MINERAL RESOURCE POTENTIAL OF THE ANDREWS MOUNTAIN, MAZOURKA, AND PAIUTE ROADLESS AREAS, INYO COUNTY, CALIFORNIA

SUMMARY REPORT

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STUDIES RELATED TO WILDERNESS

Under the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964) and related acts the U.S. Geological Survey and the U.S. Bureau of Mines have been conducting mineral surveys of wilderness and primitive areas. Areas officially designated as "wilderness, "wild," or "canoe" when the act was passed were incorporated into the National Wilderness Preservation System, and some of them are presently being studied. The act provided that areas under consideration for wilderness designation should be studied for suitability for incorporation into the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. The act directs that the results of such surveys are to be made available to the public and be submitted to the President and the Congress. This report discusses the results of a mineral survey of the Andrews Mountain (5063), Mazourka (A5064), and Paiute (B5064) Roadless Areas, Inyo National Forest, Inyo County, California. These areas were classified as further planning areas during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

SUMMARY

The principal metallic mineral resource potential in the three Inyo Mountains roadless areas (Andrews Mountain, Mazourka, and Paiute) is silver with lead, zinc, gold, tungsten, and copper, in that order, with lesser resource potential. Nonmetallic minerals include talc, graphite, and marble. Metallic mineralization is primarily in base-metal vein deposits mostly peripheral to Mesozoic plutons, in silicic and carbonate metasedimentary rocks and locally in the granitic rocks. The metal suite of lead, zinc, silver, molybdenum with some copper, gold, and tungsten is found in anomalously high concentrations in stream-sediment and heavy-mineral-concentrate samples at many places in the region. Undefined limits of alteration and mineralization and unexposed parts of known structures in existing mines suggest that undiscovered deposits probably exist.

The Andrews Mountain Roadless Area has a low resource potential for lead, zinc, and silver in an area east of Andrews Mountain.

The Mazourka Roadless Area has a high resource potential for gold and tungsten adjacent to the Betty Jumbo and Black Eagle mines, a moderate resource potential for silver and copper near the Copper Empire group, and a moderate resource potential for silver with lead and zinc near Marble Canyon. There is a low resource potential for silver, lead, zinc, copper, and gold throughout most of Mazourka Canyon and at several localities along the west front of the range.

The Paiute Roadless Area has a moderate resource potential for silver, lead, and zinc in the area around Lead Canyon.

INTRODUCTION

Area description

The study area, which includes the Andrews Mountain, Mazourka, and Paiute Roadless Areas, is within the Inyo National Forest in the northern part of the Inyo Mountains, northeast and east of Independence, Calif. (fig. 1). The three roadless areas are about 11,800 acres, 82,200 acres, and 55,900 acres, respectively. The terrain is rugged and steep with relief of about 7,000 ft along the east side of the range. Elevations range from about 3,800 ft above sea level in Owens Valley to 11,123 ft above sea level at Waucoba Mountain. The climate is arid to semiarid with a wide range in temperature controlled primarily by elevation. Vegetation consists of sage, grasses, and arid-type brushy shrubs at low elevations, pinon pine, juniper, and mountain mahogany at middle elevations, and limber and bristlecone pine at high elevations. Joshua trees are found in the southeast corner of the Paiute Roadless Area.

Previous and present investigations

The Andrews Mountain Roadless Area lies within the Waucoba Mountain 15-minute quadrangle, the Mazourka Roadless Area within the Independence, Waucoba Mountain, and Waucoba Spring 15-minute quadrangles, and the Paiute Roadless Area within the Independence, Waucoba Mountain, Waucoba Spring, and Waucoba Wash 15-minute quadrangles. A geologic map by Langenheim and others (1983) compiled from published geologic maps by Ross (1965, 1967) and Nelson (1966, 1971) gives a summary of the general geology of the northern part of the Inyo Mountains that contains the three roadless areas. The first detailed study of strata in the area was by Kirk (in Knopf, 1918, p. 19-48). Reports dealing with various aspects of the geology of the area include: stratigraphic and paleontologic studies by Langenheim and others (1956), Pestana (1960), Nelson (1962, 1963), Ross (1963, 1965, 1966), Stewart (1970), Durham (1971a, b), Stevens and Ridley (1974), and Miller (1975, 1976); igneous-rock studies by Ross (1969, 1970), Dunne (1971, 1979), and Sylvester and others (1978a, b); and structural studies by Stewart and others (1966), Stevens and Olson (1972), Nelson and others (1977), and Dunne and Gulliver (1978). California State and U.S. Geological Survey publications by Goodyear (1888), Fairbanks (1894), Crawford (1896), and Knopf (1914) recorded information on early mining activity and on the mines in the area. Specific information on various mines, prospects, and mineralized areas have been updated mainly through the effort of Waring and Huguenin (1919), Tucker (1921, 1926, 1934), Tucker and Sampson (1938), Jenkins (1942, 1957), and by Norman and Stewart (1951). Several previous property examinations have been made jointly by U.S. Bureau of Mines and (or) U.S. Geological Survey personnel; Elliot (1942),

MacKevett and others (1953), Sheahan and Stager (1954), Benson and Rinehart (1954), and Holmes (1955). A report on file at the U.S. Bureau of Mines Western Field Operations Center in Spokane, Wash., contains detailed descriptions of mining properties in the northern Inyo Mountains not discussed in this report (Schmauch and others, 1983a). A comprehensive list of mines and properties is in Schmauch and others (1983b).

The U.S. Geological Survey carried out field investigations in the summer of 1981. The work included field checking existing geologic maps, new mapping where necessary, and geochemical sampling. A total of 244 stream-sediment, 236 panned heavy-mineral, and 189 rock samples were collected for chemical analysis and served as the geochemical data base for this report. Results of these analyses are in Donahoe and Chaffee (1983), and they are evaluated in Donahoe and others (1983). An aeromagnetic survey was flown along east-west flightlines spaced 1 mi apart and at a constant altitude of 14,000 ft across the Inyo Mountains. The data produced by this survey was compiled into contour maps of total-field anomalies and used for interpretation of geologic features.

The U.S. Bureau of Mines conducted a library search which provided a large body of information on mines, prospects and mineralized areas. This data was supplemented by out-of-print, unpublished, or private information, obtained mostly through claim owners. U.S. Forest Service and U.S. Bureau of Land Management records supplied information on currently active claims. All of the Inyo County mining claim records were reviewed, and those pertaining to the study areas were organized by drainage or geographical area and plotted on base maps. Field studies by U.S. Bureau of Mines personnel required almost four man-years to complete from June to November of 1979 and 1980. During the course of this investigation, 160 mining properties were identified from which 2,375 samples were taken to help assess the mineral resources and mineral potential of the three roadless areas. The samples were analyzed by fire-assay, atomic-absorption, and inductively coupled argon-plasma spectrophotometry (ICAP) methods. At least one sample from each property was analyzed by semiquantitative spectrography to determine the presence and approximate amount of suspected elements. Complete sample analyses and detailed property maps are on file at the U.S. Bureau of Mines Western Field Operations Center, Spokane, Wash.

GENERAL GEOLOGY

The rocks in the study area can be divided into major groups according to age and type: the oldest are upper Proterozoic to Permian sedimentary rocks, intermediate age are middle and late Mesozoic plutonic rocks, and the youngest are Cenozoic volcanic rocks and surficial deposits.

Upper Proterozoic to Permian strata

The upper Proterozoic to Permian strata represent sediments that accumulated in a shallow-water marine-shelf environment. The total aggregate thickness of these strata is at least 35,000 ft but no single continuous section has been found that contains more than a fraction of this thickness. The sequence is largely conformable but hiatuses exist and are recognized by the absence of strata of various ages. The rocks are mostly clastic, made of about equal amounts of quartzose (sandstone and shale) and carbonate (limestone and dolomite) types. Fossils are rare. In most of the region, metamorphism has affected the older group of rocks to some extent. They are almost everywhere tightly compacted, recemented, and partially recrystallized. Locally, a low-grade metamorphic mineral assemblage including andalusite, sericite, metamorphic biotite, coarsely crystalline calcite, and dolomite has developed. Primary stratification and sedimentary structures, however, are the dominant fabric of the rocks.

The upper Proterozoic rocks have been divided into four formally named formations. The oldest, called the Wyman Formation, consists of at least 9,000 ft of alternating beds of brown to gray thin-bedded argillite, fine-grained quartzite, and siltstone. Lenticular gray-blue limestone and buff dolomite are parts of the formation. Overlying the Wyman is the Reed Dolomite, about 1,700 ft of massive gray to buff to white dolomite that is mostly coarsely recrystallized. Some thin sandstone beds occur in the middle part of the formation. The Deep Spring Formation conformably overlies the Reed Dolomite. It is a composite formation of about 1,400 ft of limestone, dolomite, quartzite, and siltstone. The Andrews Mountain Member of the Campito Formation is the youngest of the Proterozoic units. This unit is distinctive dark thin- to medium-bedded quartzite and shale. The Proterozoic-Lower Cambrian boundary is placed near the middle of this unit, just below the lowest olenellid tribolite fauna.

Cambrian strata consist of about 11,000 ft of sandstone, siltstone, limestone, and dolomite. Lower Cambrian rocks are mostly quartzose, Middle and Upper Cambrian are mostly carbonate. Formational names of units mapped in the study area, from oldest to youngest, are: Montenegro Member of the Campito Formation; Poleta, Harkless, and Saline Valley Formations; Mule Spring Limestone; Monola Formation; Bonanza King Dolomite; Lead Gulch Formation; and Tamarack Canyon Dolomite.

Ordovician strata, like the Cambrian strata of the region, are about equal amounts of carbonate and quartzose rock. All of Ordovician time seems to be represented by the various formations that include, in ascending order, the Al Rose Formation, Badger Flat Limestone, Barrel Spring Formation, Johnson Spring Formation, and Ely Springs Dolomite. Total thickness of Ordovician rock is about 2,000 ft. The formations can all be easily correlated with other Ordovician strata of the Great Basin—all but the Ely Springs Dolomite look like, and correlate with, units in the Pogonip Group; the Ely Springs Dolomite looks like and correlates with that formation elsewhere.

The Vaughn Gulch Limestone of Silurian and Devonian(?) age conformably overlies the Ely Springs Dolomite. The Vaughn Gulch, about 1,500 ft thick, is medium-gray medium- to thick-bedded limestone that contains abundant fossils including corals, dasycladacean algae, brachiopods, and trilobites. The formation is reeflike in character. The Sunday Canyon Formation intertongues with the Vaughn Gulch in places, and the thin-bedded limestone, calcareous shale, and occasional bioclastic limestone of this formation represent forereef, moderately deep water deposits. The Hidden Valley Dolomite, which crops out in part of the study area, is similar to and probably correlates with the Sunday Canyon Formation.

The Lost Burro Formation of Devonian age conformably overlies the Hidden Valley Dolomite. This formation, probably more than 600 ft thick, consists of light-gray thick-bedded to massive dolomite with chert bands, dark-gray dolomite beds, and some calcareous sandstone. Conformably on the Lost Burro is the Perdido Formation of Mississippian age. The Perdido is a heterogeneous unit predominantly shale, siltstone, calcareous quartz sandstone, limestone, dolomite, chert pebbly conglomerate, in various shades of gray, pink, and brown. The contact of the Perdido with the overlying Rest Spring Shale is gradational. The Rest Spring, as much as 2,500 ft thick, is dark-gray to black thin-bedded siltstone, shale, mudstone, and some limestone.

The Keeler Canyon Formation of Pennsylvanian and Permian age is about 1,000 ft thick. It is thin-bedded dark-gray to purple siltstone and thin-bedded gray cherty limestone. These lithologies give the formation a distinctive striped appearance. The Keeler Canyon is conformably overlain by the Permian Owens Valley Formation. This formation is more than 1,000 ft thick and is mostly thin bedded tan to gray sandy limestone. The upper part of the unit is a coarse conglomerate composed of dark-brown- to black-weathering quartzite and chert clasts in a sandy matrix. In the study area, the Owens Valley Formation is mostly metamorphosed to a brown aphanitic hornfels.

Mesozoic plutonic rocks

Mesozoic plutonic rocks make up about half of the pre-Cenozoic exposures in the study area and are regarded as

satellitic parts of the Sierra Nevada batholith (Bateman and others, 1963; McKee and Nash, 1967; Ross, 1969). These plutons intrude and metamorphose the upper Proterozoic and Paleozoic sedimentary rocks of the region. They generally have steep and sharp contacts with the surrounding country rocks and contact metamorphic effects extend as far as 2 mi from the contacts. Most of the plutonic rock is granodiorite but there are significant quartz monzonite, monzonite, and diorite plutons as well. The rocks are generally medium to coarse grained, porphyritic, and nonfoliated. Intrusive relation and radiometric ages indicate the following sequence, from oldest to youngest: (1) the diorite of Marble Canyon, (2) the monzonite of Joshua Flat, the Hunter Mountain Quartz Monzonite, and the Tinemaha Granodiorite (relative ages of these three plutons are unknown), (3) The Paiute Monument Quartz Monzonite, and (4) the quartz monzonite of Papoose Flat.

