Mineral Resources of the Southern Inyo Wilderness Study Area, Inyo County, California

U.S. GEOLOGICAL SURVEY BULLETIN 1705–B

Chapter B

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By JAMES E. CONRAD, JAMES E. KILBURN, and
RICHARD J. BLAKELY
U.S. Geological Survey

CHARLES SABINE, ERIC E. CATHER, LUCIA KUIZON, and
MICHAEL C. HORN
U.S. Bureau of Mines

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MINERAL RESOURCES OF WILDERNESS STUDY AREAS:
SOUTH-CENTRAL CALIFORNIA

DEPARTMENT OF THE INTERIOR
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STUDIES RELATED TO WILDERNESS

Bureau of Land Management Wilderness Study Area

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine the mineral values, if any, that may be present. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral survey of part of the Southern Inyo Wilderness Study Area (CA-010-056), Inyo County, California.

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SOUTH-CENTRAL CALIFORNIA

Mineral Resources of the Southern Inyo Wilderness Study Area, Inyo County, California

By James E. Conrad, James E. Kilburn, *and* Richard J. Blakely
U.S. Geological Survey

Charles Sabine, Eric E. Cather, Lucia Kuizon, *and* Michael C. Horn
U.S. Bureau of Mines

SUMMARY

Abstract

Mineral surveys were requested on part of the Southern Inyo Wilderness Study Area (CA-010-056) covering 27,240 acres on the west side of the southern Inyo Mountains. In this report, the area studied is referred to as "the wilderness study area", or simply "the study area". Fieldwork for this report was carried out between 1983 and 1985. No resources were identified at the 66 mines and prospects examined in and adjacent to the study area. Several areas have low and moderate resource potential for gold, silver, lead, and zinc. A zone extending from the Reward mine (near the northwest corner of the study area) 3 mi to the southeast has low and moderate resource potential for gold, silver, lead, and zinc. There is low potential for gold, silver, lead, and zinc resources in an area located about 1.5 mi northeast of the Reward mine. A mineralized shear zone on the north side of Union Wash, about 3 mi south of the Reward mine, has moderate resource potential for silver and lead on the west and low resource potential for gold, silver, lead, and zinc on the east. Two areas between Kern Knob and Dolomite Canyon along the southwest boundary of the study area and the south edge of the study area have low resource potential for silver, lead, and zinc. Low resource potential for gold, silver, lead, and zinc is indicated for the southwest flank of New York Butte on the east edge of the study area. There is low resource potential for talc in the area east of Kern Knob.

Character and Setting

The Southern Inyo Wilderness Study Area lies in the southern part of the Inyo Mountains about 5 mi east of Lone Pine, Calif. (fig. 1). The northern part of the study area is very steep and rugged with relief as much as 7,400 ft; the southeastern part of the area is less rugged but also contains numerous steep and inaccessible canyons. A sequence of intensely folded and faulted marine sedimentary rocks of Cambrian through Triassic age (570-205 million years before present (Ma); see appendix for geologic time chart) and continental volcanic and sedimentary rocks of Triassic age (240-205 Ma) underlie the area. Limestone and dolomite are the most abundant rock types in the lower part of the marine sequence; shale is more abundant in the upper part. These rocks are intruded by a number of plutons and small granitic bodies of Jurassic and Cretaceous (205-63 Ma) age. Faulting, folding, and metamorphism have greatly deformed the stratified rocks, especially near the large plutons.

Mineral Resources

Mining activity has been intermittent in this part of the Inyo Mountains for more than 100 years. The Russ mining district, organized in 1860, covers nearly the entire study area. The discovery of high-grade silver ore in 1865

at the Cerro Gordo mine, located about 5 mi southeast of the study area, attracted thousands of miners and prospectors to the area. The Inyo Mountains are among the most heavily prospected areas in the western United States and probably more than 1,000 mining claims have been located in the study area. However, only sporadic mining activity has occurred during the twentieth century, mostly during the two world wars and the great depression, and virtually no mining has been recorded since the early 1950's.

Mineral Resource Potential

The Southern Inyo Wilderness Study Area lies within a province characterized by hydrothermal deposits of gold, silver, lead, and zinc. Most large deposits in the region, such as that at the Cerro Gordo mine (fig. 1), are found in carbonate rock as veins, stockworks, or bedded replacement bodies. Small but rich gold- and silver-bearing veins can be present in all rock types but generally are concentrated in or near the large granitic plutons.

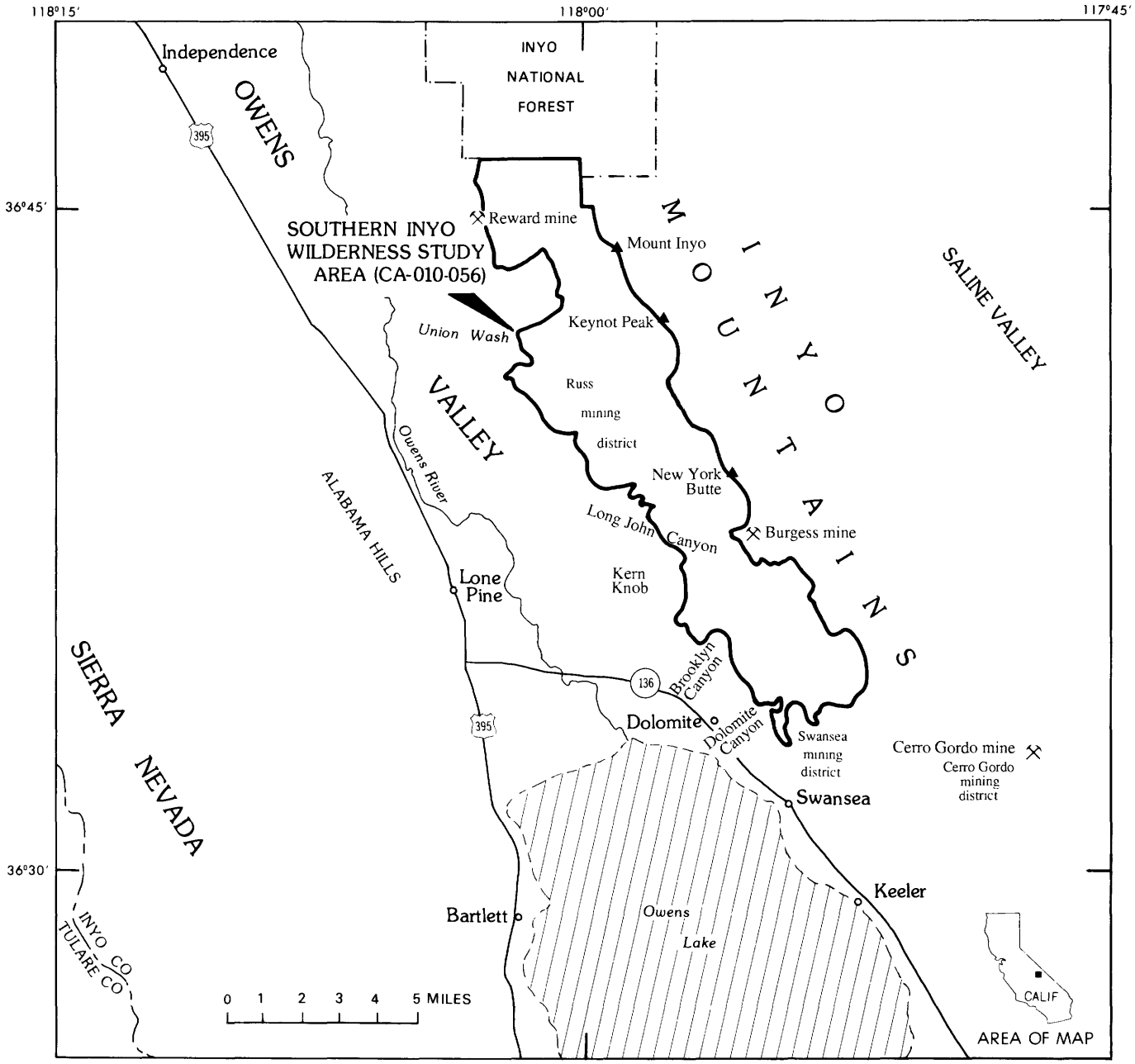

Figure 1. Index map showing location of the Southern Inyo Wilderness Study Area, Inyo County, California

The geology of the study area is also conducive to the formation of skarns, which form in carbonate rocks adjacent to large plutons. Anomalous concentrations of elements such as tungsten, molybdenum, and bismuth that are associated with skarns and the heavy minerals scheelite and pyrite were identified in geochemical samples from the study area and indicate this type of mineralization. Only small skarn deposits are known to exist in the study area, however. Talc is another type of deposit related to the contact-metamorphic effects of the large granitic plutons found in the study area. Small talc bodies were mined in and near the study area in the vicinity of Kern Knob (fig. 2). There is low resource potential for talc east of Kern Knob.

Geochemical and mineralogical evidence and an inventory of mines and prospects indicate that gold, silver, lead, and zinc mineralization has occurred in several places in the study area. Many of the mines and prospects examined in this study lie within these mineralized areas, although none have identified resources. A zone extending from the Reward mine area 3 mi to the southeast has low resource potential for gold, silver, lead, and zinc, and the immediate vicinity of the Reward mine has moderate resource potential for these elements (fig. 2). An area of fissure veins in granitic rocks about 1.5 mi northeast of the Reward mine has low potential for gold, silver, lead, and zinc resources. An east-trending shear zone on the north side of Union Wash has moderate resource potential for silver and lead and low resource potential for gold and zinc on the west and low resource potential for gold, silver, lead, and zinc on the east (fig. 2). There is low potential for silver, lead, and zinc resources along the southwest boundary of the study area extending from the upper part of Long John Canyon to Brooklyn Canyon and at the south end of the study area east of Dolomite Canyon. The southwest flank of New York Butte has low resource potential for gold, silver, lead, and zinc.

INTRODUCTION

Area Description

The Southern Inyo Wilderness Study Area (CA-010-056) covers 27,240 acres on the west side of the southern Inyo Mountains 5 mi east of Lone Pine, in southeastern California (fig. 1). Elevations in this rugged area range from about 3,700 ft at the base of the range in Owens Valley to 11,107 ft at the summit of Mt. Inyo (fig. 1). The climate is arid to semiarid, and vegetation is sparse with creosote bush, desert holly, and encelia in the valley bottom, Joshua tree, sage, and rabbit brush at middle elevations, and piñon pine, juniper, and mountain mahogany at high elevations. Perennial vegetation along streams or near springs includes willow and wild rose. Lush grasses and many varieties of wildflowers also are present.

Access within the area is limited to foot trails built by prospectors in the 1870's and 1930's. Numerous graded dirt roads in Owens Valley provide access to the western part of the study area and lead to canyons and mines along the base of the range including Union Wash, Long John Canyon, Brooklyn Canyon, Dolomite Canyon, and the Reward mine. A jeep trail, passable in four-wheel drive, runs from Swansea to the Burgess mine along the southeast boundary and provides access to the southeastern part of the study area.

