

Chew and Antrim (1982) described several environments favorable for uranium mineralization in the McCoy Mountains Formation. These environments include an ancient braided-stream system as well as faulting and slump features. Slump features in the McCoy Mountains Formation are well developed along the southern front of the Coxcomb Mountains south of the wilderness study area and may be favorable environments for uranium mineralization.

The USBM identified a single radioactive anomaly in metaigneous rocks (syenite?) in the eastern Pinto Mountains. This anomaly contains 25 ppm U_3O_8 and 397 ppm ThO_2. Larry Vredenburgh (written commun., 1981) reported a uranium and potassium anomaly at the Iron Age mine and several uranium and thorium anomalies within the Dale mining district.

Geothermal resources

In 1981, the Geothermal Division of Phillips Petroleum drilled several shallow wells on a one-township spacing to measure geothermal gradients on public lands within the Coxcomb Mountains and adjacent Sheep Hole-Cadiz Wilderness Study Areas. A second phase of drilling within the Coxcomb Mountains Wilderness Study Area was completed before September 1982. Although data from these wells are confidential to Phillips Petroleum, they probably were drilled to evaluate a north-trending zone of high but variable heat flow that extends through the wilderness study areas. Heat flow measured in 100-m (328 ft) thermal-gradient wells completed by the USGS in the same area varies from 1.29 to 3.44 HFU (J. H. Sass, written commun., 1980).

The geothermal potential of this zone of high heat flow cannot be evaluated because the USGS wells are approximately 18 mi apart, and because the local hydrologic system is complex. Mohorich (1980, p. 183) reported that the energy per unit volume of water from low-temperature geothermal systems is low and the fluids generally could not be transported economically more than a few miles. Locally, low-temperature geothermal systems may be suited for direct applications to space heating, agriculture, and industry.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Geologic, geothermal, geophysical, and mineral surveys within the Coxcomb Mountains Wilderness Study Area define several areas with low to moderate resource potential for base and precious metals. Resource-potential terms are defined by R. B. Taylor and T. A. Steven (written commun., 1983). Briefly, an area of high mineral resource potential exists where all conditions of a genetic model of ore accumulation are met. This includes not only known mining districts but other areas where geologic, geophysical, analytical, and other data demonstrate or indicate an excellent possibility that mineralized rock exists.

Areas of moderate mineral resource potential include areas where the requirements of a genetic model have been satisfied, or can reasonably be interpreted to have been satisfied, but where evidence for mineralization is less obvious or has not yet been found. Areas classified with a low mineral resource potential lack evidence to support a favorable genetic model, lack indications of potential mineralization, or have an unfavorable combination of geologic factors including lack of source or mechanism of accumulation.

Area I is defined by the aeromagnetic low that extends from the Dale mining district through the northwest corner of the wilderness study area. Evidence of gold mineralization (quartz veins and bleached rocks) and alteration of magnetite to hematite and (or) pyrite spatially associated with this low in the Dale mining district were not found within the wilderness study area. The area defined by the aeromagnetic low within the wilderness study area therefore has low potential for precious-metal resources.

Area II is located along the contact between the McCoy Mountains Formation and the biotite-hornblende granodiorite unit and is characterized by anomalous concentrations of base and precious metals. These anomalies may be divided into three areas based on the geochemical assemblages. Area IIa is located in the vicinity of the Moser mine. This area is considered to have moderate potential for hypothetical base-metal resources and inferred subeconomic precious-metal resources as indicated by the anomalous concentrations of Mo, Pb, Zn, Cu, As, Au, and Ag in rock samples, and by the mining activity at the Moser mine. Inferred subeconomic gold resources at the mine are estimated at 150,000 tons averaging 1.7 ppm Au.

Area IIb is located in the central Coxcomb Mountains south of the Moser mine. Analyses of heavy-mineral concentrates indicate anomalous concentrations of W, Mo, Pb, and Bi. The associated mineral assemblage (scheelite, apatite, gahnite, monazite, and garnet) suggests contact metasomatic activity. These geochemical and mineral data indicate that area IIb has low potential for tungsten, molybdenum, and lead resources in skarn deposits.

Area IIc is located south of the wilderness study area and includes the Erwin mine. This area contains anomalous concentrations of Mo, Zn, and Pb with varying amounts of Cu, W, and Ag. These geochemical anomalies indicate that area IIc has low potential for base and precious metals.