The diorite of Marble Canyon crops out in a small area in the northeastern part of the map area. It is a medium-gray medium-grained diorite body with small amounts of monzonite and granodiorite. It is considered to be Jurassic in age (Nelson, 1971); it is intruded by the monzonite of Joshua Flat.

The monzonite of Joshua Flat crops out in the northeastern part of the map area. This pluton consists of gray medium-grained hornblende-augite monzonite and fine- to medium-grained quartz monzonite. K-Ar age determinations ranging from about 170 to 185 million years (m.y.) suggest that this rock is Middle Jurassic in age (McKee and Nash, 1967).

The Hunter Mountain Quartz Monzonite is exposed in an area of about 25 mi^2 in the southern part of the study area. This pluton is predominantly granodiorite consisting of orthoclase phenocrysts in a medium- to dark-gray groundmass of quartz, plagioclase, hornblende, and biotite. K-Ar age determinations on hornblende range from 160 to 180 m.y., which suggests that the pluton is Jurassic (Ross, 1969). The Hunter Mountain is intruded by the Paiute Monument Quartz Monzonite.

The Tinemaha Granodiorite crops out in an area of about 40 mi^2 along the western front of the Inyo Mountains in the Mazourka Roadless Area. The Tinemaha consists of medium-gray medium- to coarse-grained equigranular granodiorite characterized by numerous veins and clots of epidote and many small inclusions of dark fine-grained diorite. K-Ar dates of about 155 m.y. on hornblende indicate a Jurassic age (Ross, 1969).

The Paiute Monument Quartz Monzonite is exposed over an area of about 45 mi^2 along the crest of the Inyo Mountains. It is typically light-gray coarse-grained quartz monzonite characterized by very large (as much as 1 in. long) phenocrysts of pink to red orthoclase and equally as large anhedral masses of quartz. Hornblende and biotite are present. K-Ar dates of 155 to 165 m.y. reported by Ross (1969) indicate that this pluton is Jurassic.

The quartz monzonite of Papoose Flat forms picturesque outcrops in the central part of the Inyo Mountains in the northern part of the study area. It crops out over about 50 mi^2. The rock is light-gray coarse-grained porphyritic biotite quartz monzonite. A K-Ar age of about 80 m.y. from biotite suggests that this pluton is Cretaceous (Kistler and others, 1965).

Numerous light- and dark-colored dikes and small intrusive bodies of diabasic to alaskitic composition occur at scattered localities throughout the study area. The dikes generally have a northerly trend and most are nearly vertical with chilled margins.

Cenozoic volcanic and surficial deposits

Small remnants of late Cenozoic basalt, mainly lava flows and agglomerate, occur on the east side of the range near the mouth of Paiute Canyon and along the west front of the range west of Badger Flat. These basalts have been isolated by erosion from their sources—those on the east from the Saline Range and those on the west from vents in Owens Valley. The rocks are medium to dark gray, dense to vesicular, and locally scoriaceous. Phenocrysts of olivine, pyroxene, and plagioclase occur in many samples.

Sedimentary deposits of Cenozoic age fill the valleys adjacent to the Inyo Mountains and within the mountains shallow accumulations floor the major canyons and cap the higher alluviated areas. The oldest rocks are Tertiary deposits that occur in scattered areas along the east side of the range. Cemented breccia, made of fragments of the older units, occurs at high elevations and some fanglomerates occur along the east front of the mountains. Quaternary deposits are divided into two groups, older and younger. The older deposits are discontinuously exposed in many canyons and higher alluviated areas and are particularly widespread in the northern part of the map area. They are mostly sand and gravel, some distinctly bedded and indurated. The younger Quaternary deposits are unconsolidated alluvium and colluvium that are virtually undissected by erosion.

Structure

Structural features in the northern part of the Inyo Mountains represent at least three distinct periods of deformation. These structural episodes include: (1) deformation that took place before emplacement of the plutonic rocks, (2) deformation associated with emplacement of the plutonic rocks, and (3) basin and range faulting that is responsible for the present uplift of the Inyo Mountains. The type of structure and style of deformation associated with these periods contrasts strongly.

Preplutonic deformation (pre-Middle Jurassic) is characterized by many high-angle normal and reverse faults with offsets usually less than 1,000 ft and by open north-trending folds. These structures both predate and postdate regional thrusting of the Last Chance thrust (Stewart and others, 1966), a large fault (upper-plate movement of at least 20 mi) that thrusts upper Proterozoic and lower Paleozoic rocks onto upper Paleozoic rocks. The Last Chance thrust which underlies most of the northern Inyo Mountains and areas to the east is exposed around three windows, one of which (the Jackass Flats window) occurs along the east flank of the Inyo Mountains in the Jackass Flats area and a short distance east of the roadless areas. The thrust cuts rocks as young as Permian and is intruded by plutons of Early Jurassic age.

Deformation associated with, or caused by, emplacement of the plutonic rocks during the middle and late Mesozoic affected almost all the upper Proterozoic and Paleozoic formations. This deformation is characterized by folds caused by forceful emplacement of the plutons and local metamorphic rock fabric caused by thermal and dynamic metamorphism. In general, the degree of deformation increases with proximity to the plutons, with very intense deformation typical of the pendants of strata at deep levels of the batholith and sharp contacts with relatively slight deformation at high intrusive levels. One of the most remarkable structural zones associated with granitic intrusion in the map area is the contact of the Paleozoic sedimentary sequence with the Papoose Flat pluton. Here the Lower Cambrian strata are thinned to a fraction of their normal thickness and bowed to conform to the elliptical western side of the pluton (Sylvester and others, 1978b).

Basin and range faulting in late Cenozoic time that caused uplift of the Inyo Mountains and downdropping of the adjacent valleys is characterized by steeply dipping normal faults. Along much of its length, the present range front coincides with the traces of high-angle fault surfaces. The large magnitude of this displacement is apparent along the west side of the range, where as much as 8,000 ft of relief separates the valley floor from the range crest and an additional 1,000 ft of fault scarp is buried by alluvium in Owens Valley (Ross, 1965). Numerous small scarps visible in the unconsolidated alluvium along the front of the range indicate that some faults are still active.

GEOCHEMICAL STUDIES

Samples of rock, stream sediment, and nonmagnetic heavy-mineral concentrates collected by the U.S. Geological Survey were analyzed for 31 elements using a six-step

semiquantitative emission spectrographic method (Grimes and Marranzino, 1968). Because of the limited amount of sample, the nonmagnetic heavy-mineral concentrates were only analyzed spectrographically. All of the rock and stream-sediment samples were also analyzed for zinc by atomic-absorption spectrometry (Ward and others, 1969); selected samples were reanalyzed for gold by the same technique (Meier, 1980). Stream-sediment samples were also reanalyzed for uranium using a modification of the fluorometric method of Centanni and others (1956). Results of the analyses and their geochemical interpretation are included in Donahoe and others (1983).

Ten elements from the stream-sediment samples and 11 from the nonmagnetic heavy-mineral concentrates were selected as those elements most likely related to hydrothermal alteration and (or) mineralization. All anomalous-value ranges and a threshold value (highest background value) for these elements were determined on the basis of a visual inspection of a frequency distribution plot. For the sediment and heavy-mineral concentrate samples, the anomalously high concentrations for each selected element were assigned to one of two or three concentration-range categories in order to better identify weakly, moderately, or strongly anomalous samples. Drainage basins with anomalous samples were assigned a numerical score based on the number of anomalous elements and their concentration (Donahoe and others, 1983). In general, the higher the anomaly score for a site, the more significant is that site and drainage basin in terms of mineral potential.

GEOPHYSICAL STUDIES

Aeromagnetic survey

Careful study of aeromagnetic data can provide subsurface information insofar as rock magnetization reflects rock type. For example, the most distinctive magnetic anomalies in the Andrews Mountain, Mazourka, and Paiute Roadless Areas are caused by plutonic rocks. The shapes of these anomalies help delineate the subsurface plutonic-sedimentary rock contact as the latter rock type is relatively nonmagnetic. This is important in a mineral assessment because certain sedimentary rocks near plutonic intrusions have a high probability for mineralization.

An aeromagnetic survey was flown along east-west flightlines spaced 1 mi apart and at a constant barometric altitude of 14,000 ft across the Inyo Mountains. The data produced by this survey were compiled as contour maps of total-field anomalies and used for interpretation of geologic features.

The largest anomaly within the Andrews Mountain, Mazourka, and Paiute Roadless Areas occurs over the Pat Keyes pluton of the Hunter Mountain Quartz Monzonite in the southern part of the study area. Broad gradients along the east and west flanks of this anomaly are largely a result of the topography of the Inyo Mountains. This same anomaly extends north over most of the Paiute Monument Quartz Monzonite pluton and northwest over the Tinemaha Granodiorite pluton. Geologic mapping shows that the Tinemaha and the Paiute Monument plutons are separated by Paleozoic sedimentary rocks at the south end of Mazourka Canyon, but the aeromagnetic data clearly indicate that the two plutons are joined at shallow depth.

The shape of the anomaly over the Tinemaha Granodiorite indicates that its east boundary dips at a shallow angle to the east under the broad arcuate belt of Paleozoic sediments in the Mazourka Canyon and Badger Flat areas, areas where geochemical anomalies have been detected.

A magnetic anomaly closely coincides with the Marble Canyon pluton which is composed of diorite and intruded by monzonite of Joshua Flat. Although this pluton is most extensively exposed outside of the map area (McKee and Nelson, 1967), the magnetic anomaly suggests that its southwestern contact dips to the southwest below Proterozoic sedimentary rocks and extends to near the boundary of the Paiute Roadless Area and therefore may have been the source mineralization of the sedimentary rocks further to the south.

A positive anomaly occurs approximately coincident with a mapped outcrop of the Proterozoic and Paleozoic silicic metasedimentary rocks (Harkless Formation) located 2 mi west of Andrews Mountain. Elsewhere rocks of this type do not produce significant magnetic anomalies which suggests the source of the anomaly west of Andrews Mountain may be from a shallow subsurface pluton.

Except for the anomalies discussed, the aeromagnetic data are relatively featureless and reflect thick sequences of sedimentary rocks. It should be noted, however, that the absence of distinctive magnetic anomalies does not necessarily mean the absence of plutonic rocks. The quartz monzonite of Papoose Flat, for example, produces no significant magnetic anomalies presumably because these rocks are relatively nonmagnetic.

MINING HISTORY AND MINING ACTIVITY

Mexicans in the 1800's are credited with the first discovery of many of the deposits located on the lower slopes of the Inyo Mountains. It is likely that the amount of production was small.

In 1851, the Russ mining district was established, located southeast of Independence, Calif., but the first important discovery was not made until 1862 at the San Carlos mine (DeGroot, 1890; Ross, 1965). Several other important gold-silver-copper deposits were discovered, mainly within a 12-mi radius of Kearsarge Station, including the Black Eagle (no. 3, fig. 2) mine, Alice Quartz (no. 4, map sheet) mine, and the Custer (Baxter) (no. 5, fig. 2) mine. By 1890, stamp mills in Owens Valley at Chrysopolis, Willow Spring, the Reward mine, and the Montezuma (no. 3, map sheet) mine, had or were processing local ores. A smelter at Elna Station, near Big Pine, Calif., processed ore from the Montezuma mine. Smaller amounts of gold were also recovered from arrastras located near springs. Most of the ore that did not contain free-milling gold was shipped by rail to various smelters in California and Nevada.

With few exceptions, most lead and silver properties were discovered at a later date. The more important properties showed production from 1880 to 1950. The three largest producers in the area were the Montezuma mine, Blake mine, and Custer (Baxter) mine (no. 5, fig. 2). Tungsten was produced from the Betty Jumbo mine (no. 2, fig. 2) only. The most recently developed deposits include talc and graphite in Mazourka Canyon and marble near Tinemaha Reservoir. Table 1 lists the recorded production from properties in the three Inyo Mountains roadless areas.

Placer gold production from areas other than in Mazourka or Marble Canyon is unknown, and probably very minor. Mazourka Canyon yielded most of its gold from 1894 to 1912 and from 1927 to 1941. Reported production from 1898 to 1941 was 396.4 oz of gold and 30 oz of silver from 1,828 yd^3. Small-scale mining in this area continues, with local residents apparently recovering small amounts. J. C. Lewis discovered gold in Marble Canyon in 1934. Eight properties, mostly east of the Paiute Roadless Area, reported that 8,375 yd^3 yielded 359.6 oz of gold and 29 oz of silver. Peak production years were from 1935 to 1941, mostly by dry concentrating gravels removed from drifts on bedrock.