Previous and Present Investigations

The Southern Inyo Wilderness Study Area includes parts of the New York Butte, Lone Pine, and Independence 15-minute quadrangles. Geologic studies of this area began with those of Knopf (1914, 1918) and Kirk (in Knopf, 1918), who described the stratigraphy and published reconnaissance geologic maps of parts of the range. A study of the mineral deposits by Merriam (1963) at the Cerro Gordo mine, located 5 mi east of the study area, included a reconnaissance map of the southern part of the Inyo Mountains. Other geologic studies covering parts of the study area include those by Ross (1965), Kelley (1973), and Stone (1984). Unpublished geologic mapping by W.C. Smith of the U.S. Geological Survey (USGS) in the New York Butte quadrangle served as the basis for geologic mapping done in the southeastern part of the study area.

The USGS carried out field investigations in the study area during the summers of 1983 and 1985. The work included field checking of existing geologic maps, new mapping where necessary, geochemical sampling, and aeromagnetic and gravity surveys. Heavy-mineral concentrates from stream sediments were collected to help identify mineralized areas; the analytical data are given in Detra and Kilburn (1986).

The U.S. Bureau of Mines (USBM) conducted a library search for information on mines and prospects within the study area. These data were supplemented by information from claim owners and Inyo County and U.S. Bureau of Land Management (BLM) claim records. Field studies by USBM personnel were carried out in 1984 and 1985 and included examination of mines and prospects, detailed mapping of selected properties, and sampling of mineralized areas to help appraise the identified mineral resources of the study area. Samples were analyzed by fire-assay, atomic-absorption, and inductively coupled argon-plasma spectrophotometric methods. Complete analytical data and detailed property maps are on file at the USBM, Western Field Operation Center, E. 360 3rd Avenue, Spokane, Wash. 99202.

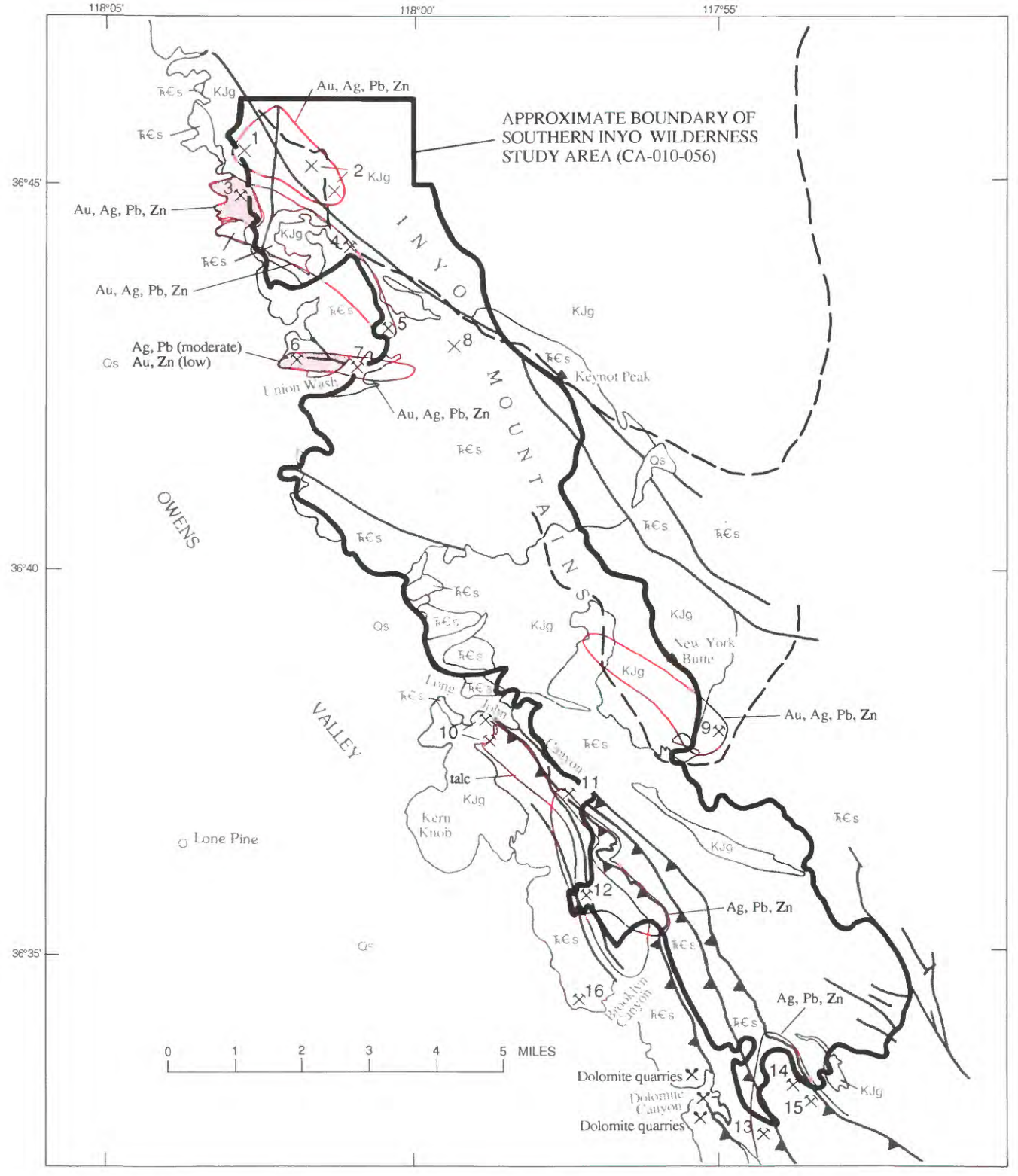

Figure 2. Mineral resource potential and generalized geology of the Southern Inyo Wilderness Study Area, Inyo County, California.

EXPLANATION

Area with moderate resource potential

Area with low resource potential

See appendix for definition of levels of mineral resource potential

Commodities

Au	Gold
Ag	Silver
Pb	Lead
Zn	Zinc
	Talc

Geologic map units

Qs	Surficial deposits (Quaternary)
KJg	Granitic rocks (Cretaceous and Jurassic)
₹C	Sedimentary and volcanic rocks (Triassic to Cambrian)

Contact

Fault

Thrust fault--Sawteeth on upper plate

Magnetic boundary

Mine--Number refers to table below

Prospect--Number refers to table below

Mines and prospects

1	International Recovery prospect (Frostbitten, Ida)
2	Spanish Belt prospects
3	Reward mine area (Eclipse, Brown Monster)
4	Pinyon (Poorchild-Raven) group
5	Old Grindstone mine
6	Silver Spur mine (Union)
7	Cheri No. 20 mine
8	San Pablo prospect
9	Burgess mine area
10	Black Warrior mine area
11	Long John mine
12	Long Trail mine
13	Pennsylvania mine
14	Flagstaff mine
15	Bud's Hope mine
16	Lakeview mine

Figure 2. Continued.

APPRAISAL OF IDENTIFIED RESOURCES

By Charles Sabine, Eric E. Cather, Lucia Kuizon, *and* Michael C. Horn, *U.S. Bureau of Mines*

History and Production

Although there had been earlier mining by Spanish and Mexican explorers, the first recorded mining activity in the Inyo Mountains began in 1860 when miners organized the Russ mining district, which covered most of the west slope of the range and nearly all of the study area. Since then, about $19 million in precious- and base-metal ore has been produced from mines in and near the study area, mostly between 1860 and 1890.

The south half of the Russ mining district became the Lone Pine mining district in 1883. The Union (Silver Spur), Eclipse (Brown Monster, Reward), and Ida (Frostbitten or International Recovery) mines were soon located and mills were built along the Owens River (Goodyear, 1888). About $200,000 in gold was removed from the Eclipse mine by the end of 1883 (Burchard, 1884). This mine, known first as the Brown Monster and later as the Reward mine, produced about $600,000 in gold, silver, lead, and copper ore between 1889 and 1951. Over $90,000 in silver was recovered from the Union mine prior to 1902 (Goodwin, 1957).

After the discovery of high-grade silver deposits at Cerro Gordo around 1865, the Cerro Gordo mining district (fig. 1) was organized in 1866 (Vredenburgh and others, 1981). About $17 million in silver, lead, zinc, and gold was taken from the Cerro Gordo mine between 1865 and 1945 (Vredenburgh and others, 1981), making it one of the largest silver producers in the history of California. Much of the ore from Cerro Gordo mine was smelted at Swansea.

The Swansea mining district was organized at about the same time as the Cerro Gordo mining district. About $120,000 in gold, silver, lead, zinc, and copper was produced from the Swansea mining district between 1879 and 1969 (USBM production files; Dimond, 1890, 1891, 1892).

Thousands of miners and prospectors were attracted to the Inyo Mountains by news of these discoveries and swarmed over the range in search of new deposits. Thousands of claims were located and relocated. Most of the mines and prospects in the study area were probably discovered and mined before 1880. Gold-bearing quartz veins were discovered on the east side of the Inyo Mountains in the late 1870's and the Beveridge mining district was organized soon thereafter. About $300,000 in gold was produced from the Beveridge mining district by 1883, principally from the Keynote and Bighorn mines (not part of this study) (Burchard, 1884).

Mining in the area peaked in the 1880's and then went into a gradual decline. There was only sporadic

mining during the twentieth century, mostly during the two world wars and the great depression, and virtually none since the early 1950's.

In addition to mining for metallic minerals, there has been considerable mining of nonmetallic commodities in the region. Dolomitic marble has been quarried since about 1885 from exposures of the Hidden Valley Dolomite along the base of the range adjacent to the southwest margin of the study area. Marble was originally quarried in blocks for architectural purposes, but it is now marketed in crushed form for roofing granules and soil supplements. Soda ash and other sodium compounds have been extracted from Owens Lake since 1885 (Norman and Stewart, 1951). A 14-mi-long tramway carried salt over the Inyo Mountains from Saline Valley to a mill and railhead at Keeler between 1913 and 1930 (Smith and others, 1978). The tramway crosses the south end of the study area, and some of the towers, cables, and ore buckets remain. Talc was produced from the Lakeview and Long Trail talc mines (fig. 2; pl. 1) during the 1940's and 1950's. Several thousand tons of quartzite were also removed from outcrops of the Eureka Quartzite in the Lakeview mine area between 1956 and 1966 (Ver Planck, 1966). An occurrence of beryl east of Kern Knob (but outside the study area) was prospected in the late 1950's and early 1960's (Benson, 1962). Pegmatite in the Kern Knob area was prospected for uranium during the 1950's.