The remainder of the Coxcomb Mountains Wilderness Study Area has low potential for mineral resources including radioactive minerals and geothermal resources. This assessment is based on the following evidence: 1) the general absence of base, precious, and radioactive mineralization in geologic environments known to be favorable for these resources; 2) generally low concentrations of metallic and radioactive elements determined by chemical analyses of stream-sediment, heavy-mineral concentrate, and rock samples; 3) the general lack of aeromagnetic and gravity anomalies associated with mineralized areas; and 4) the absence of reported production from mines and prospects within the wilderness study area.

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Table 1. Uranium and thorium content (ppm) of rocks in the Coxcomb Mountains, Calif.

	Coxcomb Granodiorite				McCoy Mountains Formation	Biotite-amphibole monzogranite
	Kgp	Kgd	Kgdm	Kg		
U_3O_8	1.10	0.84-1.94	0.41-1.96	0.54- 7.78	1.64- 2.29	3.17- 3.57
ThO_2	5.79	3.07-8.09	3.64-8.37	2.39-11.95	7.64-10.76	13.77-17.07

Kgp = Porphyritic biotite granodiorite
Kgd = Biotite-hornblende granodiorite
Kgdm = Porphyritic biotite granodiorite to monzogranite
Kg = Biotite-muscovite monzogranite

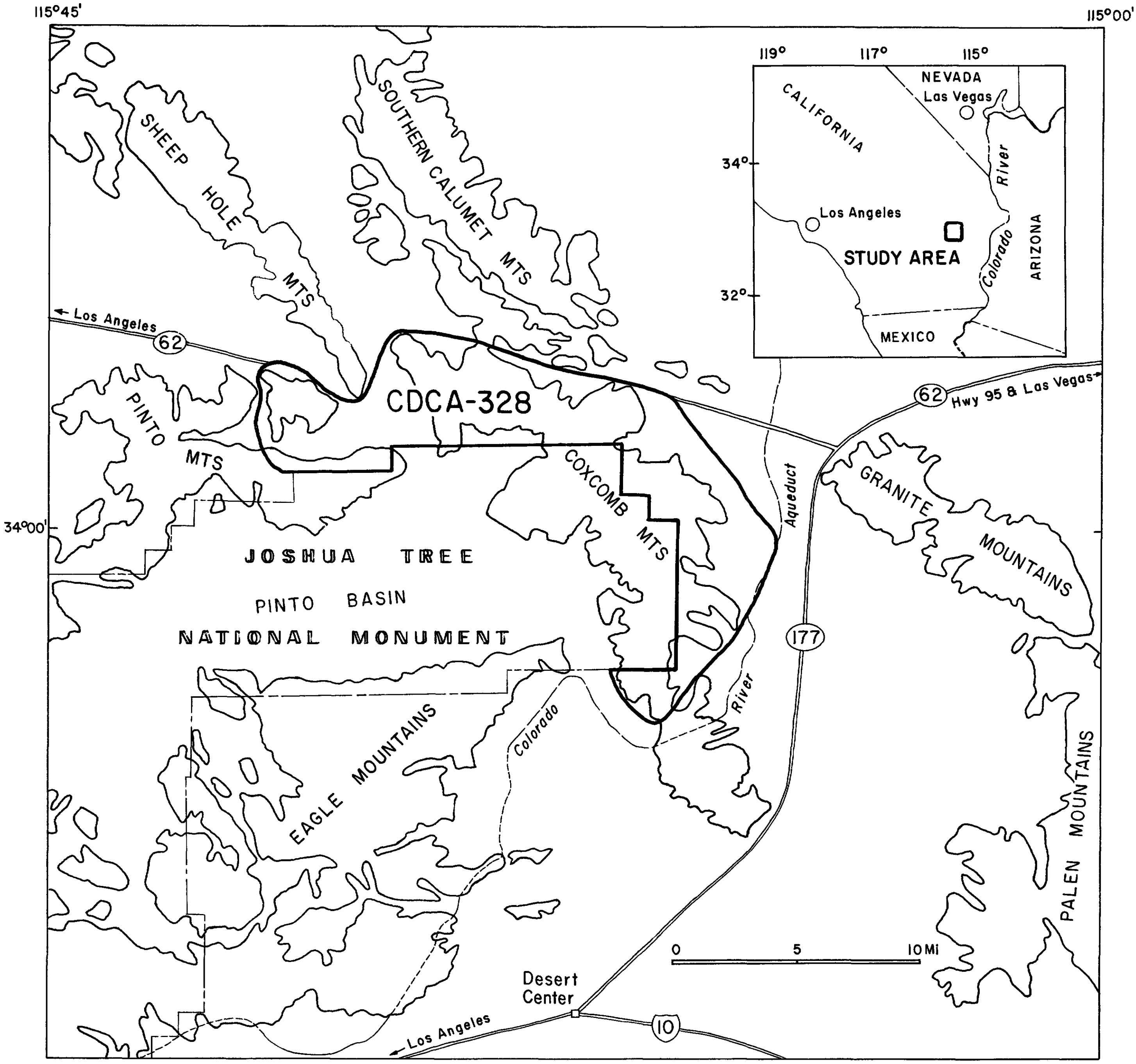

Figure 1.—Index map showing location of the Coxcomb Mountains Wilderness Study Area (CDCA-328).