Mining districts

Mining districts were important in Inyo County from 1860 until about 1920 and were used as a means of general claim location. With the increased availability of topographic maps, location by section, township, and range became standard. At least 105 district names were used in Inyo County, but only 61 gained wide acceptance. Often smaller districts or subdistricts were developed within the larger districts which helped define locations more clearly. The major districts in the Inyo Mountains vicinity are: Beveridge; Big Pine, including subdistricts Waucoba, Galena, and Saline Valley; Independence, including Tibbetts and Kearsarge; Union, including Mazourka; and Russ.

Mining claims

Approximately 8,000 claims have been located in the

northern part of the Inyo Mountains since 1862. The number of workings are several times less than 8,000 indicating that many of the properties have been relocated numerous times. Five properties have a record of leasing, and currently 40 lode and 10 placer claims in and near the study areas are active. The Eureka Consolidated Quartz mine and the Senator were the only properties patented.

Mineral properties

Locations of mines and prospects with mineral resources or resource potential are on figure 2 and summarized in table 2. Table 3 summarizes those with estimated tonnage and grade.

The definitions of mineral resource classifications are from U.S. Bureau of Mines and U.S. Geological Survey (1980). The measured, indicated, and inferred categories respectively, reflect decreasing knowledge of the characteristics of a deposit. Also for this report, an attempt has been made to further define subeconomic resources and resource potential. The following definitions are the basis for the selection of those properties appearing in table 3.

Mineral resources: Deposits classified as reserves are mineral resources believed to be minable at a profit, under current (1983) economic conditions. Feasibility studies were conducted to substantiate this classification. Properties having marginal reserves would require improvement of economic conditions; around 50 percent increase in commodity price, or identification of a larger deposit. Subeconomic resources would require a great improvement in economic conditions and (or) identification of a larger deposit to be mined profitably. In this report, a subeconomic resource, if mined, is expected to return at least 20 percent of the cost of producing the commodity(s).

In some cases, identified tonnage and grade estimated at a property may not be sufficient to support a subeconomic resource classification. However, it may be favorably located for consolidated development with other deposits and with centrally located processing facilities. Because of relatively small tonnages at individual properties, they would be developed by small-scale mining operation, possibly involving portable concentrating equipment. Properties that collectively may represent a resource are included in table 3.

Resource potential: The terms high, moderate, and low resource potential, as used in this report, reflect degrees of probability that undiscovered resources exist. The terms are based on the assessment of published information, the results of field examination, sample analyses for specific elements and groups of related elements, the apparent degree of geologic continuity, and favorable geologic environment.

Properties not included in table 2 are those which have little apparent resource potential or for which data are insufficient to determine resource potential. A complete description of all the properties are in Schmauch and others (1983a and b).

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

General: The northern part of the Inyo Mountains, an area that includes the Andrews Mountain, Mazourka, and Paiute Roadless Areas, has a high resource potential for gold and tungsten near several existing mines and a moderate to low resource potential for several other metallic elements at other places in the area. There is a moderate to low resource potential for the nonmetallic minerals talc, graphite, and marble. The metallic element for which there is a high resource potential is silver; gold, lead, and zinc associated with the silver have a moderate resource potential and scattered occurrences of copper and tungsten offer low resource potential.

The numerous mines and prospects throughout the area are an indication of the widespread nature of alteration and mineralization. Geochemical sampling that documents the presence of a number of elements, many of which indicate mineral suites and mineralizing systems, affirms this regional alteration and mineralization. The suite of elements including molybdenum, lead, zinc, and silver with local addition of copper, tungsten, and gold is found in anomalously high concentrations at many places—most of these locations are also the sites of prospects and mines. This group of elements indicative of base-metal vein deposits formed by hydrothermal systems fits well with the geologic framework of the northern Inyo Mountains. Hydrothermal solutions associated with the large Mesozoic plutons of this region would find a suitable host for vein deposits in the much fractured and faulted Proterozoic and Paleozoic metasedimentary rocks that they intrude and locally in the plutons themselves. The general distribution of the molybdenum, lead, zinc, silver enrichment is peripheral to or within the plutons (fig. 2). The metal suite is not typical of porphyry copper or molybdenum-type deposits. The lack of geologic features such as stock-work alteration and alteration zones and halos rules against porphyry-type deposits as well. The base-metal veins are in a variety of rock types—some are in granitic rocks, some in carbonate units, but most seem to be in silicic metasedimentary rocks such as shales or quartzites. This may be due to the more fractured condition of the silicic rocks which develop more small fractures than the less brittle carbonate rocks. The relative density of large faults on a regional scale is about the same in all rock types. No particular structural features that have been mapped by standard geologic means seem to be preferentially mineralized or related to mineralization. The association of alteration and mineralization to silicic rocks seems to be controlled by features and shears smaller than those mapped at a scale of 1:62,500.

Some small mineralized tactites occur near granitic contacts with carbonate rocks and contain tungsten, copper, a little gold and, at one place, iron. None of the tactites are large and the contact zone is sharp and unmineralized in most places. Talc bodies form locally at the contact between granite and dolomite or even fairly far from the surface exposure of granite where the dolomite has been strongly metamorphosed. Talc deposits of this type have been mined in southern California and Nevada for many years.

Andrews Mountain Roadless Area.—Metallic mineral resource potential of the Andrews Mountain Roadless Area is low. A weak anomaly in molybdenum, zinc, copper, gold, and tungsten was detected in stream-sediment samples from one drainage west of Andrews Mountain (fig. 2) and five properties show some resource potential, including one past producer, the Squaw Flat nos. 1-4 (no. 4, fig. 2), with a small production of silver, gold, and lead (table 1). An occurrence of low-grade scheelite on the Blue Crystal nos. 1-6 (no. 38 on accompanying map) claim is in a small garnet-bearing tactite. There are no known nonmetallic deposits in this roadless area.

Mazourka Roadless Area.—The Mazourka Roadless Area has a high mineral resource potential for gold and tungsten in the area adjacent to, and including, the Black Eagle and Betty Jumbo mines (nos. 3 and 2, respectively, fig. 2) in the southern part of the area. There is a moderate resource potential for copper with some silver in the vicinity of the Copper Empire group near the mouth of Mazourka Canyon and a moderate resource potential for silver with lead and zinc in the northeastern part of the roadless area in the vicinity of Marble Canyon, The Narrows, and areas directly to the east of The Narrows. There is a low resource potential for silver, lead, zinc, copper, and gold throughout most of Mazourka Canyon, and at several other localities along the west front of the range (fig. 2). Talc and graphite have a moderate to low resource potential in local areas on the east side of Mazourka Canyon about 5 mi from its mouth.

Evaluation of analyses of key metallic elements from stream sediments and panned heavy-mineral concentrates delineates five subareas within the roadless area that have significantly high anomalous amounts of the metal suite lead, zinc, molybdenum, and silver to warrant their classification as areas of moderate to low mineral resource potential (fig. 2). Inspection of mines and prospects with accompanying assays of rock from the mines substantiates this subarea delineation.

The Mazourka Roadless Area has 39 properties with some resource potential; 11 of these were past producers (table 1). There are 5 mines near the roadless area at the

mouth of Mazourka Canyon that have produced some copper and gold as well. The Betty Jumbo mine, Black Eagle mine, Silver Princess (Nancy Hanks), and the Copper Empire group are the most important mines in the area, all having had past production. Resource estimates from these and other deposits in the area are in tables 2 and 3.

The Copper Empire group has seven mineralized areas along or near a 2-mi-long igneous-sedimentary rock contact. About 460,000 tons of indicated and inferred low-grade resources average 0.83 percent copper; this includes 69,000 tons that average 0.59 oz silver per ton. The Betty Jumbo mine has two scheelite-bearing tactite bodies; one at the east adit and one at the west adit. The east adit has had previous production and is nearly mined out, but the west adit has an indicated and inferred reserve of 52,000 tons averaging 0.70 percent tungsten trioxide. The Black Eagle mine has had a long history of past production and is fully developed. A small, demonstrated and inferred reserve of 12,000 tons averaging 0.21 oz gold per ton remains.

Graphite and marble mines in the area have produced a relatively small amount, compared to the amount of similar grade material left in place. Only a small amount of talc remains in present mines but the possibility for discovering more is high. Resource estimates for these nonmetallic deposits are in tables 2 and 3.

Placer gold is known from the Mazourka Roadless Area from two localities; Marble Canyon in the northeast and the upper and middle parts of Mazourka Canyon. The Marble Canyon deposits were discovered in 1934 (Dorsey, 1960) and have produced small amounts ever since. The coarsest gold and deepest gravels are found in the vicinity of the east roadless-area boundary. The presence of gold in a gold-barren area suggests its origin was not the headwater region of Marble Canyon. Rather, the inverted gravel depths and size distribution of the gold can be best explained as gravel derived from a pre-Tertiary stream system with headwaters north of the roadless areas. Gold-bearing erosional remnants found as far as 30 mi north in the White Mountains help support this hypothesis.

Most of the known placer production from the upper and middle regions of Mazourka Canyon area probably comes from numerous gold-bearing quartz veins and veinlets close by. Commonly, gold is found still attached to quartz in these eluvial deposits. Mazourka Canyon yielded most of its gold from 1894 to 1912 and from 1927 to 1941. Reported production from 1898 to 1941 was 396.4 oz of gold and 30 oz of silver from 1,828 yd^3. Local residents use small-scale mechanized concentrators, working with limited available water. The unreported production is assumed to be small.

Paiute Roadless Area.—The Paiute Roadless Area has a moderate resource potential for silver and associated lead and zinc in the area around Lead Canyon. This estimate is based on high anomalous values of lead, zinc, molybdenum, and silver from stream sediment and heavy-mineral concentrate as well as identified resources from several mines and prospects in the area. Although molybdenum is ubiquitous in samples from this area it is probably not in concentrations high enough or voluminous enough to be indicative of a potential for molybdenum resources.

There are six mining properties with identified resources, including one past producer, the Custer (Baxter) mine, in the Paiute Roadless Area. Adjacent to the east edge of the area, the Bunker Hill and Blue Monster mines produced lead, silver, and zinc over a period of several decades. Other properties with identified resources are listed in tables 2 and 3.

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Table 1.--Recorded production from lode deposits[1] in the Andrews Mountain, Mazourka, and Paiute Roadless Areas
[From U.S. Bureau of Mines production records[2]; N.R.,not reported. Map number refers to accompanying map sheet]

Map No.	Property	Year(s)	Tons	Gold (oz)	Silver (oz)	Copper (lb)	Lead (lb)
			Andrews Mountain				
41	Denman group (Squaw Flat nos. 1-4)	1949	36	1.0	123	N.R.	2,294
	Andrews Mountain totals:		36	1.0	123	N.R.	2,294
			Mazourka				
34	Black Eagle mine	1901-1938	2,476	1,070.1	6,838	641	4,136
32	Birthday nos. 1-4	1912-1913	4	2.0	26	32	485
28	Copper Empire group[3]	1917	500	N.R.	N.R.	30,000	N.R.
24	Fitzgerald[4] (Maid of Erin nos. 1-3)	1913	1	N.R.	8	310	N.R.
37	Johnson and Williams (West adit, Betty Jumbo)	1918	26	N.R.	46	5,575	N.R.
31	Mary Roeper (Hidden Valley nos. 1-6)	1918	29	N.R.	49	2,854	N.R.
3	Big Pine Mining and Milling (Montezuma mine)	1893-1949	605	1,014	4,150	47	18,340
5	Blake mine (JR no. 1)	1919	37	N.R.	525	N.R.	22,660
4	Lovett (Alice Quartz mine)	1907	20	393	2	N.R.	N.R.
47	Daisy (Silver Spur)	1918	1	N.R.	12	N.R.	854
45	Nancy Hanks (Silver Princess nos. 1-4)	1949	27	N.R.	233	12	13,961
	Mazourka totals:		3,726	2,479.1	11,889	39,471	60,436
			Paiute				
51	Custer (Baxter)	1933-1949	34	92.2	1,266	2,351	28,866
	Paiute totals:		34	92.2	1,266	2,351	28,866
	Roadless Areas range totals:		3,796	2,572.3	13,278	41,822	91,596

[1]Two talc, one marble, and one graphite property also had production. The Blue Stone Talc mine produced 800 tons of probable steatite-grade talc in the early 1940's (Page, 1951, p. 32). The D. R. Mar Jak also produced 183 tons of talc in 1957. Amorphous graphite-bearing shale was produced from 1960 until the mid-1970's from the Black Lady nos. 1 and 2 claims. From the size of the workings, an estimated 5,000 tons was removed. About 250 tons of marble chips used for terrazzo aggregate was produced from the Green Giant Marble nos. 1-8 claims in 1978.