In 1985, there were about 70 lode claims in the study area, most of them near the Reward and Silver Spur mines. Forty-six lode claims, 1 placer claim, 1 millsite, and 4 patented claims at the Long John mine (fig. 2) are adjacent to the study area. Another 47 lode claims, 14 limestone placers, 5 millsites, 1 tunnel site, the Brown Monster and Hirsch patents at the Reward mine, and several patented claims owned by the Inyo Marble Company lie near the study area.

Aside from annual assessment work that is being done on most claims, the only recent activity was the development of a crosscut adit in 1981-1984 which was intended to intersect a possible extension of the Brown Monster vein at the Reward mine. The extension was not found. The effort was abandoned and the equipment auctioned in 1984. Apart from intermittent operations at the Inyo Marble quarries and some research and development activity at Owens Lake by Cominco American, Inc., there is currently no significant mining activity in the area.

Mineral Resources

For this study, the USBM examined 66 mines and prospects, 41 within the study area and 25 outside. Most of the sites are silver-lead-zinc occurrences; gold occurs rarely. Talc is found at five sites and barite at one. Data for all of these mines and prospects are summarized in the appendix. Detailed descriptions of the more significant mineral deposits are in Sabine and others (1986).

Most of the mines and prospects can be grouped into five trends or systems. One such group is a belt of gold-silver-lead-zinc deposits that extends from the Reward mine about 3 mi southeast through the Pinyon (Poorchild, Raven) mine to the Old Grindstone mine. The belt follows the trend of an anticline that involves Pennsylvanian and Permian marbles and hornfelses.

A mineralized fault and shear zone extends for 2 mi east from the base of the range along the north side of Union Wash. The western half of the belt is highly mineralized in silver, lead, and zinc, and includes the Silver Spur and Cheri No. 20 mines, both past producers. The eastern half, which is inside the study area, is weakly mineralized and has only a few prospects in it.

A belt of gossan zones and quartz veins extends 2.5 mi between the Long John mine and the Copper Summit prospect. The zone is in dolomite adjacent to a fault contact with shale to the northeast. The Long John mine, a past producer of silver and lead, at the northwest end of the belt, is in a pipelike body of secondary silver-lead minerals, iron oxides, and clay that apparently filled a solution cavity in the gossan zone. Similar gossans, evidence of open joints enlarged by solution, and small areas of internal drainage are present along the zone south of the Long John mine.

A system of quartz veins, faults, shears, and limonitic zones is weakly mineralized in gold and silver at New York Butte on the east side of the study area. The Burgess mine, located outside the study area, produced gold and silver from veins along a northwest-trending structure that appears to extend at least 1.5 mi into the study area.

Northeast of the Reward mine, a system of quartz veins crops out in quartz monzonite, granodiorite, and diorite. Most of the veins are discontinuous stringers along fractures, faults, and shear zones, but some crop out for considerable distances and attain thicknesses of several feet. The veins are thickest and most abundant near intrusive contacts with metasedimentary rocks. Most veins are barren or weakly mineralized, but at the International Recovery prospect, Spanish Belt prospect, and an unnamed prospect, they contain argentiferous galena in significant quantities and some copper, zinc, and gold. The Spanish Belt prospect and the unnamed prospect, 2,000 ft to the northwest, lie on the same trend and are mineralized similarly.

With the possible exception of the veins at the Reward and Silver Spur mines (outside the study area), none of the gold-silver-lead-zinc occurrences are large enough or rich enough to be considered resources. Detailed mapping and drilling at these two mines would disclose if resources remain. Mineral deposits have been found at numerous sites in the area, and there were at least five past producers. In recent years, depressed silver and base-metal prices have caused closures of mines throughout the western United

States. Dramatic increases in prices of precious and base metals would stimulate exploration in the study area. Prospecting would be warranted in the five areas described above, and in the areas of the San Pablo prospect and the Pennsylvania mine.

Occurrences of talc in the study area are too small to develop. Talc deposits on the east side of the Inyo Mountains and the Talc City Hills are large enough to satisfy local markets in the foreseeable future. It is unlikely that demand for talc will increase to the point that exploration for new deposits would be warranted. Dolomite and limestone, being quarried outside the study area in Dolomite Canyon, need not be considered resources in the study area because sufficient quantities to meet the current demand are available outside the study area. Deposits of dolomite marble do not extend into the study area.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

By James E. Conrad, James E. Kilburn, *and* Richard J. Blakely
U.S. Geological Survey

Geology

The Southern Inyo Wilderness Study Area is underlain by a sequence of marine sedimentary rocks of Cambrian to Triassic age which are capped by a sequence of continental volcanic and sedimentary rocks of Triassic age. These are highly folded and faulted and are intruded by several Jurassic and Cretaceous plutons, some of which are probably comagmatic with the Sierra Nevada batholith (Bateman and others, 1963; McKee and Nash, 1967; Ross, 1969).

A composite section of about 18,000 ft of strata is present in the southern Inyo Mountains. Only parts of this section, however, are exposed at any single place in the study area because widespread faulting, folding, and metamorphism have greatly distorted these strata, especially adjacent to the large granitic plutons. The Cambrian to Devonian strata are comprised mostly of medium- to thick-bedded limestone and dolomite that formed in a shallow-water continental-shelf environment (Stevens, 1986). Interbedded with these carbonate rocks are siliceous rocks that include clean medium- and fine-grained quartz sandstones and locally abundant chert blebs and stringers. Mississippian to Triassic marine sedimentary rocks are comprised of roughly equal amounts of carbonate and argillaceous strata. Most of this strata, which includes Upper Mississippian shales and Pennsylvanian and Permian turbidite deposits, were deposited in fairly deep water in basins on the continental shelf. The carbonate rocks are mostly thin- to medium-bedded limestones that are interbedded with shale and argillite. Lower Triassic rocks are mostly thin-bedded limy shales, with some thick-bedded limestone near the top of the sequence.

Unconformably overlying the marine strata is a sequence of mostly continental volcanic and sedimentary rocks of Triassic age. This sequence, as much as 6,000 ft thick, contains andesitic flows and flow breccias, tuffs, and fresh-water lacustrine deposits and represents a subduction-related volcanic-arc environment (Oborne and Dunne, 1982).

Jurassic and Cretaceous plutons underlie most of the northern part of the study area and smaller similar stocks intrude the Paleozoic and Triassic rocks in the southern part of the study area. Contacts with the surrounding country rock generally are steep and sharp, and contact metamorphism has affected most of the strata in the study area. The widespread signs of alteration include hornfelsic texture, low-grade metamorphic mineral assemblages, and anomalous amounts of limonite staining. These criteria suggest that plutonic rocks may underlie these strata at shallow depths throughout the entire southern Inyo Mountains. Most of the plutonic rocks are quartz monzonite and granodiorite in composition, but granite, alaskite, monzonite, diorite, and gabbro also are present. These rocks are mostly medium to coarse grained, equigranular, and nonfoliated. Along the western part of the study area, predominantly mafic, mostly northwest-trending, steeply dipping dikes have intruded the Paleozoic and Mesozoic strata and older Mesozoic plutons, and are considered part of the Independence dike swarm (Moore and Hopson, 1961; Smith, 1962; Chen and Moore, 1979).

Quaternary deposits in the study area include older, well-bedded, partly consolidated sand and gravel deposits and younger alluvial and colluvial deposits. The older deposits form small, discontinuous outcrops in canyon bottoms or perched remnants along the rangefront. The younger deposits are found as alluvial fans along the edge of Owens Valley, unconsolidated sand and gravel in stream bottoms, and unconsolidated rock debris on gentle slopes and talus on steeper slopes. Included with this unit is a large, dissected landslide near the mouth of Long John Canyon.

The Paleozoic and Triassic strata in the study area are strongly folded and faulted. Three major episodes of deformation are recognized in this region: (1) northwest-trending faulting and folding prior to emplacement of plutonic rocks; (2) deformation associated with emplacement of plutonic rocks (including thrust faults in the southwestern part of the study area); and (3) faulting and folding after emplacement of plutonic rocks. Intrusion of the granitic plutons created widespread, pervasive hornfelsic texture, foliation, lineation, and recrystallization. Postintrusive deformation is related to late Cenozoic regional extension that has tilted the Inyo Mountains block to the west and resulted in the downdrop of Owens Valley.

Geochemical Studies

The reconnaissance geochemical survey was conducted in 1985 to help delineate areas of possible mineralization. Nonmagnetic heavy-mineral concentrates were selected as being most useful in detection of ore and ore-related elements from drainage basins. Samples were collected from drainages near the range front that encompassed areas from less than 1 mi^2 to several square miles in size. Analytical data and a description of the sampling and analytical techniques are given in Detra and Kilburn (1987).

All samples were analyzed for 30 elements by a six-step semiquantitative emission spectrographic method (Grimes and Marranzino, 1968). These analyses identify drainages with anomalous concentrations of metallic or metal-related elements. Anomalous concentrations were determined by inspection of histograms, percentiles, and enrichment relative to crustal abundance. Commonly these anomalies reflect known mining activity, but in some cases they indicate areas of undisclosed or previously unrecognized mineralization.

Elements present in anomalous amounts and minerals identified from heavy-mineral concentrates indicate four areas of possibly significant hydrothermal and metasomatic mineralization in the study area: (1) the Long John Canyon area; (2) the northern part of the study area from Union Wash to the Reward mine; (3) the southwestern part of the study area from Kern Knob to Dolomite Canyon; and (4) the southeastern part of the study area south of New York Butte.

Anomalous elements from the Long John Canyon area include arsenic, barium, gold, molybdenum, lead, silver, tin, and tungsten, and minerals identified by optical examination of the the heavy-mineral concentrates include galena, barite, pyrite, arsenopyrite, scheelite, gold, and fluorite. The intensity of these anomalies is probably enhanced by the numerous prospects and dumps associated with mining activity near the base of Long John Canyon. Man-made contaminants, such as lead shot and wire identified in the samples, also contribute to inflated values for ore-related elements. Farther up Long John Canyon, however, lead, molybdenum, and tungsten anomalies with associated minerals gold, barite, wulfenite, scheelite, and pyrite in the concentrates suggest some hydrothermal and metasomatic activity below the summit of New York Butte but above the major mining horizon in Long John Canyon.

Widespread barium, lead, molybdenum, and silver anomalies as well as locally high concentrations of antimony, arsenic, bismuth, boron, copper, tungsten, and zinc characterize the northern part of the study area from Union Wash to the Reward mine. Optical examination of the heavy-mineral concentrates identified widespread barite, pyrite, and scheelite and local occurrences of galena, wulfenite, cerussite, anglesite, chalcopyrite, and fluorite. Tourmaline is coincident with the boron anomaly. The most prominent anomalies are mainly present along the range front where contamination from previous mining activities is expected; but generally the anomalies here suggest the presence of both tungsten-bearing skarns and epithermal vein and replacement bodies.