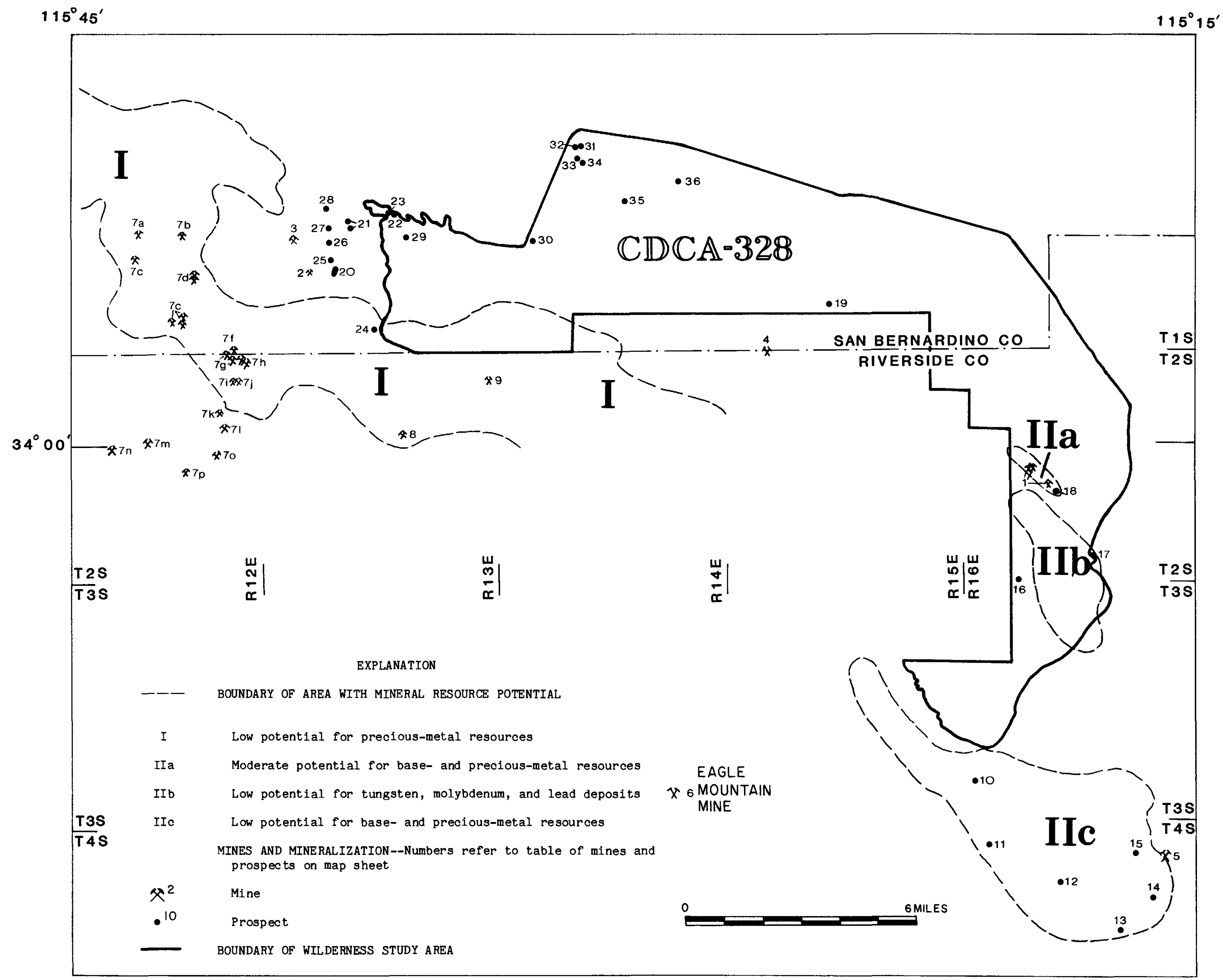

Figure 2.—Mineral resource potential and locations of mines and prospects in and near the Coxcomb Mountains Wilderness Study Area (CDCA-328).