[2]These production data were made from one source only. They do not reflect (1) amounts recovered prior to 1892, (2) amounts not reported, and (3) additional data supplied by claimants. The latter information is found in production tables accompanying the property reports. Also, production from mines probably inside the areas, but without confirmed locations, was not included.

[3]According to Sheahan and Stager (1954, p. 5), 500 tons of selected copper ore averaging 3 percent was shipped. This production was not reported to the U.S. Bureau of Mines Statistical Division.

[4]U.S. Bureau of Mines production records list the following names: Fitzgerald, Johnson and Williams; Mary Roeper; Big Pine Mining and Milling; Nancy Hanks; Custer; Denman group; Daisy; and Lovett. Through correlation studies, these were found to be the same properties as those found in the parentheses.

Table 2.--Summary of mines and prospects with mineral resources or resource potential in the Andrews Mountain, Mazourka, and Paiute Roadless Areas

Map no.	Name	Summary	Workings and production	Resource/sample data
1	Big Pine	Interbedded shale and limestone have several subparallel quartz bedding-plane veins a few inches thick, with pods up to 4 ft thick, which are traceable for about 20 ft. Most of the quartz is massive; brecciated areas are filled with siliceous limonite and steel galena.	There are three adits, a 22-ft-deep shaft, and a small pit. The lowest adit has 216 ft of workings, and appears to have been driven to intersect the quartz veins found in the upper workings.	Structures were not continuous enough to permit tonnage and grade estimates. Six chip samples across quartz contained a trace to 0.8 oz silver per ton and 0.03 to 1.95 percent lead. A random chip from a 2-in.-thick galena-bearing quartz vein assayed 2.9 oz silver per ton and 4.05 percent lead. About 25 tons of stockpiled quartz at this prospect averages 2.3 oz silver per ton and 2.6 percent lead. The quartz veins at this property contain small isolated concentrations of lead and silver. The potential for lead and silver resources is low.
2	Blister Lode	A 30-ft-wide, 120-ft-long area of dolomite is cut by northerly trending, east- and west-dipping faults. Most are short, irregular, and discontinuous; the longest one was 1 to 4 in. thick, 30 ft long. The zones are composed of gouge, limonite, siliceous dolomite, siderite, and quartz veins or pods. Randomly distributed cubic masses of galena are sometimes concentrated into streaks or lenses in the fault zones. The largest lens is 0.3 ft thick and 1.5 ft long.	Three of the four short adits form a series of interconnected, 15° inclined stopes and drifts totaling 260 ft of development.	Fifteen chip, one select, and one grab sample were taken from quartz veins and shear zones. Two galena lenses contained 55.3 to 65.9 oz silver per ton and 13.0 to 20.6 percent lead. Thirteen of the samples had 1.2 oz silver per ton or less. A moderate potential exists for silver-lead resources.
3	Montezuma mine	Northeast- to northwest-trending faults have displaced, tilted, and locally overturned limestone argillite, and dolomite strata. Faulting, landslides, bulldozer trenching, and the westerly dip of the strata, which is coincident with slope angles, obscure geologic detail. Irregular replacement bodies of lead-zinc-silver ore were found in the Monola Formation limestone. Because of overturned sediments, sulfide bodies were positioned above previously oxidized carbonate bodies. Sulfide bodies were reported by Tucker (1921, p. 29) to be 30 ft wide and 50 ft long. Oxidized carbonate bodies were 200 ft long and wide. Thicknesses as reported by Crawford (1896, p. 32, 33) range from 7 to 12 ft. The sulfide ore body consisted of finely disseminated galena, sphalerite, pyrite, and tetrahedrite. larger intergrown crystals of sphalerite and galena also occur. In addition to the above, the carbonate body contained vuggy, crusty forms of cerrusite, smithsonite, and azurite. Much of the galena was argentiferous (see Knopf, 1914, p. 110; Eakle, 1923, p. 138; and Hurlbut, 1945, p. 48-55).	Two upper adits, an intermediate, and a lower adit are all caved. They were reported to be 200, 400, 400, and 1,400 ft long. A 35-ft-long adit near the millsite was used for storing explosives. Switchback access roads and a series of bulldozer trenches and open cuts are the most recent development. Production was intermittent from 1893 to 1968, and at least 1,023.7 oz gold, 4,964 oz silver, 52,244 lb lead, 38,872 lb zinc, and 47 lb of copper were produced (U.S. Bureau of Mines production files).	A grab and a select sample, presumably of ore from the replacement bodies, had 7.2 and 8.2 oz silver per ton, 5.0 and 8.8 percent lead, 5.0 and 6.3 percent zinc, 0.15 and 0.11 percent copper. There is a moderate potential for silver-lead-zinc-copper resources.

Table 2.—Continued

Map no.	Name	Summary	Workings and production	Resource/sample data
4	Alice Quartz mine	Short, northwest-trending shear zones 1 to 2 ft thick are composed of altered dolomite, gouge, siliceous dolomite, and disseminated pyrite. Structure limits were not traceable beyond the workings.	Five adits, two of which intersected shear zones, ranged between 10 and 50 ft long. Mr. A. Lovett produced 39.3 oz gold from 20 tons in 1907 (U.S. Bureau of Mines production files).	The shear zones were too short and irregular to sample well enough to determine resources. One of 13 chip samples assayed 0.33 oz gold per ton; the others contained a trace gold. Three grab or select samples of siliceous dolomite had 0.19, 0.41, and 0.99 oz gold per ton. This property has a moderate potential for gold resources.
5	Blake mine 1/ (JR no. 1)	Altered limestone permeated with limonite, gouge, siliceous limonite, and siderite forms gradational, indistinct boundaries within locally overturned limestone strata. The area of intense alteration is about 60 ft wide and 200 ft long in the northwest trending, 40°-50° NE. dipping rocks. Galena occurs in random cubic masses and as matrix fillings of brecciated, siliceous gossan zones up to 1.0 ft thick and 12 ft long.	Six adits totaling more than 500 ft of excavation, one caved adit, and three pits. In 1919, the property yielded 525 oz silver and 22,660 lb of lead from 37 tons (U.S. Bureau of Mines production files).	The largest mineralized area, 40 ft long and 2.3 ft wide, combined with two smaller areas has a total of 600 tons of indicated and inferred subeconomic resources with a weighted average of 1.49 oz silver per ton and 4.87 percent lead. The property has low potential for additional silver-lead resources.
6	Lucky Jim	Dark-gray, iron-stained slate is cut by a 0.5-ft-thick, 55-ft-long shear zone that strikes east, dips 70°-88° N. Discontinuous veinlets of brecciated quartz in the shear zone contain blebs and thin stringers of galena and sphalerite.	A 30-ft trench with a 15-ft-deep shaft and a 25-ft-long adit.	Three chip samples from the shear zone and quartz had up to 0.04 oz gold per ton, 3.0 oz silver per ton, 0.23 percent copper, and 7.0 percent lead. A select sample of mineralized quartz contained 1.6 oz silver per ton, 3.3 percent lead, and 3.1 percent zinc. This property has a low potential for silver-lead-zinc resources in the shear zone.
7	Green Giant Marble nos. 1-8	Paleozoic dolomite, shale, and limestone strike northwest and dip 40° to 75° SW., with local overturning of some strata. Marbleized dolomite crops out over an area about 1 mi long, and 1,000 ft thick. Major northwest-trending faults and overturning of beds have intensely fractured and brecciated the rocks.	Quarry development is on four bench levels, with about 1,000 ft of bulldozer trenches, and covers approximately 15 acres. Older workings investigated portions of major faults and the igneous-sedimentary contacts. They include three short caved shafts, an 8-ft adit, and two pits. The owner states an unknown amount of marble was produced in the 1950's. In 1978, Mr. LaVigne produced 250 tons of marble chips, used for terrazzo aggregate.	A series of bench cuts over the entire outcrop could easily provide 5 million tons of inferred subeconomic resources. A high potential for additional marble resources exists.
8	Contact Silver no. 8	A 1-ft-thick, northwest-trending fault in dolomite is filled with siliceous, iron-stained earthy gouge. The only visible mineral in the untraceable fault was malachite. A major fault has been mapped in this area which also projects through the Alice Quartz mine, 0.75 mi northwest of this location.	Two adits, each 30 ft long, two pits, and a trench.	Three select, one grab, and one chip sample, all from siliceous limonite material from a shear zone, contained from 0.01 to 0.37 oz gold per ton, 0.1 to 4.4 oz silver per ton, and 0.02 to 0.47 percent copper. The shear zone has low potential for gold-silver-copper resources.

Table 2.—Continued

Map no.	Name	Summary	Workings and production	Resource/sample data
9	Black Aster 1/	An area 1,100 ft long and 400 ft wide in the vicinity of a dolomite-slate contact has several 1- to 5-ft thick shear zones. The longest one is exposed underground for 140 ft. Quartz veins crop out in siliceous dolomite, but larger more continuous veins and lenses are in the gouge-filled shear zones. Randomly disseminated blebs of oxidized galena and malachite are in some of the quartz and siliceous dolomite.	Four small pits, two adits 60 and 200 ft long, and a 22-ft-deep shaft with an 80-ft drift at the bottom.	Nine hundred tons of indicated and inferred subeconomic resources average 1.0 oz silver per ton from a quartz-rich portion of the largest shear zone. Other more highly mineralized quartz veins were not sufficiently exposed to determine resources. It is likely that the three select samples represent the highest grade material available. Results ranged from 2.6 to 5.4 oz silver per ton and 1.3 to 1.4 percent lead. Shear zones at this prospect have a low potential for additional silver and lead resources.
10	Gold Bug	The predominant trend of joint sets in fractured dolomite is N. 15°-50° E. and N. 35°-70° W. Very minor silicification has occurred along the poorly defined, untraceable joints. Finely disseminated galena is associated with siliceous dolomite.	Three adits, 10, 20, and 70 ft long, and a 40°-50° inclined shaft, 94 ft deep.	All 15 samples contained from a trace to 0.05 oz gold per ton, with one assay of 0.26 oz gold per ton. Two stockpile samples also contained 2.9 and 20.62 oz silver per ton. Fractured dolomite has a low potential for gold resources.
11	Squaw mine (Valley View nos. 1 and 2)	Four shear zones less than 20 ft long and 1-ft thick are composed of highly fractured, altered, quartz monzonite, light to heavily iron stained gouge, and white quartz veins or pods. The quartz contains siliceous iron, limonite, manganese oxides, pyrite cubes, scattered grains of chalcopyrite, and malachite in fractures.	Two adits 23 and 26 ft long, a caved adit, and three pits.	About one-half of the nine chip, grab, or select samples of quartz from the shear zones had insignificant gold and copper values. Three select samples from stockpiles representing less than 2 tons had 0.14, 0.49, and 0.61 oz gold per ton and 0.36, 0.01, and 0.52 percent copper. A grab sample of quartz from a dump had 0.10 oz gold per ton and 0.17 percent copper. This property has low potential for gold and copper resources.
12	Badger Flat prospects	A 400- to 500-ft-thick limestone-dolomite unit strikes N. 55°-80° W., dips 40°-55° SW., and is highly fractured. Numerous short, highly irregular discontinuous veins, veinlets, and pods of quartz, calcite, and siderite are in gouge-filled sheared zones. These are poorly exposed and not traceable due to alluvium covering the area. A 40-ft-long, 4.1-ft-thick segment of a shear zone in a winze appears to have more gold and silver than those in the surrounding area. Very minor amounts of malachite stain are found elsewhere in this vicinity.	A cluster of five closely spaced adits have 340 ft of development, including a 70-ft-long winze. In addition, there are three shafts 40 ft deep and less, nine trenches, three short adits, and 43 pits.	A 40-ft segment of a shear zone has 550 tons averaging 0.05 oz gold per ton and 0.7 oz silver per ton. This property has a low potential for gold-silver resources.
13	Zincite	Thin bedded, siliceous, iron- and manganese-stained limestone strikes northwest and dips 22° to 65° SW. Local areas are recrystallized. Bedding-plane quartz veins 2 in. thick contain fine-grained disseminated galena and sphalerite in a zone 2.8 ft thick. Shear zones that strike N. to N. 20° W. crosscut the area, and offset the quartz veins a few feet.	Two adits totaling 96 ft, one inclined shaft 22 ft deep, and seven pits.	A quartz vein contains 450 tons averaging 1.1 oz silver per ton, 2.9 percent lead, and 4.6 percent zinc. A moderate potential for lead-silver-zinc resources exists at this property.