Anomalies detected south of Long John Canyon are fewer and less intense than those present elsewhere in the study area. Samples collected along the range front near Kern Knob and Dolomite Canyon, however, contain anomalous concentrations of lead, molybdenum, silver, tin, tungsten, and zinc; and minerals identified in the samples include barite, scheelite, pyrite, and fluorite. At high elevations, widespread barium and lead anomalies, and scattered occurrences of molybdenum, silver, strontium, tin, and tungsten are present. Barite is abundant in nearly all the heavy-mineral concentrates, whereas scheelite, pyrite, and wulfenite are present as minor components in only a few of the samples. These anomalies suggest widespread hydrothermal activity in this part of the study area as veins and replacement deposits and in skarns.

Geophysical Studies

Most known hydrothermal deposits of lead, zinc, and precious metals within the Southern Inyo Wilderness Study Area are located in Paleozoic and Mesozoic rocks adjacent granitic intrusions. Therefore, magnetic data are important in assessment of the mineral resource potential of this area because most of the granitic rocks of the Inyo Mountains have substantially higher magnetic susceptibility than the older sedimentary rocks. Consequently, significant magnetic anomalies within the study area coincide with outcrops of plutonic rocks and, more importantly, provide information concerning the location of contacts between plutonic and sedimentary rocks in the subsurface and may indicate possible mineralized areas at shallow depth.

Two aeromagnetic surveys were flown over the Southern Inyo Wilderness Study Area and surrounding region (U.S. Geological Survey, 1982, 1983). Each was flown at a constant altitude appropriate for the terrain. The northern survey extended south to about latitude 36°42' N and was flown at 14,500 ft above sea level; the southern survey extended south from this latitude and was flown at 11,000 ft above sea level. Flightlines were flown along parallel east-west lines spaced approximately 1 mi apart. To compare these data with geologic and topographic maps, standard techniques were used to subtract the regional magnetic field from each survey, interpolate the residual data to a rectangular grid, and contour the gridded data at appropriate intervals In addition, significant magnetic boundaries were automatically located from the data using a technique described by Blakely and Simpson (1986). Significant magnetic boundaries are shown in figure 2 along with the location of exposed granitic rocks of the study area.

Gravity data also provide subsurface geologic information and regional gravity studies help determine the tectonic setting of the area (Blakely and McKee, 1985). Gravity measurements within the study area, however, were too sparse to have direct bearing on mineral potential studies.

The magnetic data from the study area show that, in general, the plutonic rocks of Jurassic age are appreciably magnetic, whereas younger granitic rocks of Cretaceous age are relatively nonmagnetic. For example, the two magnetic anomalies of highest amplitude within the study area are located over major topographic features underlain by plutonic rocks of Jurassic age: Mount Inyo (elevation 11,107 ft) and New York Butte (elevation 10,668 ft). These high-amplitude anomalies result from the relatively high magnetic susceptibility of the plutonic rocks and the close proximity of the magnetic sensor to the topographic edifices.

The magnetic data indicate an abrupt southern limit to subsurface magnetic rocks about 2 mi south of the summit of New York Butte and approximately coincident with the southern extent of exposed Jurassic plutonic rocks. This southern limit of magnetic sources is shown in figure 2. The Burgess mine, outside the study area, is located on this magnetic boundary and mineral potential may exist elsewhere along this edge. Granitic rocks of Cretaceous age south of New York Butte and aplitic intrusions in the extreme southern part of the study area have no apparent magnetic effects. Granitic rocks of Cretaceous age exposed west-northwest of New York Butte are relatively nonmagnetic. The magnetic boundary northwest of New York Butte continues through exposed granitic rocks and may indicate the boundary between Jurassic and Cretaceous plutons.

A significant magnetic boundary trends east-southeast approximately coincident with a mapped fault that intersects Keynot Peak (fig. 2). Part of this magnetic gradient coincides with the zone of silver, lead, and zinc mineralization that extends east-southeast from the Reward mine. Hence, mineral resource potential may exist elsewhere along this magnetic boundary.

Mineral Resource Potential

Geologic studies, geochemical sampling, examinations of mines and prospects, and review of mine production and ore types indicate that the Inyo Mountains lie within a province characterized by hydrothermal deposits containing lead, zinc, and silver and local gold-quartz veins. Throughout this province ores contain significantly higher ratios of silver to gold than most places in the western United States, and copper, although present, is not abundant.

Studies within the study area indicate that base- and precious-metal deposits containing lead, zinc, silver, and occasionally gold are the dominant ore type. These deposits are found in veins, stockworks, and bedded replacement bodies in the granitic and carbonate rocks and are generally associated with shear zones and sometimes dikes. On the basis of trace elements and the mineral suites identified in the geochemical samples, the conceptual model for mineralization appears to be related to low- to moderate-temperature hydrothermal events. The mineralizing fluids that formed the veins and replacement bodies were probably derived from the granitic plutons and dikes as they intruded the country rocks.

A second type of mineral deposit that might be expected in the area on the basis of geologic environment is skarn, specifically skarn deposits with the Bishop-type trace-element signature (Rose and others, 1979). These skarns are characterized by the presence of tungsten, molybdenum, bismuth, and the heavy minerals scheelite and pyrite. All are present in anomalous amounts in places in the study area and indicate the presence of Bishop-type skarns. Skarn bodies are present east of Kern Knob and in the vicinity of New York Butte, but are typically small and poorly developed.

Geochemical and mineralogical evidence and assessment of mines and prospects indicate base- and precious-metal mineralization occurred at several areas in the study area. These areas are marked by numerous mines and prospects, and heavy-mineral concentrate samples from stream sediments yielded anomalous concentrations of barium, bismuth, gold, lead, molybdenum, silver, tungsten, and zinc. Although no mineral resources were identified during this study, several areas have some resource potential (fig. 2; pl. 1). Assessments of mineral resource potential were made according to the classifications of Goudarzi (1984).

The richest deposits in this area, which include the Reward, Silver Spur, Black Warrior, Long John, Pennsylvania, and Flagstaff mines, lie outside the study area but are within areas of resource potential that extend into the study area. Some of these areas are in part defined by extensions or inferred extensions of mineralized shear zones.

An area centered about 1.5 mi northeast of the Reward mine (fig. 2; pl. 1) has low potential, certainty level C, for gold, silver, lead, and zinc resources in fissure quartz veins in granitic rocks (see appendix for explanation of resource potential and certainty levels). A zone extending from the Reward mine to the Old Grindstone mine has low resource potential, certainty level C, for gold, silver, lead, and zinc and moderate resource potential, certainty level C (mostly outside the study area), for these metals in the vicinity of the Reward mine. This area parallels the axis of a large anticline, but it is unknown whether the mineralization observed reflects an increased favorability for mineralization in the anticlinal axis or is due to the proximity of granitic rocks which truncate the east limb of the anticline.

There is low potential, certainty level C, for gold, silver, lead, and zinc resources along an east-trending shear zone north of Union Wash and moderate resource potential, certainty level C, for silver and lead in the western part of this zone (outside the study area).

The southwest flank of New York Butte has low resource potential, certainty level C, for gold, silver, lead, and zinc in quartz veins that may be extensions of those at the Burgess mine. There is low potential, certainty level C, for silver, lead, and zinc resources along the southwest boundary of the study area from Long John Canyon to Brooklyn Canyon and at the south end of the study area south of Dolomite Canyon. Mineralization in these areas is primarily along pervasive shears associated with the thrust faults in this part of the study area.

Small talc bodies have been mined in and adjacent to the study area near Kern Knob. The talc is found in small discontinuous pods within the Silurian and Devonian Hidden Valley Dolomite. There is low resource potential, certainty level C, for talc in exposures of Hidden Valley Dolomite east of Kern Knob.

There is no potential for geothermal resources in the study area. The Great Basin of southeastern California is considered by Scott (1983) to have low to zero resource potential for petroleum due to metamorphism and intense structural deformation in the region. The Southern Inyo Wilderness Study Area is considered to have no potential for petroleum resources.

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APPENDIXES

DEFINITION OF LEVELS OF MINERAL RESOURCE POTENTIAL AND CERTAINTY OF ASSESSMENT

Definitions of Mineral Resource Potential

LOW mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics define a geologic environment in which the existence of resources is unlikely. This broad category embraces areas with dispersed but insignificantly mineralized rock as well as areas with few or no indications of having been mineralized.

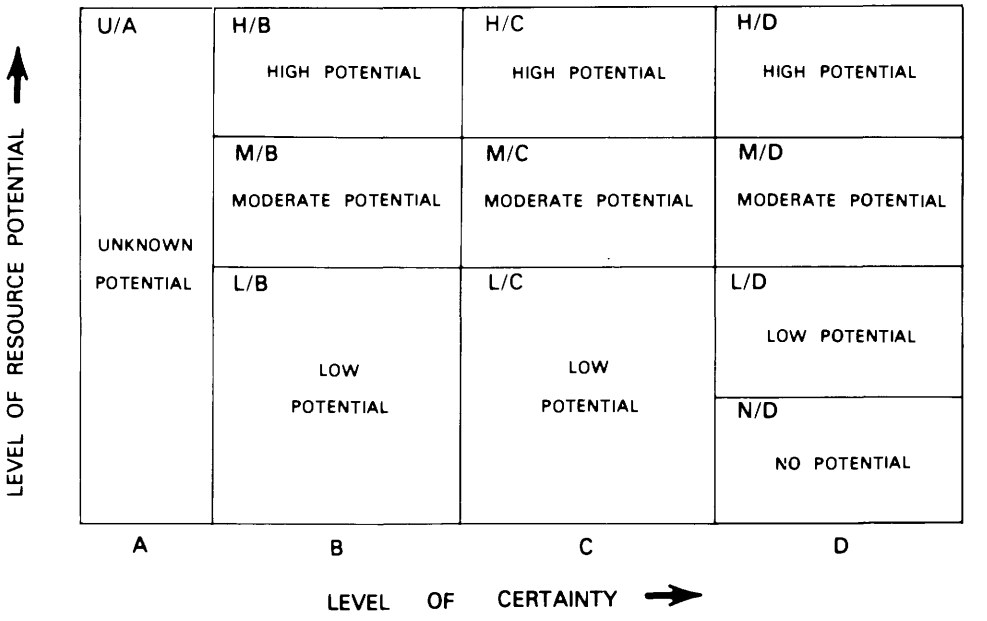
MODERATE mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resource occurrence, where interpretations of data indicate a reasonable likelihood of resource accumulation, and (or) where an application of mineral-deposit models indicates favorable ground for the specified type(s) of deposits.

HIGH mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resource occurrence, where interpretations of data indicate a high degree of likelihood for resource accumulation, where data support mineral-deposit models indicating presence of resources, and where evidence indicates that mineral concentration has taken place. Assignment of high resource potential to an area requires some positive knowledge that mineral-forming processes have been active in at least part of the area.

UNKNOWN mineral resource potential is assigned to areas where information is inadequate to assign low, moderate, or high levels of resource potential.

NO mineral resource potential is a category reserved for a specific type of resource in a well-defined area.

Levels of Certainty



A. Available information is not adequate for determination of the level of mineral resource potential.

B. Available information suggests the level of mineral resource potential.

C. Available information gives a good indication of the level of mineral resource potential.

D. Available information clearly defines the level of mineral resource potential.

Abstracted with minor modifications from:

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GEOLOGIC TIME CHART

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

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

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

[2]Informal time term without specific rank.

Summary of mines and prospects in and adjacent to the Southern Inyo Wilderness Study Area

Map No. (pl. 1)	Name	Summary	Workings and production	Sample and resource data
1	Unnamed prospect	A quartz vein with chalcopyrite and secondary copper minerals is located in iron-stained and altered quartz monzonite. Limonite and goethite bands, blebs, and boxworks also found in the quartz. Vein strikes N. 50° W., dips 38° NE., and ranges from 0.2 to 0.5 ft thick. Could not be traced beyond the limits of the pit.	One pit; no production	One sample of vein contains 0.3 oz/ton silver, 1.1 percent copper, 0.0029 percent lead, and 0.0068 percent zinc.
2	Valley View prospect	Poor exposure of a quartz-limonite vein in hornblende-biotite monzonite associated with a pegmatite dike. Vein also contains siliceous limonite and chalcedonic quartz. It strikes west, dips steeply north, and is 0.2 ft thick. Vein float was traced for about 300 ft along the trenches.	Four shallow trenches; no production.	One select and one chip sample were taken of vein material. Chip sample contains 0.2 oz/ton silver. No other anomalous metal values were found.
3	Unnamed prospect	Siliceous limonite zones located in altered monzonite. They strike N. 30° W., dip 65° SW., and are 1.2 ft thick. Zones can be traced by float for about 200 ft.	One pit; no production	One chip sample from zone contains 0.01 percent copper, 0.013 percent lead, and 0.12 percent zinc.
4	Rolling Thunder No. 3 prospect	Two quartz veins and a silicified zone exposed in quartz monzonite near the Pat Keyes Trail. Silicified zone strikes N. 67° E., dips 75° NW., and is present in a 5-ft-thick shear zone. One quartz vein strikes N. 30° W., dips 38° SW., and is as much as 1.0 ft thick; the other vein strikes N. 40° E., dips 10° NW., and is as much as 1.6 ft thick. Silicified zone contains quartz veinlets, limonite, and gouge. Quartz veins contain some vugs with limonite and boxwork, iron-stained carbonate, and ferruginous quartz.	None	Three chip samples from veins and silicified zone contain from 0.00075 to 0.0050 percent zinc; two contained 0.0025 to 0.0057 percent copper. No significant metal values were found.
5	Peacock Nos. 1 and 2 prospect	A north-trending zone of yellow-green argillic alteration, with jasperoid veins as thick as 1.8 ft, extends 85 ft in recrystallized, marly limestone and dolomite. No ore minerals were observed in place, but secondary copper minerals were found in a stockpile.	Two adits, 16 and 42 ft long; no apparent production.	Two chip samples of jasperoid veins contain minor gold, silver, copper, and lead, and 0.13 and 2.0 percent zinc. Two grab samples from stockpiles contain 2.4 and 0.28 oz/ton silver, 2.8 and 0.47 percent copper, and 2.6 percent zinc.
6	Unnamed prospect	A northwest-trending quartz vein contain pockets of limonite, galena, and chalcopyrite. Vein averages 1.1 ft thick and was traced underground for 140 ft. Vein is in dolomite marble adjacent to a contact with intrusive diorite.	One adit, 140 ft long; no apparent production.	Three chip samples of vein average 0.47 oz/ton silver, 4.03 percent zinc, and 0.44 percent lead.

Summary of mines and prospects in and adjacent to the Southern Inyo Wilderness Study Area–Continued

Map No. (pl. 1)	Name	Summary	Workings and production	Sample and resource data
7	Unnamed prospect	A 2-ft-thick quartz lens in diorite is exposed on a dip slope that is 90 by 15 ft. Pockets of spongy limonite and small amounts of galena are present in the quartz.	One 40-ft adit; no production evident.	Five chip samples and one select sample of quartz have no significant metal content.
8	Unnamed prospect	A shear zone in diorite partially replaced by vein quartz containing argentiferous galena, limonite, jasperoid, chalcopyrite, malachite, and chrysocolla. Shear can be traced for 110 ft along the surface and 20 ft in depth. Ranges from 0.2 to 1.5 ft thick.	Two 10-ft adits and one pit; no production evident.	Three samples: one chip sample from zone contains 0.067 oz/ton silver, 0.025 percent copper, 0.12 percent lead, and 0.14 percent zinc. One select sample of quartz contains 0.015 oz/ton gold, 12.8 oz/ton silver, 0.83 percent copper, 1.8 percent lead, and 0.049 percent zinc. Another select sample of quartz contains 0.064 oz/ton silver, 0.0026 percent copper, and 0.012 percent lead.
9	Frostbitten prospect	A milky quartz vein in diorite strikes N. 50° to 80° W. and dips 10° to 40° NE. It averages 1.2 ft thick and is exposed for 250 ft along strike and 110 ft down dip. Vein contains abundant limonite blebs and stringers, some galena, and minor chalcopyrite, malachite, and chrysocolla. A 3-ft-thick shear zone with quartz stringers is exposed 200 ft north of the inclined shaft.	One 110-ft inclined shaft and one 34-ft open cut; no production is evident.	Six chip samples and one select sample of quartz and shear material were collected. Two chip samples contain 0.007 and 0.0016 oz/ton gold. One chip contain 0.069 oz/ton silver, and three contain 0.0052 to 0.01 percent lead. Four contain only minor amounts of zinc.
10	International Recovery prospect	Four quartz veins in a shear zone in quartz monzonite are exposed for 970 ft along the surface. They are partially folded and faulted. Veins strike from N. 60° W. to N. 50° E., dip generally less than 45° to the northeast or southwest, and range from 0.5 to 7.0 ft thick. Quartz contains stringers, blebs, and boxworks of limonite, chalcopyrite, pyrite, galena, calcite, and pseudomorphs of pyrite.	One 38-ft inclined shaft, two caved adits, one 25-ft open cut, 12 trenches, and 2 pits; no known production; 60 tons of vein material stockpiled.	Thirty-six samples of quartz were collected. One select sample from the stockpile contains 0.01 oz/ton gold; one select sample from the open cut contains 0.07 oz/ton gold, 0.1 oz/ton silver, 0.13 percent copper, and 0.014 percent lead. All but four of the 34 chip samples have negligible metal content. The four samples, representing two vein segments, average 0.17 oz/ton gold, 2.4 oz/ton silver, and 1.3 percent copper.
11	Unnamed prospect	Shear zones containing quartz and siliceous limonite vein material are present in an area of faulting and hydrothermal alteration in quartz monzonite. Quartz veins contain chalcopyrite, chrysocolla, malachite, limonite, and goethite. A pod of limonitic jasper and gossan in a gouge zone is exposed in the open cut. Shear zones strike N. 40° to 86° E. dip 85° NW. to 85° SE., are as wide as 8 ft, and are from 20 ft to more than 1,000 ft long.	One 11-ft open cut, two pits; no production.	One select and two chip samples of quartz and shear zone material were collected. Select sample contains 0.66 oz/ton gold, 0.4 oz/ton silver, 0.9 percent copper, 0.042 percent lead, and 0.012 percent zinc. A 0.2 ft chip sample contains 0.19 oz/ton gold, 0.1 oz/ton silver, 0.25 percent copper, 0.012 percent lead, and 0.005 percent zinc. A 2 ft chip sample contains no detectable gold or silver, 0.09 percent copper, 0.0082 percent lead, and 0.0052 percent zinc.

Summary of mines and prospects in and adjacent to the Southern Inyo Wilderness Study Area–Continued

Map No. (pl. 1)	Name	Summary	Workings and production	Sample and resource data
12	Unnamed prospect	Quartz and limonitic-jasper vein present in a shear zone in monzonite. Vugs in vein contain iron-stained quartz crystals. Limonitic jasper contains limonite boxworks and goethite. Vein strikes N. 60° W., dips 15° NE., ranges from 0.4 to 1.2 ft thick, and is about 35 ft long. It is an extension of the International Recovery vein system.	One pit; no production	Two chip samples of vein have no significant metal content.
13	Unnamed prospect	Shears and siliceous limonite zones in quartz monzonite are partially replaced by quartz veins with associated chryocolla, malachite, limonite, hematite, goethite, and specular hematite. Main shear zone strikes N. 40° W. to N. 40° E., dips 55° SW. to 80° NW., and ranges from 0.4 to 1.4 ft thick. Exposed for 90 ft along strike and 24 ft downdip. A shear zone with a siliceous limonite vein is exposed 120 ft northeast of the main workings. It strikes north to N. 20° W., dips 65° to 75° W., averages 1.2 ft thick, and extends 100 ft along the surface.	One caved adit, one 24-ft inclined shaft, two open cuts, and one pit; no production.	Twelve samples from main shear zone were collected. Nine contain a trace to 0.29 oz/ton gold. One chip sample of a cross shear contains 2.0 oz/ton silver, 13.6 percent lead, 5.6 percent zinc, 0.66 percent copper, and trace gold.
14	Unnamed prospect	Three parallel shear zones in quartz monzonite contain quartz veins, argentiferous galena, hemimorphite, limonite, hematite, calcite, secondary copper minerals, and silicified county rock. They strike from N. 50° to 70° W, dip 50° to 85° NE., range from 0.6 to 3.5 ft thick, and are exposed for 45 ft, 90 ft, and 155 ft. Structures are aligned with similar shears 2,000 ft to the southeast at the Spanish Belt prospect (loc. 15).	Four adits, from 8 to 20 ft long, one 35-ft inclined shaft with a 25-ft drift, and two pits; no production.	Seventeen chip samples from shear zones average 0.01 oz/ton gold, 2.3 oz/ton silver, 0.11 percent copper, 6.9 percent lead, and 2.7 percent zinc.