Table 2.—Continued

Map no.	Name	Summary	Workings and production	Resource/sample data
14	Pyrite extension 1/	Two 4-ft-thick quartz-limonite veins are partly exposed for 240 ft in quartz monzonite. The veins strike N. 40°-66° W. and dip 30°-45° NE.	An 11-ft-long adit and two pits.	About 6,700 tons of indicated and inferred subeconomic resources having a weighted average of 0.08 oz gold per ton are in the quartz veins. A low potential exists for additional gold resources.
15	Manlan nos. 1-9	Quartz stringers and pods a few inches thick and up to 5 ft long crop out in widely spaced locales in quartz monzonite. Quartz is also associated with shear zones that are up to 20 ft thick. The quartz is iron stained and has fracture fillings of malachite, chrysocolla, and traces of azurite.	Seven small pits and an 11-ft-deep shaft with 3.5- and 25-ft long drifts.	Fifteen chip, grab, and select samples were taken from quartz veins and shear zones. Most samples contained a trace of gold, silver, and copper. One sample contained 0.18 oz gold per ton; another had 0.24 percent copper. A select sample from a 25-ton stockpile contained 0.02 oz gold per ton, 0.9 oz silver per ton, and 5.2 percent copper. The claims have a low gold-copper resource potential.
16	Old River Arrastre-Black Jack Gold nos. 1-10 1/	Quartz monzonite is cut by numerous north- to northwest-trending, nearly vertical diabase dikes, faults, and quartz veins. The larger structures can be traced for several miles and are 10 ft thick or more in places. The faults contain various amounts of highly cleaved country rock, iron-stained gouge, and quartz veins. The larger veins are 1 to 4 ft thick and can be traced for up to 150 ft. The quartz is typically massive and milky white, but portions are iron stained and contain discrete blebs of pyrite, chalcopyrite, chrysocolla, and malachite.	A 2,500-ft-long segment of a shear zone has been explored by ten shafts, eight adits, 21 pits, and two trenches. Underground workings total 1,222 ft; the longest adit is 337 ft. Smaller nearby veins or dikes have two adits and four pits or trenches on them.	The portion of the shear zone exposed between three shafts has a total of 25,000 tons of indicated and inferred subeconomic resources with a weighted average grade of 0.04 oz gold per ton. About 6,800 tons of this resource, in the vicinity of shafts 5 and 6, averages 0.03 oz gold per ton; and 2,000 tons near shaft 7 averages 0.06 oz gold per ton. Potential is moderate to high for additional gold resources at this property.
17	Old River Arrastre-Owl	A north-trending, 3- to 5-ft-thick shear zone is mostly traceable for 153 ft. Its margins have corrugated cleavage surfaces along some portions. Country rock is quartz monzonite. The shear zone is composed mostly of altered country rock, limonite stringers, and 2- to 12-in.-thick, massive to brecciated quartz stringers and pods. In some areas of the shear zone, chrysocolla is finely disseminated or occurs as fracture fillings.	Two shafts, 37 and 17 ft deep, two adits, and seven pits. The adits are 28 and 285 ft long with 80 ft of drift. The deepest shaft intersects the 80-ft drift of the longest adit.	A mineralized portion of the zone is estimated to contain 10,000 tons quartz monzonite, quartz, and gouge having an average grade of 0.20 percent copper. The prospect has low potential for copper resources.
18	Gold Bug nos. 1 and 2	A 0.5-mi-long, northwest-trending shear zone composed of altered and brecciated chlorite schist and clay fault gouge is from 0.5 to 5 ft thick in quartz monzonite. Isolated quartz veinlets in the shear zone are 6 in. thick and 3 ft long or less. The quartz contains finely disseminated specular hematite and pyrite with malachite and azurite stains and fracture fillings.	Seven adits from 12 to 140 ft long, a caved adit, a 37-ft-deep shaft with a 45-ft drift, two caved shafts, one inclined shaft 10 ft deep, and 20 pits.	Twenty of the 72 chip, select, or grab samples from the shear zone, quartz veins, stockpiles, or dumps assayed from 0.01 to 0.96 oz gold per ton; 29 others had a trace gold. The select sample gold assays closely paralleled the chip sample results. Three select samples had 0.6, 1.9, and 4.6 oz silver per ton. Eight select and two chip samples contained copper ranging from 0.12 to 1.7 percent and one had 8.40 percent. The values are localized in small, undefineable pockets or shoots along the shear zone, and resources could not be determined. The potential for gold-copper resources is moderate to low.

Table 2.—Continued

Map no.	Name	Summary	Workings and production	Resource/sample data
19	Eureka Consolidated Quartz mine	North-trending shear zones up to 9 ft thick and 50 ft long cut coarse-grained quartz monzonite. The zones are composed of rock fragments, gouge, discontinuous diabase dikes, and discontinuous, interlaced quartz pods and stringers 0.5 in. to 1.2 ft thick. Some of the quartz contains finely disseminated pyrite, chalcopyrite, limonite, and chrysocolla.	A 45° inclined shaft 104 ft deep with a 22-ft-long drift at its bottom, seven pits, and three adits totaling 125 ft of development. Several more workings on the property lie outside the study-area boundary and were not examined. Quartz stringers selectively mined were reported to have averaged 3.7 oz gold per ton. Specific production data is unknown (Knopf, 1914, p. 120).	Twenty-nine chip, grab, or select samples were collected from quartz stringers and pods, shear zones, stockpiles, and dumps. Eight samples contained detectable gold, of which seven ranged from 0.01 to 0.06 oz gold per ton; the other had 0.13 oz. The highest silver values in two samples were 1.1 and 1.0 oz per ton. Two chip and two select samples also assayed 0.11, 0.70, 0.25, and 2.2 percent copper, respectively. Most of the easily accessible, mineralized quartz was removed. The extreme small size and apparent restricted occurrence of gold-bearing quartz indicates a low resource potential.
20	Gwen group 1/	A swarm of dark-green, aphanitic-to-schistose diabase dikes 1- to 8-ft thick, and tan-pink aplite dikes 1- to 2.5-ft thick strike predominantly northeast in quartz monzonite. A definite pattern of northwest-trending dikes is also visible. The dikes partly or totally fill shear zones which also have schistose, chloritized, altered country rock, gouge, and discontinuous, fractured, iron-stained quartz veins. The largest shear zone is exposed for over 500 ft and averages 50 ft thick.	Two adits 20 to 45 ft long, and 37 pits.	A mineralized segment of the largest zone contains 1,100 tons of indicated and inferred subeconomic resources. The average grade is 0.79 oz silver per ton. Fifty-one samples from the structures and numerous small, high-grade stockpiles indicate copper and silver are isolated in small pockets. Potential for additional resources appears to be low.
21	Lucky Larry group	Blocky, medium-grained quartz monzonite is cut by numerous N. 20° E. to N. 20° W. striking shear zones, quartz veins, and aplite and diabase dikes. All of the structures are discontinuous and irregular, especially the larger ones over 3 ft thick. The smaller ones, up to 1 ft thick, are traceable up to 60 ft. Most of the quartz is milky white with discrete areas of chalcopyrite that is finely disseminated, or in blebs and large aggregate masses. Chrysocolla and malachite are associated with the chalcopyrite.	A caved adit, 12 adits ranging from 10 to 280 ft long, 13 pits, and two trenches.	A mineralized segment of a zone contains 32,000 tons of quartz monzonite, quartz, and gouge averaging 0.24 percent copper. About 25 tons from various stockpiles in this area have an average grade of 0.61 percent copper. Mineralization was localized, and some restricted areas with gold-bearing quartz exist. This property has low to moderate potential for copper resources in shear zones.
22	Unknown 2/ "crystal area" (4/9, 12, 35)	Quartz veins, and dacite and diabase dikes trend northwest in quartz monzonite. The largest structures are exposed for over 1,000 ft; quartz veins average about 2 ft thick and 50 ft long. Cavities in the quartz contain euhedral, clear, smokey, or rutilated quartz crystals. Random blebs of chalcopyrite, pyrite, and malachite occur sparsely in localized areas of the quartz veins.	A 20-ft-deep shaft with 12 ft of drifts, a 6-ft-long adit, and over 125 shallow pits and trenches.	One hundred and forty-two select, chip, or grab samples were taken from workings and quartz-vein outcrops. Of these, 24 had values greater than 0.01 oz gold per ton, 0.2 oz silver per ton, or 0.01 percent copper. The highest values were 0.08 oz gold per ton, 2.0 oz silver per ton, and 1.19 percent copper. The quartz crystals were judged to be a common variety having no commercial value. The potential for gold-silver-copper resources is low.

Table 2.--Continued

Map no.	Name	Summary	Workings and production	Resource/sample data
23	D. R. Mar Jak	A dolomite and quartzite contact is partly exposed for 3 mi along the east limb of an arcuate-shaped syncline exposed in Mazourka Canyon. The rocks strike N. 30° W. and dip 80° SW. This site is one of three known talc deposits found along the contact. Underground, highly irregular talc bodies pinch out and swell to 8.0 ft thick along strike and dip for 147 ft. There are some country-rock inclusions, but soft, massive, steatite-grade talc bodies up to 6 ft thick occur.	Three adits total 225 ft of development, excluding two stoped areas and a 36-ft winze. Other workings include a 12-ft-deep shaft and a pit. U.S. Bureau of Mines production files indicate 183 tons of talc were mined in 1957.	An estimated 18,000 tons of indicated and inferred subeconomic resources, of which 10 percent is steatite-grade talc, occurs along the contact. There is a high potential for additional talc resources along the dolomite limestone-quartzite contact.
24	Maid of Erin nos. 1-3 1/	A 2- to 4-ft-thick quartz vein in a 3- to 5-ft-thick shear zone strikes N. 45° E., dips 70° NW. in medium-grained granodiorite. The vein contains disseminated chalcopyrite and has chryscolla and malachite stain.	A pit and a 68-ft-deep inclined shaft with a 10-ft-long drift. U.S. Bureau of Mines production files show 1 ton of ore that yielded 8 oz silver and 310 lb of copper.	A total of 2,000 tons of indicated and inferred subeconomic resources has a weighted average grade of 0.04 oz gold per ton. This property has low potential for additional gold resources in the shear zone.
25	Blue Stone Talc mine	Irregular, gradational talc bodies occur along a 1,200-ft-long segment of a 3-mi-long dolomite-quartzite contact. The rocks strike north and dip 73° W. Two pale gray-green, soft, massive talc bodies are 2.9 and 10 ft thick and 100 ft long. The steatite-grade talc locally contains rock fragments.	On the south side of a canyon three short adits total 92 ft. Two elongate glory holes 34 and 43 ft long, and a 200-ft-long adit are on the north side. A winze, now caved, connected the adit with the lowest glory hole. Eight hundred tons of steatite talc was mined in the 1940's (Page, 1951, p. 32; Chidester and others, 1964, p. 27-61).	Both talc bodies show indications of pinching out at depth and along strike. A total of 4,200 tons of indicated and inferred steatite- and nonsteatite-grade talc are estimated. There is a high potential for additional talc resources along the dolomite-quartzite contact.
26	Black Lady nos. 1 and 2	A 200- to 300-ft-thick carbon-rich member of the Rest Spring Shale crops out in Mazourka Canyon for 3 mi. The rocks strike northerly and dip 55° SW. An X-ray diffraction analysis determined that some of the carbon was amorphous graphite and that it occurs as a thin filmlike smearing on the shale. Workings indicate that the higher grade lenses are 35 to 60 ft wide and 80 to 140 ft long.	There are two bulldozer workings, separated by 2,000 ft. One is 80 ft long, 35 ft wide, and 32 ft deep; the other is 140 ft long, 60 ft wide, and 5 ft deep. Production has been intermittent over the last 20 years. At one point, 130 tons a month was shipped. Estimates from the sizes of the workings indicate about 5,000 tons could have been removed.	If 1 percent of the 3-mi-long, 200-ft-thick zone was similarly mineralized for a downdip distance of 200 ft, about 500,000 tons of inferred subeconomic graphite resources remain. The percentages of moisture and volatile content are too high and the flake size and percent graphite are too small for most uses of graphite. However, the deposit may be in demand for limited uses, such as lubricating runners and nozzle blocks in steel mills. The property has a high potential for additional low-grade graphite resources.
27	Gray Eagle Talc	Poorly exposed talcose bodies up to 110 ft long and 17 ft thick are along a quartzite-dolomite contact. The rocks strike north, dip 50°- 80° westerly, and are exposed for about 3 mi in Mazourka Canyon. Magnesium-deficient dolomite is prevalent within the talcose bodies, and little if any significant steatite-grade talc was formed.	A bulldozer-made bench cut is 140 ft long, with a 20-ft-high headwall. Other workings are seven pits and a 40-ft-long Mazourka adit.	The adit and bench-cut area is estimated to contain 38,000 tons of inferred subeconomic resources of nonsteatite-grade talc. There is a moderate to high potential for additional talc resources along the quartzite-dolomite contact.