Summary of mines and prospects in and adjacent to the Southern Inyo Wilderness Study Area-Continued

Map No. (pl. 1)	Name	Summary	Workings and production	Sample and resource data
15	Spanish Belt prospect	Two partially mineralized shear zones in diorite contain quartz, argentiferous galena lenses, limonite, gouge, minor secondary copper, and silicified country rock. Shear zones strike N. 37° to 88° W., are steeply dipping generally to the southwest, range from 0.6 to 1.8 ft thick, and are exposed for 110 and 120 ft. Shear zones may extend between the workings along a northwest structural trend for 850 ft. About 550 ft to the southeast, quartz float is south of an east-trending felsic dike. The quartz contains galena, chalcopyrite, chrysocolla, malachite, limonite, hematite, and siderite. Float was traced for 50 ft and suggests a north-trending vein 0.2 to 0.3 ft thick. Veins are aligned with structures 2,000 ft to the northwest at loc. 14, and mineralization is similar.	Two adits, 43 ft and 55 ft long, two open cuts 10 ft and 17 ft long; no production.	Two select and nine chip samples from shear zones were collected. Nine chip samples average 0.02 oz/ton gold, 0.46 oz/ton silver, 0.03 percent copper, 0.67 percent lead, and 0.62 percent zinc. One select sample from the stockpile contains 41.1 oz/ton silver, 25.1 percent lead, 0.01 oz/ton gold, 0.25 percent copper, and 0.34 percent zinc. A select sample from a quartz vein contains 5.2 oz/ton silver, 0.01 oz/ton gold, 5.8 percent lead, 2.6 percent copper, and 0.09 percent zinc.
16	Reward mine area	Several veins found near and parallel to the axis of a northwest-trending anticline in the Keeler Canyon Formation. The Brown Monster and Reward (Hirsch) veins contain gold, silver, lead, and zinc minerals in zones as much as 16 ft thick at the anticline axis but are generally barren on the east limb where they extend into the study area. Other veins along and to the east of the anticline axis are locally mineralized.	A 550-ft inclined shaft, extensive stopes, and a 1,700-ft crosscut in the Brown Monster vein. Seven levels totaling about 5,300 ft of drifts and crosscuts in the Reward vein. Elsewhere on the property are 12 adits (all less than 120 ft), 5 shafts, and about two dozen pits. Production from the Brown Monster, Hirsch, Eclipse, F. D. Roosevelt, and Golden West mines totals about 19,370 oz gold, 102,600 oz silver, 30,980 lb copper, and 203,300 lb lead.	Sixty samples: one chip sample contains 1.49 oz/ton gold; five chip and five select samples contain 0.114 to 0.81 oz/ton gold, nine chip and two select samples contained 0.01 to 0.089 oz/ton gold; and 36 chip, one select, and one random sample contain less than 0.01 oz/ton gold. Three select samples contain from 10.2 to 42.0 oz/ton silver; 10 chip and one select samples contain from 1.9 to 9.83 oz/ton silver, 41 chip, four select, and one random samples contain less than 0.631 oz/ton silver. Three select and two chip samples contain from 1.1 to 5.7 percent copper; two select and five chip samples contain from 0.12 to 0.48 percent copper. Two select and 1 chip sample contain 20.3 to 29.8 percent lead; 1 select and 10 chip samples contain 1.0 to 8.4 percent lead. Although several samples contain significant silver, gold, copper, lead, and zinc, none represent sufficient tonnage to calculate resources.
17	Annex-Arrow group	North- to west-trending, steeply dipping shear zones found in granitic intrusive and banded marble-hornfels metasedimentary rocks. Zones locally contain vein quartz and silver, copper, lead, and zinc minerals. Longest shear zone is exposed intermittently for about 240 ft and averages 1.8 ft thick.	One 25-ft shaft, a 78-ft adit, three trenches as much as 30 ft long, a 10- by 10-ft open cut, and a pit. No production.	Ten chip samples from shear zones: each contains from 0.1 to 1.0 oz/ton silver, two samples contain 0.34 and 0.45 percent copper, two contain 0.41 and 0.91 percent lead, and 0.18 and 0.96 percent zinc.

Summary of mines and prospects in and adjacent to the Southern Inyo Wilderness Study Area–Continued

Map No. (pl. 1)	Name	Summary	Workings and production	Sample and resource data
18	Julie L. prospect	Two veins containing quartz, calcite, and limonite found in diorite. One vein strikes N. 23° W., dips 64° SW., and is exposed for about 50 ft. The other could not be traced beyond workings.	Two pits	Two samples: a grab sample from a 25-lb stockpile contains 0.1 oz/ton silver, 0.56 percent lead, and 0.004 percent zinc. A select sample from a small dump contains 0.01 oz/ton gold, 0.1 oz/ton silver, 0.0011 percent copper, 0.044 lead, and 0.004 percent zinc.
19	Sweet Thing No. 2 prospect	Two northwest-trending shear zones about 100 ft apart cut thinly banded greenish-gray to light-gray hornfels and marble and a chlorite-bearing intrusive. Vein quartz found intermittently along the structures for 120 and 240 ft and are as much as 1 ft thick.	One 15-ft-deep shaft, eight pits, and trenches from 5 to 25 ft long.	Seven samples from shear zones: four chip samples contain from 0.1 to 0.7 oz/ton silver, less than 0.02 percent copper, 0.02 to 0.27 percent lead, and 0.009 to 0.19 percent zinc; three select samples from small stockpiles contain 16.5, 7.2, and 4.9 oz/ton silver; 18.1, 8.9, and 7.8 percent lead, as much as 0.2 percent copper, and as much as 3.0 percent zinc.
20	Inyo Bee prospect	A barite-calcite vein, 3.4 ft thick, strikes N. 5° W. and dips 85° NE, in calcareous siltstone.	One 13-ft shaft and some bull-dozer cuts.	One sample of vein contains 0.017 oz/ton silver, 0.15 percent zinc, and about 50 percent barite.
21	Lucky Slim mine	Several northwest-trending shear zones dip steeply in siltstone, marble, and quartzite. Quartz veins and silicified zones locally are as much as 1 ft thick but generally are less than 0.5 ft. No veins were exposed for more than 30 ft. Talc found along one shear zone and locally is as thick as 3 ft.	Five shafts as deep as 23 ft, six adits, one about 310 ft long, and the others less than 65 ft, four trenches, and several pits. Although no production is recorded, the presence of small stopes suggests minor production.	Twenty chip samples of shear zone: five contain from 1.4 to 8.1 oz/ton silver, others contain less than 0.79 oz/ton silver. All contain 1 percent or less copper. Eight contain from 1.1 to 7.9 percent lead; others contain less than 0.77 percent lead. Eight contain from 1.1 to 8.6 percent zinc; others contain less than 0.57 percent zinc. Three samples from altered zones contain talc as a major constituent.
22	Pinyon (Poorchild-Raven) group	A series of quartz veins containing galena, chalcopyrite, sphalerite, and pyrite occur near the axis of a northwest-trending anticline. The veins are in banded hornfels and marble of the Keeler Canyon Formation and in granitic dikes and sills that intrude the anticline. Most of the veins are short but one was traced about 400 ft and averages 0.5 ft thick.	Twelve adits, one shaft, and 10 pits; total underground workings of about 740 ft. Gold production of $4,500 is reported for the White Hill mine at this approximate location.	Forty-four samples of quartz were collected. Eight samples from 400-ft vein, representing about 4,000 tons of vein material, have weighted averages of 4.9 oz/ton silver, 2.9 percent lead, and 5.0 percent zinc. Four samples from a 150-ft-long vein have weighted averages of 4.9 oz/ton silver, 0.5 percent copper, 3.9 percent lead, and 1.4 percent zinc; the vein averages 0.9 ft thick where sampled.

Summary of mines and prospects in and adjacent to the Southern Inyo Wilderness Study Area–Continued

Map No. (pl. 1)	Name	Summary	Workings and production	Sample and resource data
23	Old Grindstone mine	Two segments, 200 and 140 ft long, of a vein that may extend 850 ft are exposed. Vein pinches and swells reaching a maximum thickness of 5 ft, averaging 1.4 ft. A second, parallel vein is 350 ft to the northwest. Galena, chalcopyrite, and secondary lead and copper minerals found in the veins. Host rock is quartzite of the Lone Pine Formation.	Three adits, 115, 55, and 8 ft long, one 20-ft shaft, three pits, and one glory hole; production is unknown.	Eleven chip and three select samples were collected. Samples from two exposed vein segments average 0.92 and 0.25 oz/ton silver, and 1.2 and 0.16 percent lead. Select samples contain as much as 17.1 oz/ton silver and 18.3 percent lead. If the two segments are continuous, then 18,000 tons could be present, but average grade is too low and vein too thin to mine economically.
24	Silver Spur mine	An east-trending quartz vein, 6 to 20 ft thick, in a zone in Triassic marine sediment is exposed for 4,000 ft along strike. The vein contains galena in pods and disseminations, chalcopyrite, pyrite, and iron oxides.	Vein was developed by 3,000 ft of underground workings in 8 adits. Foundation of a mill and a loading bin remain. Vein yielded 100,000 oz silver prior to 1902. Additional silver, gold, lead, and copper were produced until 1939.	Owner refused the U.S. Bureau of Mines permission to map and sample the mine. High-grade silver-bearing material probably remains in the vein, but its tonnage and grade are unknown.
25	Cheri No. 20 mine	A 1.4-ft-thick quartz vein in thinly bedded limestone of the Lone Pine Formation trends east for 135 ft. Vein contains galena, chrysocolla, and azurite. Vein is an extension of the Silver Spur vein and continues 4,000 ft eastward to Loc. 26.	Two inclined shafts, 50 ft and 75 ft deep, are 110 ft apart on the vein. Deeper shaft may have 100 ft of workings; production is unknown.	Three surface chip samples of vein average 1.75 oz/ton silver and 4.89 percent lead.
26	Unnamed prospect	A quartz vein, 2.6 to 3.2 ft thick, is exposed for 1,000 ft in argillized limestone and gouge along a ridge line. Vein is probably an extension of the Silver Spur–Cheri No.20 structure.	Two pits and two crosscut adits, 30 and 10 ft long. The adits did not reach the structure.	Two chip samples from vein are barren of metal content.
27	San Pablo prospect	A north-trending shear zone in metasedimentary rocks of the Keeler Canyon Formation is exposed for 200 ft and may extend an aditional 165 ft. Average width of exposed part of zone is 1.8 ft. Discontinuous bands and stringers of quartz and jasperoid in zone contain sulfide and secondary copper and lead minerals.	Three adits, 95, 30, and 15 ft long, one cut, and one trench; probably no production.	Six chip samples from shear zone average 5.84 oz/ton silver, 8.52 percent lead, and 1.03 percent zinc. Two select samples contain 1.94 and 3.06 oz/ton silver, 14.2 and 18.3 percent lead, and 0.55 and 0.23 percent zinc.
28	Howard No. 7 prospect	A weakly argillized northwest-trending fault in volcanic rocks was prospected.	One 16-ft-long cut; no production.	One chip sample from fault has no significant metal content. Owner reported platinum values, but no platinum was detected.