Table 2.—Continued

Map no.	Name	Summary	Workings and production	Resource/sample data
28	Copper Empire group	Six tactite bodies occur along a 2-mi segment of an igneous-sedimentary rock contact or in sedimentary rocks within 0.5 mi to the east. The gradational lens-like bodies range from 30 to 60 ft thick and 180 to 800 ft long. Several more persistent bands of tactite crop out in a zone 100 to 150 ft wide in one area only. Malachite and chrysocolla stain and fracture filling is common. High-grade lenses in the tactite are 1 to 6 ft thick, usually less than 20 ft long, and compose 10 to 50 percent of the rock. These lenses also contain fine to coarse blebs of chalcopyrite. A major north-trending fault has two small areas with fractures filled with chrysocolla. It appears that this fault cuts off the copper-mineralized zone to the east.	Sixteen adits totaling about 900 ft, four shafts with a combined depth of 60 ft, 62 pits and trenches, and two caved adits. The longest adit was about 200 ft long. About 500 tons of hand-sorted tactite averaging 3 percent copper was produced in 1917 (Sheahan and Stager, 1954, p. 5).	Four of the six tactite bodies are estimated to have a total of 460,000 tons of indicated and inferred subeconomic resources. The weighted average grade is 0.43 percent copper and 0.09 oz silver per ton. Two other tactite bodies contain lenses of similar copper-silver content, but the limits were not well enough exposed to determine resources. In addition, 3,900 tons from two widely spaced mineralized segments of the major shear zone average 2.56 percent copper and 0.27 oz silver per ton. A moderate to high potential exists at these claims for additional copper-silver resources.
29	Gold Rabbit 1/	A 1.5- to 5.5-ft-thick shear zone in quartz monzonite trends north-northeast and is partly exposed for 400 ft. Gouge, sericite, and discontinuous quartz stringers and veins up to 0.5 ft thick fill the shear zone. Limonite and disseminated pyrite are associated with the quartz.	Two 15-ft-deep shafts and a pit.	Between the shafts, 4,300 tons of rock average 0.03 oz gold per ton. Potential is low for gold resources.
30	Philday Lode	A poorly defined 2- to 5-ft-thick shear zone strikes N. 72° E., dips 77° SE., and is partly exposed for 165 ft in quartz monzonite. Scattered blebs of chalcopyrite and fracture fillings of chrysocolla occur along structure margins and in silicified country rock pods within a clay gouge matrix. The largest mineralized pod is 3 ft thick and 12 ft long.	A 56-ft-long, 13-ft-deep trench, and four shallow bulldozer trenches ranging from 20 to 111 ft long.	Three of the nine samples, all from the 56-ft-long trench area, had significant mineral values. Gold, silver, and copper values from two select and one chip sample were: 1.83, 0.02, and 0.38 oz gold per ton, 1.3, 0.2, and 0.2 oz silver per ton, 6.1, 0.61, and 9.0 percent copper, respectively. The shear zone at this property has a low potential for gold-silver-copper resources.
31	Hidden Valley nos. 1-6	Irregularly shaped pods and lenses of platy, specular hematite crop out at a limestone-quartz monzonite contact. The largest pod is 105 ft long by 35 ft wide; the longest lens is 110 ft long and averages 1.3 ft thick. Thirteen other small lenses average 11 ft long by 3 ft wide. Associated with the hematite are minor amounts of magnetite, limonite, pyrite, and quartz.	An adit 110 ft long, a 10-ft-deep shaft, and several shallow bulldozer scrapes up to 90 ft long. U.S. Bureau of Mines production records show that 29 tons containing 49 oz silver and 2,845 lb of copper were produced in 1918.	The largest lens and pod are estimated to contain 23,000 of the 25,000 tons of hematite-rich rock identified. An additional 1,800 tons are in subsidiary occurrences. The average grade, 43.5 percent iron, is marginal and tonnage is small. None of the samples contained significant silver or copper values. Low potential for iron resources exists at this property.
32	Birthday nos. 1-4	Highly irregular shear zones are traceable for 0.5 mi along an east-trending fault that dissects an overturned anticline which plunges 50°-70° SW. The limestone and dolomite strike north and are locally recrystallized. The largest shear zone is 50 ft long and 1 to 3 ft thick; most others are considerably smaller. Some limonite gouge-filled zones contain finely disseminated oxidized galena, malachite, and chrysocolla blebs.	Seven adits, two with winzes 21 and 18 ft deep total 218 ft of underground development. Other workings include a 33-ft deep shaft and three pits. Bureau of Mines production files show this property produced a total of 4 tons in 1912 and 1913, which contained 2 oz gold, 26 oz silver, 32 lb copper, and 484 lb lead.	Six of twenty chip samples across gouge- and limonite-filled shear zones had from 0.01 to 0.06 oz gold per ton, 0.1 to 1.2 oz silver per ton, and 0.01 to 0.15 percent copper. Two select samples, representing less than 2 tons, had 0.14 and 0.15 oz gold per ton, 3.3 and 14.1 oz silver per ton, 0.77 and 1.2 percent copper, 6.9 and 18.8 percent lead, and 0.25 to 4.1 percent zinc. These claims have a low potential for gold-silver-copper-lead-

Table 2.—Continued

Map no.	Name	Summary	Workings and production	Resource/sample data
33	Condor No. 1	A 100- by 300-ft area of fractured dolomite hosts several discontinuous northeast- to northwest-trending shear zones. The largest is 63 ft long and averages about 1 ft thick. Limonite-siderite pods 1 to 4 ft long and 0.5 to 1.5 ft thick are mineralized with highly oxidized lead and zinc minerals and stained with malachite. The pods are confined to the shear zones.	A 50-ft-long open cut leads to a 10-ft-long adit and two converging 10-ft shafts forming a single 50-ft-deep shaft. Other workings include two adits, 63 and 75 ft long, and four shallow pits.	Nineteen chip, random chip, or select samples were collected from dolomite, shear zones, and limonite pods. Five chip samples from the shear zones contained 0.8 to 4.0 oz silver per ton, 4.9 to 31.0 percent zinc, 0.51 to 0.89 percent lead, and up to 0.47 percent copper. Five select samples of stockpiles assayed from 0.5 to 25 oz silver per ton, 1.82 to 20 percent lead, 6.0 to 19 percent zinc, and 0.11 to 0.75 percent copper. Pods in the shear zones have a low to moderate potential for silver-lead- zinc resources.
34	Black Eagle mine	The main quartz vein strikes N. 45°-50° E., and tips vertically to 70° SE. in quartz monzonite, near a limestone contact. It averages 2.6 ft thick, and is exposed for 340 ft along strike underground. Quartz is continuous downdip for about 250 ft, but it gradually forms lenses and pods within a gouge-filled shear zone. Bands and streaks of limonite and hematite, along with fine disseminations, small aggregates, and hairline fracture fillings of free gold and pyrite are in the quartz. One hundred ft from either side of the main vein, two smaller subparallel quartz veins are partly traceable for 120 and 180 ft. Vein thicknesses are about 3.5 and 1.6 ft, respectively.	The main working is a 308-ft-deep shaft with 1,660 ft of drifts on six levels. Two stopes along the main vein open to the surface. Other nearby workings include four shafts with 240 ft of drifts two shafts 18 and 44 ft deep, two trenches, and five pits. An unknown amount of ore was produced from 1883 to 1900. From 1901 to 1950 about 2,476 tons yielded 1,070.4 oz gold, 6,838 oz silver, 641 lb copper, and 4,136 lb lead (U.S. Bureau of Mines production records).	In the main working 12,000 tons of demonstrated and inferred reserves averaging 0.21 oz gold per ton, and 44,000 tons of indicated and inferred subeconomic resources averaging 0.07 oz gold per ton, are estimated. An additional 4,000 tons of indicated marginal reserves averaging 0.05 oz gold per ton are on the dump. The quartz veins subparallel to the main vein total 7,200 tons of indicated and inferred subeconomic resources averaging 0.05 oz gold per ton. Potential is high for additional gold resources at this property.
35	Noble no. 6	At least five poorly defined, northwest-trending mineralized shear zones occur in a 300- by 700-ft area of limestone. Small blebs of chalcopyrite, bornite, and galena, and azurite-malachite stains and coatings occur in the zones.	Five pits, two adits, and two shafts.	Eight chip and one random chip sample were taken from the adits and shafts, seven grab samples from pits and dumps, and two select samples from stockpiles. The two select samples had 1.4 and 1.0 oz gold per ton, 6.4 and 8.8 oz silver per ton, and 1.9 and 0.21 percent copper, respectively. Seven other chip and grab samples, mostly of altered limestone fault gouge, contained from 0.4 to 1.4 oz gold per ton, trace to 4.7 oz silver per ton, and 0.01 to 0.73 percent copper. This property has moderate potential for gold-silver-copper resources.
36	Bluebird 1/	A shear zone partly traceable over a distance of about 700 ft, strikes N. 25° W., dips 70° NE., and ranges from less than a foot to 12 ft thick where exposed in limestone. The shear zone is composed of calcareous gouge, limonite-stained jasperoid, siliceous limonite, and fracture coatings of chrysocolla and malachite.	A 15-ft-deep shaft, three pits, and a 10-ft adit.	A 110-ft segment of the zone averages 5.5 ft thick and has 7,900 tons of subeconomic resources with a grade of 1.19 percent copper. The potential for additional copper resources is moderate.

Table 2.—Continued

Map no.	Name	Summary	Workings and production	Resource/sample data
37	Betty Jumbo mine	Tactite bodies were formed along and near igneous-sedimentary rock contacts. Scheelite occurs as fine disseminations, coarse aggregates, and along hairline fractures in tactite. The two largest tactite bodies were developed by the East and West adits. At the East adit an original resource was about 125 ft long, 20 ft wide, and 10 ft thick. The West adit is centered on the thickest portion of a tactite outcrop that is partly exposed for 450 ft. It ranges from 2 to 28 ft thick, and is 100 ft wide, as developed by the West adit. The adit also exposes a copper-gold-bearing shear zone 46 ft long and 2.5 ft thick. The Betty Jumbo No. 6 contains a gold-bearing shear zone 38 ft long and 1.5 ft thick.	The East, West, and South adits total over 1,200 ft of mostly single-level development. Other workings nearby include two shafts no more than 25 ft deep, two trenches, three pits, and three adits 10, 60, and 75 ft long. Production from the property in 1918 and 1951 totals 1,037 lb tungsten, 5,575 lb copper, and 46 oz silver. An additional 18,750 lb of tungsten was estimated recovered from a 1952 shipment, but was not recorded.	The West adit has 52,000 tons of indicated and inferred reserves averaging 0.70 percent WO_3. Within this block 350 tons average 0.22 oz gold per ton, 1.18 oz silver per ton, and 1.59 percent copper. An eastward extension of the tactite body is estimated to contain 5,100 tons of indicated and inferred subeconomic resources with 0.08 percent WO_3. The East adit has 5,000 tons of indicated and inferred marginal reserves grading 0.38 percent WO_3. The Betty Jumbo No. 6 has 90 tons of inferred subeconomic resources with 0.57 oz gold per ton. Potential is high for additional tungsten-gold-copper resources at this property.
38	Blue Crystal nos. 1-6	A limestone facies in the Precambrian Wyman Formation is intruded by a Cretaceous granitic pluton resulting in the development of tactite zones up to 1,100 ft long and about 150 ft wide. Traces of disseminated scheelite and a small magnetite pod are present. The tactite zones are up to 5 ft thick.	Three open cuts, twelve shallow trenches, and six pits.	A grab sample of tactite contained 2.4 oz silver per ton and 0.22 percent WO_3. Twelve other chip or grab samples contained 0.01 to 0.12 percent WO_3. Three samples from the magnetite pod had from 16.5 to 31.0 percent iron. The property has a low potential for tungsten resources.
39	Unknown 2/ (18, 10, 36)	A 6-in.- to 2-ft-thick quartz vein strikes N. 39 W. and dips 35 SW., in impure buff-gray limestone. The quartz vein contains disseminated galena and pyrite and about 5 percent white calcite. It can be traced for about 30 ft downdip, but not along the surface beyond the shaft collar.	A 40°-SW.-dipping inclined shaft is caved at the collar.	Four samples were taken from the prospect. A select sample from a 200-lb stockpile contained 10.8 oz silver per ton, 22.0 percent lead, and 2.0 percent zinc. Two chip samples across the quartz vein had 0.12 and 4.5 percent lead, and 0.6 and 3.30 percent zinc; one had 2.6 oz silver per ton. Poor access to the underground workings precluded a resource estimate. The property has a low to moderate potential for silver-lead-zinc resources.
40	Andrews nos. 1-17	Quartz-limonite pods along limestone-shale contacts occur in deposits up to 2 ft thick and 30 ft long. Typically, the minerals present are pyrite, galena, and sporadic occurrences of chrysocolla. Veins in the shale are discontinuous and displaced by faulting.	At the Andrews nos. 14-17 there are a 120-ft adit, five pits, and two trenches. The Andrews nos. 1 and 2 has a vertical 50-ft-deep shaft with 80 ft of drifting, five pits, and a 25° inclined, 25-ft-deep shaft with 50 ft of drifting.	Thirty-four samples were collected from the Andrews claims. One select sample of stockpiled material had 17.8 oz silver per ton and 37 percent lead. The other samples contained considerably less. In general, the assay data indicates the mineralization was spotty and erratic. The property has a low potential for silver-lead resources along limestone-shale contacts.

Table 2.—Continued

Map no.	Name	Summary	Workings and production	Resource/sample data
41	Squaw Flat nos. 1-4 1/	Discontinuous, quartz fissure-filling veins intrude fine-grained, massive quartzite and thin, interbedded white dolomite. The two longest veins extend for about 42 ft and average 1.1 ft thick. Sulfide pods and veins up to 3 in. thick contain galena, sphalerite, and pyrite.	Development consists of a headframe, two inaccessible shafts, a 58-ft-long adit with a 50-ft-deep inclined winze, several shallow trenches, and one small pit. About 5 tons of quartz is stockpiled near the headframe. U.S. Bureau of Mines production files show 1 oz gold, 123 oz silver, and 2,294 lb lead were recovered from 57 tons in 1950.	Two quartz veins combined have indicated and inferred subeconomic resources of 300 tons with an average weighted grade of 1.6 oz silver per ton, 3.69 percent lead, and 1.85 percent zinc. About 5 tons of similarly mineralized quartz is stockpiled at the workings. The property has moderate potential for additional silver-lead-zinc resources in quartz veins.
42	San Pedro nos. 1-6	Quartz veins are normal to a northwest-trending fault system. The largest vein is a massive, sinuous, branching quartz vein that crops out in a 200- by 50-ft area in thin-bedded siltstone, shale, and phyllite. Other outcrops occur as small discontinuous pods. Cubic, irregular masses of galena are randomly distributed in the vein. The veins are up to 10 ft thick, but generally less than 2 ft.	There are nine pits, four adits, one trench, and one shaft with 70 ft of drifts.	Four chip, fifteen select, and five grab samples were collected. One chip sample across a 1.7-ft-thick quartz vein had 3.9 oz silver per ton, 1.2 percent lead, and 0.17 percent zinc. Five select samples of quartz from stockpiles and waste material averaged 6.8 oz silver per ton, 3.0 percent lead, and 0.62 percent zinc. Limited subsurface access and poor surface exposure of the vein system preclude a resource estimate. However, the potential for silver-lead-zinc resources at this property is moderate to high.
43	Dorothy	Massive milky white quartz veins, apparently no larger than 40 ft long by 2 ft thick, cut argillite. Cubic masses of galena up to 2 or 3 in. in diameter are randomly distributed in some of the quartz. Some of the galena has been completely oxidized leaving a cellular boxwork which has been encrusted with limonite.	A 22-ft-long trench with a caved 13-ft-deep shaft and a pit comprise the upper workings. The lower working is a pit. Distance between the upper and lower workings is 800 ft. The workings are likely not on the same vein.	A select sample from the shaft area had 4.6 oz silver per ton and 5.65 percent lead. Quartz from the nearby pit contained no significant values. A select sample from the lower working contained 1.6 oz silver per ton and 1.3 percent lead. This property has low potential for silver-lead resources.
44	Narrows nos. 1-6	Veins, veinlets, and pods of quartz up to 2 ft long have rehealed segments of a thrust fault. Mineralization was more localized than the quartz, yet occurs in several widely spaced areas along the fault. The quartz contains randomly disseminated blebs, cubes, or masses and stringers, up to 4 in. thick of galena, spalerite, and pyrite.	A 251-ft adit is the longest of six adits totaling 485 ft of underground development and three small pits.	Of 44 samples, nine contained more than 1 oz silver per ton and 1 percent lead or zinc. Higher grade concentrations of minerals are erratically distributed in thin, discontinuous quartz veinlets and blebs or pods. The apparent overall average grade is too low to constitute a resource. A moderate potential for silver-lead-zinc resources exists along the thrust fault.

Table 2.—Continued

Map no.	Name	Summary	Workings and production	Resource/sample data
45	Silver Princess nos. 1-4 1/ (Nancy Hanks)	Discontinuous-fissure filling veins occur in limestone and dolomite along a major east-trending thrust fault, up to 40 ft thick and partly exposed for over 2 mi along strike. The veins are generally less than 10 ft long and range up to 1.5 ft thick. Intergrown, cubic galena and sphalerite occur as blebs and streaks in the quartz, but also form solid, massive sulfide veins and pods.	Two pits and one adit with 325 ft of workings. Production has totaled at least 233 oz of silver, 12 lb of copper, and 13,951 lb lead (U.S. Bureau of Mines production records).	Twenty-eight samples were taken. Underground workings exposed mineralized quartz veins in an area 30 ft thick, 50 ft wide, and 120 ft long. If the veins constitute 10 percent of the total rock, 3,000 tons of vein material averages 1.3 oz silver per ton, 4.1 percent lead, and 1.8 percent zinc. There is a high potential for silver-lead-zinc resources.
46	Opal mine 1/	Fractures filled with quartz form irregular, discontinuous veins and pods in a 160- by 340-ft area of thin-bedded slate. Massive and cubic galena with minor amounts of sphalerite and pyrite are unevenly distributed in the quartz.	Eleven pits, three adits totaling 220 ft of underground workings, and three shafts 14, 28, and 43 ft deep.	Assay results of 37 samples indicate that silver, lead, and zinc are erratically distributed, with only eight samples containing more than 1 oz silver per ton. The largest vein is 48 ft long, averages 2.5 ft thick, and contains 240 tons of indicated and inferred subeconomic resources. The average grade is 2.86 oz silver per ton and 4.59 percent lead. The potential for additional silver-lead resources at this property is low.
47	Silver Spur 1/ (Daisy)	Two parallel quartz veins 360 ft and 150 ft long, and from 2 to 6 ft thick follow bedding planes in calcareous fissile slate and interbedded limestone. Cubic masses or streaks of galena and pyrite up to 4 in. wide by 6 in. long occur in some portions of the veins.	There are five inclined shafts from 10 to 40 ft deep, and five small pits. U.S. Bureau of Mines production records are incomplete; but, at least 74 oz of silver, 854 lb lead, and 0.8 oz gold have been produced.	Twenty-eight samples were collected. There are approximately 30 tons of mineralized quartz stockpiled and mixed in the dumps. Sample results for this material ranged from 2 to 5 oz silver per ton, 3 to 14 percent lead, and 2 to 4 percent zinc. At one inclined shaft, about 200 tons of indicated and inferred subeconomic resources are estimated. At another inclined shaft, 7 tons of vein quartz averages 18.1 percent lead, 2.6 percent zinc, and 1.2 oz silver per ton. Potential for additional lead-zinc-silver resources is low.
48	Lucky Josephine no. 10	Discontinuous fissure-filling quartz veins range in length from 10 to 400 ft, with thicknesses up to 5 ft. The veins occur in an alteration zone of tactite and hornfels that is at least 120 ft wide and 1,500 ft long. The metamorphic rocks resulted from the Cretaceous intrusion of a granitic pluton into carbonate and clastic rocks of Cambrian age. Mineralization produced pyrite, limonite, and traces of disseminated galena in the quartz veins.	Five pits and trenches up to 20 ft long, three adits 35, 43, and 440 ft long, and a 70-ft-deep inclined shaft are on the property.	Of 42 samples collected from the property, values are as much as 4.0 oz silver per ton, 3.15 percent lead, 0.9 percent copper, and 0.23 percent molybdenum sulfide. However, the majority of values are considerably below these. Potential for silver-lead-copper-molybdenum resources is low.

Table 2.—Continued

Map no.	Name	Summary	Workings and production	Resource/sample data
49	Inyo Queen nos. 1 and 2	A northeast-striking shear zone averaging 5 ft thick and dipping 50° to 70° SE. in a quartz monzonite intrusive. The zone, which is partially exposed in the adits for 170 ft vertically and 172 ft horizontally, is composed of altered quartz monzonite and limonite-stained vein quartz. The vein ranges from less than 0.1 ft to approximately 7 ft thick and contains sporadic isolated concentrations of galena, pyrite, and possibly bornite. Cavities contain clear quartz crystals up to 5 in. long.	Three adits have a total of 242 ft of workings. Remnants of a mill site are present.	Sixteen samples were collected from this property. Five of the 13 samples from shear zones had 0.2 to 0.9 oz silver per ton and 0.05 to 1.3 percent lead. One of the three select samples from the dumps contained 0.4 oz silver per ton and 1.5 percent lead. Some samples were also analyzed for copper, zinc, and tungsten; anomalous values above background levels were not detected. Low-grade lead and silver values occur in sporadic, isolated concentrations. A low potential exists for silver-lead resources.
50	Independence claims	Irregular, discontinuous shear zones are composed of limestone fragments, gouge, and quartz veins. Most veins are 1 to 3 in. thick, with pods up to 3.5 ft thick. Oxidized pyrite cubes and blebs of galena and malachite stain are associated with quartz.	There are four adits 10, 40, 75, and 210 ft long. There are also two caved adits and three pits.	Sixteen chip, five select, and two grab samples were taken from shear zones and quartz veins. A sample of galena-bearing quartz collected from a stockpile had 7.8 oz silver per ton and 50.5 percent lead. Four other samples contained more than 1 oz silver or 1 percent lead. Two samples contained anomalous amounts of molybdenum. This property has a low potential for silver-lead-copper-molybdenum resources.
51	Custer (Baxter)	Altered, black hornfels, shale, and quartz monzonite, in a contact zone 4 to 6 ft thick, strikes N. 40° E. and dips 40° NW. (Tucker and Sampson, 1938, p. 435). Siliceous limonite and 2-in.-thick quartz-vein material occur in a 2-or 3-ton stockpile at the portal of a caved adit.	Two accessible adits are 5 and 22 ft long. A caved adit was driven on the contact zone and is reported to be 100 ft long (Jenkins, 1957, p. 435). Remnants of a gravity tram system exist. Bureau of Mines records indicate 34 tons of ore have been produced yielding 92.2 oz gold, 1,266 oz silver, 2,351 lb copper, and 23,866 lb lead.	Five samples were collected. Two select samples from stockpiles contained 0.02 and 0.20 oz gold per ton, 6.6 and 8.9 oz silver per ton, 2.4 and 20.4 percent copper, and 7.2 and 5.8 percent lead. The three chip samples contained traces of gold, silver, lead, and copper. A low potential for gold-silver-lead-copper resources exists at this property.
52	Lucky Boy 1/ (Creeper and Dungeon)	A 2- to 7-ft-thick, white quartz vein exposed for 1,650 ft strikes approximately N. 60 W. and dips 50° to 65° SW. in a predominantly carbonate country rock. The vein is up to 15 ft thick, locally fractured, has minor amounts of galena, chalcopyrite, and bornite, with secondary iron and copper stains along fractured surfaces.	The property has 20 adits ranging from 2 to 220 ft long, and 20 pits and trenches. Total underground development is 1,500 ft.	A 220-ft-long mineralized portion of the 1,650-ft-long quartz vein contains an estimated 2,800 tons of inferred subeconomic resources. Its weighted average grade is 5.38 oz silver per ton, 7.48 percent lead and 0.19 percent copper. Waring (1919, p. 117) reported that this property had molybdenum; however, no molybdenum was detected in our samples. The potential for additional silver-lead-copper resources is low.

Table 2.—Continued

Map no.	Name	Summary	Workings and production	Resource/sample data
53	Arroyo group	Bedding-plane shear zones less than 1 ft thick contain fractured limestone, secondary calcite, siderite, quartz veinlets, and heavy limonite staining.	Three adits 32, 40, and 60 ft long, and nine pits.	Ten chip and seven grab samples were taken. A chip sample across a shear zone contained a trace of gold and 0.6 oz silver per ton. Two grab samples from waste dumps of two pits assayed 1.9 and 0.8 oz silver per ton and a trace of gold each. Potential for gold-silver resources is low.

1/ This property would not return enough revenue to be classified as a subeconomic resource, based on hypothetical production costs for this deposit alone. However, it is favorably located for possible consolidated development with other deposits, and, viewed collectively, they represent resources.