Summary of mines and prospects in and adjacent to the Southern Inyo Wilderness Study Area-Continued

Map No. (pl. 1)	Name	Summary	Workings and production	Sample and resource data
29	Cynthia Nos. 1-22 prospect	A series of northwest-trending shear zones as long as 800 ft in volcanic rocks were prospected. Shears are argillically altered and locally contain disseminated pyrite and secondary copper minerals.	Two adits, 39 and 51 ft long, one 10-ft shaft, 3 pits, and the ruins of a cabin in an area about 2,500 ft^2; no apparent production.	Eleven chip samples from shear zones were collected. Ten have low precious- and base-metal content. One from a zone of malachite- and chrysocolla-lined fractures contains 0.8 oz/ton silver, and 3.9 percent copper. Platinum was reported to be present by the owner, but none was detected.
30	Golden Lady prospect	A 2-ft-thick quartz vein with traces of galena and copper minerals extends 40 ft in volcanic rocks at the adit and is terminated at both ends. At the shaft, a shear zone trends east in volcanic rocks for 100 ft. Traces of chalcopyrite and secondary copper minerals found in veinlets along the shear.	One 20-ft adit and two pits, 1,500 ft to the northwest is a 15-ft shaft; probably no production.	Two samples from stockpiles at shaft have no significant metal content. Two samples from stockpiles at adit contain 5.45 and 0.93 oz/ton silver, 0.83 and 0.81 percent copper, 21 and 0.69 percent lead, and 1.1 and 0.2 percent zinc. A chip-sample from the vein has no significant metal content.
31	Hummingbird prospect	A northeast-trending shear zone, 8 ft long and 1 ft thick, in hornfels contains quartz stringers with traces of pyrite and secondary copper minerals.	One pit; no production	One chip sample from the shear zone has no significant metal content.
32	Hancock No. 1 prospect	A northwest-trending shear zone in hornfels is exposed for about 250 ft. Shear contains quartz stringers as thick as 0.1 ft which locally contain minor chalcopyrite and secondary copper minerals.	Two pits about 250 ft apart; no production.	Two of three chip samples from shear zone have no significant precious- or base-metal content. The third from northwest pit contains 1.05 oz/ton silver, 0.46 percent copper, 0.0034 percent lead, and 0.12 percent zinc.
33	Patent Pending prospect	A northwest-trending quartz vein in diorite is exposed for 20 ft along strike. It is as thick as 0.5 ft and contains scattered crystals of galena and chalcopyrite.	One 12-ft shaft; no production.	One grab sample from a stockpile contains 2.6 oz/ton silver, 0.66 percent copper, 3.1 percent lead, and 0.25 percent zinc.
34	Duarte prospect	A northwest-trending fault in Triassic andesite extends more than 700 ft along strike. One copper-stained quartz stringer, 0.2 ft thick and 10 ft long, was the only mineralized rock observed.	Four adits, 95, 85, 13, and 10 ft long.	One of six chip samples from shear zone contains 0.68 oz/ton silver and 5.0 percent lead. Others have low metal contents.
35	Unnamed prospect	A series of north- to northwest-trending shears in andesitic volcanic rocks contain galena and chalcopyrite in quartz-calcite veins. Veins are as thick as 1.2 ft but generally less than 0.5 ft and are not persistent along strike.	Two adits, 52, and 34 ft long, one trench, and three prospect pits.	Seven samples of shear zone material: of two select samples, one contains 12 oz/ton silver, 0.25 percent copper, 22.2 percent lead, and minor zinc. Other samples contain minor amounts of silver, copper, lead, and zinc.

Summary of mines and prospects in and adjacent to the Southern Inyo Wilderness Study Area–Continued

Map No. (pl. 1)	Name	Summary	Workings and production	Sample and resource data
36	Unnamed prospect	An east-trending fracture zone in Triassic volcanic rocks contains pods and discontinuous veins of quartz. Largest vein observed is 25 ft long, but it appears to be cut off at depth by a low-angle fault. Small amounts of chalcopyrite, malachite, and galena found in the veins.	Two adits, 10 and 40 ft long	Five samples: one select sample of quartz from a 200-lb stockpile contains 0.4 oz/ton silver, 0.18 percent copper, 0.74 percent lead, and 0.40 percent zinc. Four chip samples of fracture zone material contain minor amounts of silver, copper, lead, and zinc.
37	Unnamed prospect	A diorite dike in quartz monzonite trends N. 40° W. for 1,000 ft. Secondary copper minerals are along the trend, and silver-bearing quartz stringers about 0.3 ft thick are exposed in prospect pits.	Two pits about 1,000 ft apart; no production.	A select sample of quartz from northwest pit contains 5.7 oz/ton silver, 8.9 percent lead, 1.9 percent copper, 0.084 oz/ton gold, and 0.021 percent zinc. A random chip sample of quartzose material from southeast pit contains 17.4 oz/ton silver, 0.36 percent copper, 0.042 percent lead, 0.046 percent zinc, and no gold. Limited exposure precludes estimation of resources.
38	Unnamed prospect	Limonitic joints with northwest-trending quartz stringers in quartz monzonite were prospected.	One inaccessible shaft, four trenches, two pits in an area about 800 ft^2; no production.	Five select samples of quartzose material contain 0.019 to 0.34 oz/ton silver, 0.0016 to 0.074 oz/ton gold, 0.001 to 0.61 percent lead, and insignificant copper and zinc.
39	Unnamed prospect	A quartz vein found in a limonitic zone in quartz monzonite. Vein is not exposed, but vein material is present in a stockpile.	One pit; no production	One select sample of quartz from the stockpile contains 0.072 oz/ton silver, 0.066 percent lead, and insignificant copper, zinc, and gold.
40	Macaroon prospect	Quartz stringers associated with limonitic joints in quartz monzonite found at three of the workings. Veins are not exposed, but vein material is present in stockpiles.	Four pits and two collapsed shafts were developed in an area of about 350 by 150 ft; no production is known.	Select samples of vein material from stock-piles contain 0.09 to 0.79 oz/ton silver, 0.006 to 0.038 oz/ton gold, 0.12 to 2 percent lead, 0.002 to 0.072 percent copper, and 0.059 to 0.29 percent zinc.
41	Million Dollar Baby prospect	Several small diorite and aplite dikes trend east in quartz monzonite. One quartz vein, which is exposed for 70 ft in underground workings, contains visible galena and pyrite. Vein strikes north, dips 8° west, and pinches and swells between 0.1 and 1 ft in thickness.	Two adits are about 600 ft apart in the bottom of a steep-sided drainage. One adit is 70 ft long; the other is 125 ft long. No production is known.	Four samples from the vein in the 70-ft adit contain 1.02 to 3.85 oz/ton silver, 0.76 to 2.5 percent lead, 0.12 to 5.5 percent zinc, 0.001 to 0.011 oz/ton gold, and 0.016 to 0.0078 percent copper. Four samples from the 125-ft adit contain no significant values.

Summary of mines and prospects in and adjacent to the Southern Inyo Wilderness Study Area–Continued

Map No. (pl. 1)	Name	Summary	Workings and production	Sample and resource data
42	Burgess mine area	Area is underlain by volcanic and sedimentary rocks of Triassic age. A poorly exposed zone of quartz veins along faults in limestone, shale, and quartzite trends northwest and dips 35° to 50° southwest. Zone is 80 to 100 ft wide, at least 3,800 ft long, and apparently extends to the north in quartz monzonite into the study area.	Underground workings include a 156-ft inclined shaft, a 700-ft crosscut adit, and 2,000 ft of drifts. There are 64 pits, 12 inclined shafts, 6 shafts, 12 trenches, and 10 adits in the mine area. Nearly all the underground workings are caved. In 1910, 46 tons of ore were shipped which yielded 22 oz gold and 11 oz silver. Ore milled in 1919 was valued at $20 to $40 per ton.	Burgess mine area was previously mapped and sampled as part of the USBM wilderness appraisal of the eastern side of the Inyo Range (Close, 1985, 1986). In addition, 13 grab or select samples of vein material were taken from dumps during this study. Six samples contain more than 0.1 oz/ton silver with a high of 8.5 oz/ton. Lead values in excess of 1 percent were reported in four samples with a high of 4.8 percent, and one zinc value of 1.6 percent was reported. No copper values above 0.15 percent and negligible gold values were reported. Close (1986) reported similar values and concluded that metal-bearing occurrences are numerous but scattered, poorly exposed, discontinuous, and diversely oriented. Stockpiles contain good metal values, but in most cases, nearby structures do not.
43	Unnamed prospect	A small isolated zone of thin calcite veinlets in Triassic andesite was prospected.	One inclined shaft, 20 ft deep; no production.	One select sample from dump has no significant metal content.
44	Far Ridge prospect	A limonitic quartz vein in Triassic andesite and interbedded sandstone is exposed for 30 ft along strike. Vein trends N. 45° W., dips 70° NE., and is 0.2 to 2 ft thick.	One inclined shaft, 20 ft deep; no production.	One select sample of quartz vein material from stockpile contains 0.22 oz/ton gold, 0.3 oz/ton silver, 0.18 percent lead, 0.008 percent copper, and 0.002 percent zinc.
45	Black Warrior mine	Several shear zones found along and near the contact between granitic rocks and dolomitic marble. Longest exposed structure was traced 480 ft along a N. 75° E. strike. Dips range from 17° to 60° SE. Vein quartz along the structures averages about 1.1 ft thick and is exposed intermittently for 325 ft. It contains pyrite, limonite, and galena. Other veins are less than 0.1 ft thick and also contain galena.	Four adits, three are 80, 55, and 30 ft long, fourth is locked, a 12-ft shaft, one open cut, and 10 pits; production is unknown.	Eleven samples: six chip samples from longest exposed vein average 3.0 oz/ton silver, 0.67 percent lead, and 1.72 percent zinc. Four other chip samples from vein segments less than 50 ft long. Three contain 9.3, 1.2, and 0.003 oz/ton silver; four contain 6.5, 6.4, 0.077, and 0.036 percent lead; four contain 16.8, 13.9, 0.11, and 0.025 percent zinc. X-ray diffraction analysis shows a talc-like lens to consist mainly of chlorite.

Summary of mines and prospects in and adjacent to the Southern Inyo Wilderness Study Area–Continued

Map No. (pl. 1)	Name	Summary	Workings and production	Sample and resource data
46	Delthe Black Warrior mine	Silver-, lead-, and zinc-sulfide minerals found along a northwest-trending shear that dips 50° to 70° NE. in dolomite. The sulfide minerals are generally disseminated along the shear, but material on the dump suggests that pods of nearly 100 percent sphalerite and galena were mined. Mineralized zone was traced for about 120 ft along strike and averages 1.5 ft thick where sampled. Small talc deposit found at the intersection of a mafic dike and two shears.	One working includes a 300-ft crosscut, a 50-ft drift, and a 120-ft inclined shaft. A 100-ft adit, a 25-ft trench, and six pits are also on the property. Production is unknown.	Seven chip samples from shear zone average about 1.5 oz/ton silver, 9.0 percent lead, and 9.0 percent zinc.
47	Long John mine	Area is underlain by dolomite, limestone, quartzite, and argillite of the Hidden Valley Dolomite. Beds strike northwest and dip steeply to the southwest and northeast. A younger felsite porphyry dike trends east across the area. Galena, lead and iron carbonate, calcite, limonite, clay, and quartz found in a pipe-like deposit in a fissure vein in dolomite. Vein strikes N. 30° W. and dips 60° E. Deposit is generally 4 to 6 ft thick and extends from surface to depth of 230 ft.	Main adit has about 456 ft of crosscuts and drifts with winze, raise, and stope development on fissure vein to a depth of 230 ft. One 20-ft adit, four inaccessible shafts, and several pits were developed where iron oxide, iron carbonate, and quartz are exposed at the surface. In 1925 and 1926, $60,000 in silver-lead ore was shipped; in 1939, 23 tons of ore yielded 203 oz silver, 2,733 lb lead, 333 lb copper, and some gold.	Seven chip samples from fissure vein average 2.1 oz/ton silver, 1.27 percent lead, 0.50 percent copper, 0.14 percent zinc, and 0.048 oz/ton gold. Three of these samples averaged 0.215 percent tin. Remaining 17 samples from dumps, structures, and altered zones contain no significant values. The pipe-like deposit appears mined out.
48	Unnamed prospect	Limonitic gossan, 120 ft long and 1 to 2 ft thick in the Hidden Valley Dolomite.	Three cuts; no production	One chip sample of gossan has no significant metal content.
49	Unnamed prospect	A 1-ft-thick gossan zone is exposed at cut. A zone of silicified dolomite with scattered secondary copper minerals is exposed at shaft.	One 17-ft shaft and one cut about 200 ft apart; probably no production.	A chip sample from gossan contains 0.2 oz/ton silver, 0.03 percent copper, 0.09 percent lead, and 0.11 percent zinc. A select sample of silicified dolomite from dump at shaft contains 14.1 oz/ton silver, 1.6 percent copper, 5.7 percent lead, and 0.18 percent zinc.
50	Unnamed prospect	Milky quartz vein and limonitic gouge zone, 1 ft thick, trends northwest for 10 ft in the Hidden Valley Dolomite.	One cut; no production	One chip sample from quartz vein has no significant metal content.

Summary of mines and prospects in and adjacent to the Southern Inyo Wilderness Study Area–Continued

Map No. (pl. 1)	Name	Summary	Workings and production	Sample and resource data
51	Unnamed prospect	A gossan in the Hidden Valley Dolomite is 8 ft thick, 20 ft long, and trends N. 15° E. About 100 ft north-northwest is a body of high-grade talc which may be as large as 200 ft by 50 ft.	Gossan was developed by a 15-ft shaft, the talc by a pit; no production.	A grab sample from gossan has no significant metal content. Sample from talc body at pit is virtually pure talc with traces of chlorite. Sample contains 31.8 percent MgO and 60.6 percent SiO_2. Distribution of the high-grade talc was not determined.
52	Unnamed prospect	Highly fractured, silicified Hidden Valley Dolomite has limonitic coatings on fractures.	One pit; no production	One sample of silicified dolomite has no significant metal content.
53	Unnamed prospect	Highly sheared and pulverized Hidden Valley Dolomite with yellow-orange powdery limonite.	One pit; no production	One chip sample of sheared dolomite contains 0.05 oz/ton silver, 0.03 percent lead, and 0.2 percent zinc.
54	Unnamed prospect	Impure, siliceous talc vein, 2.5 ft thick and 10 ft long, exposed in southeast cut; silicified dolomite in the other.	Two cuts about 100 ft apart; no production.	One sample of vein is mostly talc with minor quartz and contains 29.0 percent MgO and 56.6 percent SiO_2. Sample of silicified dolomite from northwest pit has minor talc and contains 10.3 percent MgO and 79.4 percent SiO_2.
55	Long Trail mine	Zone of talc mineralization follows a north-trending fault in the Hidden Valley Dolomite for 600 ft. Discontinuous pods and lenses of talc are about 0.3 to 5 ft thick. The largest body, at north end of zone, is 50 ft long, 3 to 5 ft thick, and at least 20 ft deep.	Main talc body is developed by two groups of workings about 500 ft apart. Southern group includes two crosscut adits, 30 and 40 ft long, one cut, and one 20-ft-deep pit. Northern workings consist of a 35-ft shaft and a 45- by 10-ft cut. About 1,000 tons were transported from mine site by an aerial tram, probably during World War II.	Three chip samples from main zone contain mostly talc with some chlorite. MgO ranges from 28.4 to 30.8 percent and SiO_2 from 57.2 to 62.8 percent. Largest talc body contains about 400 tons, which is too small to be minable.
56	Unnamed prospect	Zone of white, chalky, gritty, altered dolomite, about 10 by 20 ft.	One 12-ft adit and one pit; no production.	One sample from zone consists mostly of albite and clay with no talc.
57	Unnamed prospect	1-ft-thick vein of cellular limonite and goethite trends northwest for 50 ft along a fault in the Hidden Valley Dolomite. Some secondary copper minerals found in footwall of vein.	Two pits, one cut, and one 5-ft crosscut adit; probably no production.	A chip sample of vein contains 0.49 oz/ton silver, 0.19 percent copper, 1.7 percent lead, and 10.6 percent zinc. A grab sample from a stockpile contains 4.35 oz/ton silver, 0.09 percent copper, 7.7 percent lead, and 1.0 percent zinc.

Summary of mines and prospects in and adjacent to the Southern Inyo Wilderness Study Area–Continued

Map No. (pl. 1)	Name	Summary	Workings and production	Sample and resource data
58	Copper Summit prospect	A gossan of massive goethite trends north for 480 ft in Hidden Valley Dolomite and dips 50° to 85° east. It is as thick as 5 ft. Central part of zone contains secondary copper minerals including native copper. These minerals were not seen at north and south ends.	Seven pits and cuts, two shallow shafts; no production is evident.	Four chip samples from gossan and five grab samples from stockpiles and dumps were collected. Samples contain as much as 14.9 percent copper; other metals are negligible. Two samples contain 0.22 and 0.33 percent arsenic, and one contains 0.11 percent vanadium.
59	Unnamed prospect	A set of parallel quartz-calcite veins trend northwest along the fault contact between the Keeler Canyon and the Lone Pine Formations. Veins are steeply dipping and associated in places with an altered dike. Veins are generally thin and discontinuous, but principal vein is as thick as 3.3 ft and crops out intermittently for about 1,500 ft along strike.	Three pits along principal vein; no production.	Four chip samples from veins contain no significant metal values.
60	Silver Reef No. 5 prospect	Two mineralized zones in the Keeler Canyon Formation were identified. An east-trending fracture zone is as thick as 3 ft and dips steeply. It is exposed intermittently in workings for about 120 ft along strike. Small amounts of lead and copper minerals found on a dump suggest that ore minerals were encountered at depth. Second zone is along a shear that strikes N. 25° W. and dips 85° NE. Secondary lead and copper minerals occur in a 0.4 ft-thick stringer and on a dump near shaft.	Two shafts, 36 and 15 ft deep, a 46-ft adit, and two pits.	Five samples: one select sample of secondary lead minerals contains 12.8 oz/ton silver and 5.3 percent lead. Other samples from mineralized zones contain only minor amounts of silver, copper, lead, and zinc.
61	Pennsylvania mine	Two shear zones in the Keeler Canyon Formation contain lead and zinc carbonates, galena, calcite, and limonite. Northern shear zone is 300 ft long and averages 1.7 ft thick; southern zone is 1,000 ft long and averages 2.5 ft thick.	Sixteen shafts, 1 partly caved adit, 9 pits, and 5 trenches in an area about 0.3 by 0.2 mi. Between 1918 and 1969, 252 tons mined yielded 5,584 oz silver, 86,473 lb lead, and some copper, zinc, and gold.	Twenty-seven samples were collected. Samples from north shear zone average 1.1 oz/ton silver, 4.2 percent lead, and 4.2 percent zinc. Samples from south shear zone average 3.5 oz/ton silver, 5.6 percent lead, and 4.8 percent zinc. A topographic lineament suggests a possible third shear zone.
62	Unnamed prospect	Silicified, limonite-stained, volcanic rocks on trace of north-trending fault between Triassic volcanic rocks and the Permian Lone Pine Formation.	One pit; no production	One chip sample of altered volcanic rock had no significant metal content.

Summary of mines and prospects in and adjacent to the Southern Inyo Wilderness Study Area–Continued

Map No. (pl. 1)	Name	Summary	Workings and production	Sample and resource data
63	Unnamed prospect	Brecciated, limonitic quartz vein, 0.4 ft thick, in interbedded shale and marble exposed in pit.	One pit; no production	One select sample of quartz contains 0.27 oz/ton silver, 0.06 percent copper, 0.15 percent lead, and 0.22 percent zinc.
64	Flagstaff mine	Series of shear zones with quartz veins are in phyllite, argillite, siltstone, and quartzite of the Lone Pine Formation. Largest shear zone is exposed for 450 ft and averages 1 ft thick. It contains veins of quartz and jasperoid which locally contain argentiferous galena. Four other smaller structures consist chiefly of shear zones and quartz-dolomite veins that locally contain pyrite, chalcopyrite, sphalerite, and tetrahedrite(?).	Seven adits with drifts, winzes, and stopes totaling 600 ft, one 90-ft shaft, one 80-ft inclined shaft, four other shafts, and 14 pits, cuts, and trenches. U.S.B.M. records indicate mine yielded 454 oz silver and 2.66 oz gold from 1889 to 1891.	Forty-three chip and one select sample were collected. The largest structure inferred to contain about 3,700 tons averaging 3.37 oz/ton silver, 1.36 percent lead, and 2.01 percent zinc. Structure is too small and low grade to be minable. Other structures generally have low metal content with a few small pockets that contain as much as 18 oz/ton silver, 6.0 percent lead, and 2.1 percent zinc.
65	Unnamed prospect	Series of shear zones and quartz stringers in quartzite. Largest zone is 25 ft long and 3.6 ft thick.	Two adits, 25 and 14 ft long, and one pit; no production.	Three chip samples from adits have no significant metal content. One select sample from pit has 0.12 oz/ton silver and 0.15 percent lead.
66	Bud's Hope mine	Two mineralized structures found on property. Principal structure is a bedding-plane shear zone in phyllites of the Lone Pine Formation. Shear is marked by limonitic argillic gouge with a few quartz veins and stringers as thick as 1 ft. Entire zone is 500 ft long and averages 1.75 ft thick. East of shear zone, the Lone Pine Formation is faulted against Triassic volcanic rocks. Fault is marked in one place by intense blue and green copper staining and some remnant chalcopyrite.	Shear zone is developed by 6 adits, 2 shafts, 7 pits, and 3 trenches, the fault by two adits and one trench. Underground workings exceed 850 ft. Production is unknown.	Twenty-nine chip samples from bedding-plane shear average 0.96 oz/ton silver. Other metals are negligible. Zone is too thin and grade too low to mine. Three samples from fault zone contain 0.57, 3.3, and 5.2 oz/ton silver; 0.47, 2.6, and 8.8 percent copper; and 0.056, 0.24, and 0.064 percent lead.

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