2/ Three numbers in parentheses below unknown name refer to section, township, and range, with respect to the Mount Diablo Meridian.

Table 3.--Properties with mineral resources from lode deposits in the Andrews Mountain, Mazourka, and Paiute Roadless Areas

Map no.	Property name	Type of occurrence	Classification of resource	Quantity (tons)	Grade (oz per ton)	Grade (percent)
			Mazourka			
5	Blake mine (JR no. 1)[1]	Fissure veins	Indicated and inferred subeconomic resources	600	1.49 silver	4.87 lead
7	Green Giant Marble nos. 1-8	Contact-metasomatic	Inferred subeconomic resources	5,000,000	Marble	
9	Black Aster[1]	Shear zone-fissure veins	do	900	1.0 silver	
14	Pyrite Extension[1]	Fissure veins	Indicated and inferred subeconomic resources	6,700	0.08 gold	
16	Old River Arrastre-Black Jack Gold nos. 1-10	do	do	25,000	0.04 gold	
	do	Stockpiles	Measured subeconomic resources	35	0.04 gold	
20	Gwen group[1]	Shear zone-fissure veins	Inferred subeconomic resources	1,100	0.79 silver	
23	D. R. Mar Jak	Replacement	Indicated and inferred subeconomic resources	18,000	Nonsteatite-grade talc	
				1,800	Steatite-grade talc	
24	Maid of Erin nos. 1-3[1]	Shear zone-fissure veins	do	2,000	0.03 gold	
25	Blue Stone Talc mine	Replacement	Inferred subeconomic resources	1,200	Steatite-grade talc	
	do	do	do	3,000	Nonsteatite-grade talc	
26	Black Lady nos. 1 and 2	Contact-metasomatic	do	500,000	Graphite-bearing shale	
27	Gray Eagle Talc	Replacement	Inferred subeconomic resources	38,000	Nonsteatite-grade talc	
28	Copper Empire group	Contact-metasomatic	Indicated and inferred subeconomic resources	460,000	0.09 silver	0.43 copper
	do	Shear zone	do	3.900	0.27 silver	2.56 copper
	do	Mine dumps	Measured subeconomic resources	200		1.32 copper

Table 3.--continued

Map no.	Property name	Type of occurrence	Classification of resource	Quantity (tons)	Grade (oz per ton)	Grade (percent)
			Mazourka			
29	Gold Rabbit[1]	Shear zone	Inferred subeconomic resources	4,300	0.03 gold	
34	Black Eagle mine	Fissure veins	Demonstrated and inferred reserves	12,000	0.21 gold	
	do	do	Indicated and inferred subeconomic resources	51,000	0.07 gold	
	do	Mine dump	Indicated marginal reserves	4,000	0.05 gold	
36	Bluebird[1]	Shear zone	Inferred subeconomic resources	7,900		1.19 copper
37	Betty Jumbo mine (west adit)	Contact-metasomatic	Indicated and inferred reserves	52,000		0.70 WO_3
	do	do	Indicated and inferred subeconomic resources	5,100		.08 WO_3
	do	Shear zone	Indicated and inferred marginal reserves	350	0.22 gold 1.18 silver	1.59 copper
37	Betty Jumbo mine (east adit)	Contact-metasomatic	do	5,000		.38 WO_3
	No. 6	Fissure veins	Inferred subeconomic resources	90	0.57 gold	
45	Silver Princess nos. 1-4[1] (Nancy Hanks)	do	Indicated and inferred subeconomic resources	3,000	1.3 silver	4.1 lead 1.8 zinc
46	Opal mine[1]	do	Inferred subeconomic resources	240	2.86 silver	4.59 lead
47	Silver Spur (Daisy)[1]	do	Indicated and inferred subeconomic resources	200		4.3 lead
	do	Stockpiles and mine dumps	Measured subeconomic resources	30	2.0 silver	3.0 lead 2.0 zinc
			Paiute			
52	Lucky Boy[1] (Creeper and Dungeon)	Fissure veins	Inferred subeconomic resources	2,800	5.38 silver	7.48 lead
			Andrews Mountain			
41	Squaw Flat nos. 1-4[1]	do	Indicated and inferred subeconomic resources	300	1.6 silver	3.69 lead 1.85 zinc

[1] This property would not return enough revenue to be classified as a subeconomic resource, based on hypothetical production costs for this deposit alone. However, it is favorably located for possible consolidated development with other deposits, and viewed collectively, they represent resources.

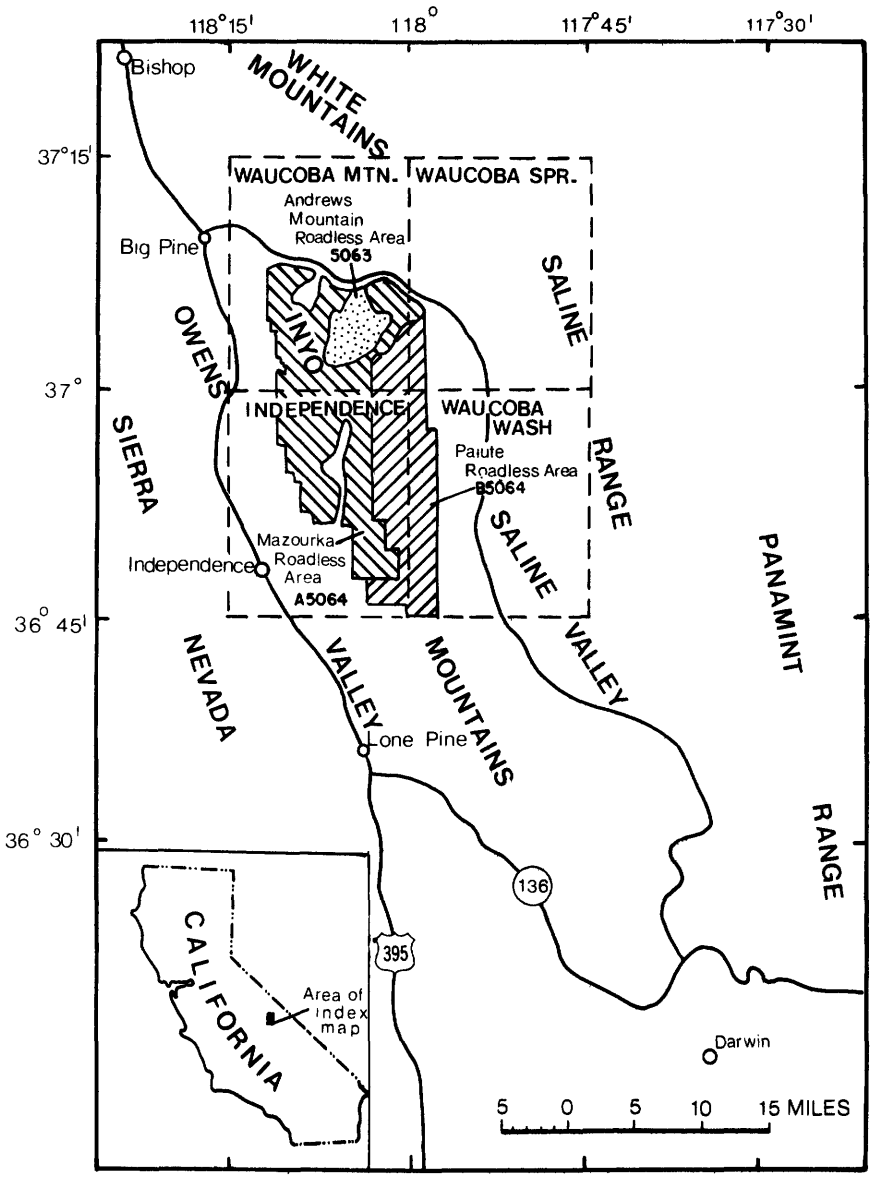
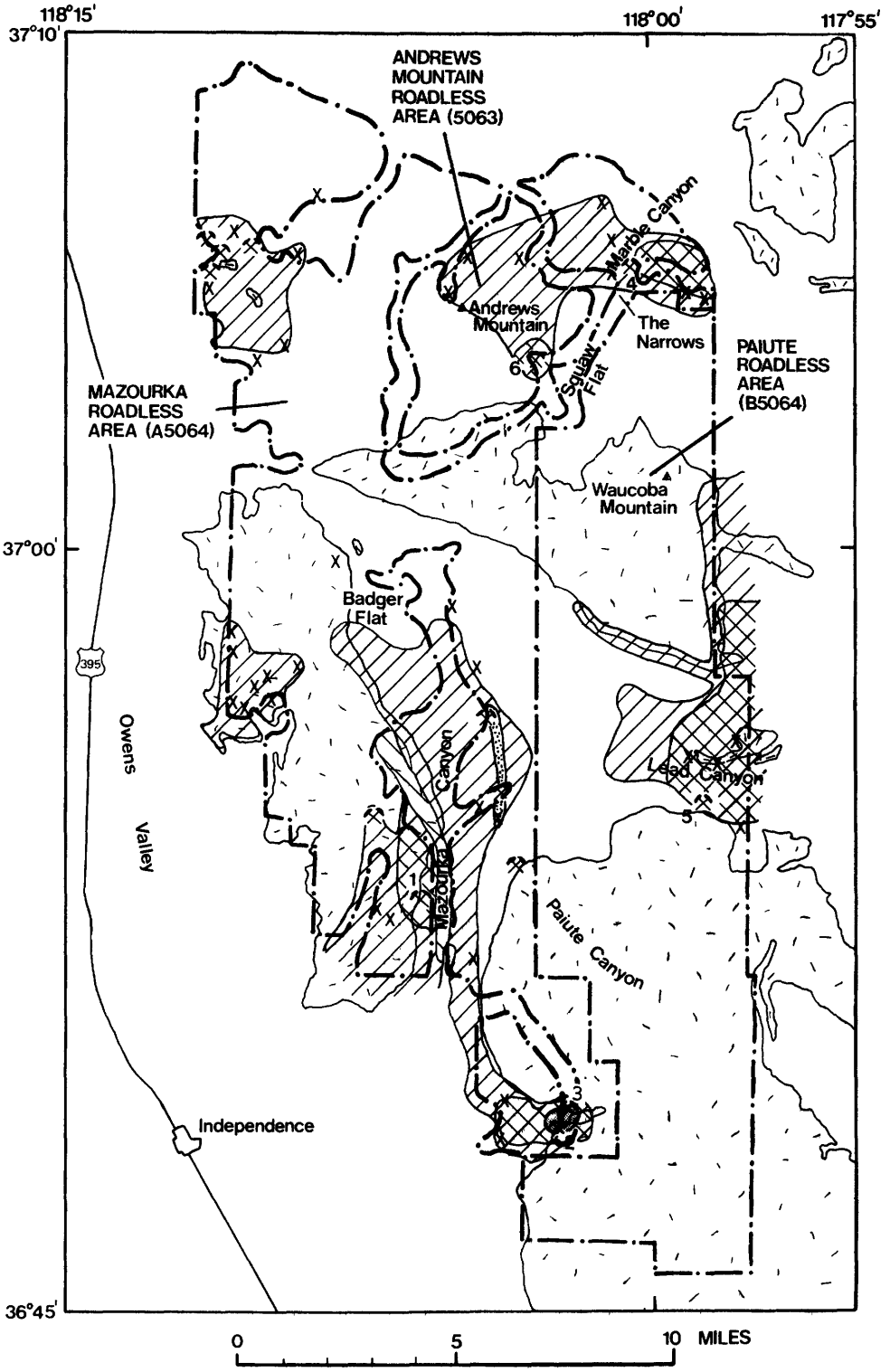


Figure 1.—Index map showing location of the Andrews Mountain, Mazourka, and Paiute Roadless Areas in the Inyo Mountains.



EXPLANATION

AREA WITH MINERAL RESOURCE POTENTIAL

- High resource potential for gold and tungsten, moderate resource potential for silver, lead, zinc, and copper
- Moderate resource potential for silver with associated lead, zinc, copper, and gold
- Low resource potential for silver with associated lead, zinc, copper, and gold
- Low resource potential for gold in placer deposits
- Moderate to low resource potential for talc and (or) graphite
- BOUNDARY OF ROADLESS AREA

- GRANITIC ROCKS
- SEDIMENTARY AND VOLCANIC ROCKS
- CONTACT
- MINE
  - 1- Copper Empire group
  - 2- Betty Jumbo mine
  - 3- Black Eagle mine
  - 4- Silver Princess nos. 1-4
  - 5- Custer (Baxter) mine
  - 6- Squaw Flat nos. 1-4
- PROSPECT

Figure 2.—Mineral resource potential of the Andrews Mountain, Mazourka, and Paiute Roadless Areas.