MINERAL RESOURCE POTENTIAL OF PART OF THE VENTANA WILDERNESS AND THE BLACK BUTTE, BEAR MOUNTAIN, AND BEAR CANYON ROADLESS AREAS, MONTEREY 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 part of the Ventana Wilderness and the Black Butte (5102), Bear Mountain (5103), and Bear Canyon (5104) Roadless Areas, Los Padres National Forest, Monterey County, California. The Ventana Wilderness was established by Public Law 91-58; this report discusses additions to the Ventana Wilderness that were established by Public Law 95-237 in 1978. The Black Butte, Bear Mountain, and Bear Canyon Roadless 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

A geologic, geochemical, and geophysical investigation and a survey of claims and prospects have been conducted to evaluate the mineral resource potential of part of the Ventana Wilderness and the Black Butte, Bear Mountain, and Bear Canyon Roadless Areas. The study area is part of the Los Padres National Forest and lies in the Santa Lucia Range on the central California coast. Most of the area is underlain by crystalline basement consisting of high-grade metamorphic rocks intruded by Cretaceous granitic plutons which is unconformably overlain by sedimentary rocks of Late Cretaceous and Tertiary age.

There has been virtually no mining within the study area. In the central California coastal area, most mining of metallic-mineral deposits has been from rocks of the Franciscan assemblage; igneous and metamorphic rocks like those of the study area have yielded no significant deposits. Geochemical study of 167 stream-sediment samples showed anomalous values of certain elements in 9 samples, but most of these anomalies appear to correlate with minerals that are not abundant enough to indicate resource potential. Field examination and chemical analyses of rock samples revealed little evidence of metallic mineralization. The igneous and metamorphic rocks of the study area have a low potential for metallic-mineral deposits and no potential for oil and gas.

Petroleum and natural gas are produced from sandstone in the Monterey Formation in the nearby Salinas Valley. The Monterey in the study area is beyond the known limits of productive sandstone and has a low potential for oil and gas production. Other sedimentary rocks of the area have a very low potential for oil and gas. The sedimentary rocks have a low or no potential for metallic-mineral deposits. The Monterey Formation contains phosphate rock in the study area, but the abundance is not known; there may be a low resource potential.

The study area contains deposits of crystalline limestone, sand, and gravel. The deposits are small and inaccessible and thus have a low resource potential. Hot springs of moderate discharge occur adjacent to the area and are utilized as hot baths. No hot springs are known in the study area and thus the potential for geothermal energy is low.

INTRODUCTION

Area description

The Ventana Wilderness encompasses approximately 159,000 acres, of which 98,000 acres was initially designated as a primitive area and 61,000 acres was later added. This report deals with the areas added to wilderness together with the Black Butte, Bear Mountain, and Bear Canyon Roadless Areas. In all, they comprise about 116,000 acres in the Los Padres National Forest, Monterey County, Calif. (fig. 1). For the purpose of this report the areas will be referred to collectively as the study area.

The study area is located in the Santa Lucia Range between U.S. Highway 101 and California Highway 1. Paved roads from Greenfield and King City provide access from the east. A paved road from Jolon crosses the range and reaches the coast just south of the area.

The study area has rugged relief and dense vegetation. Cone Peak, only 3.2 mi from the Pacific Ocean, has an elevation of 5,155 ft. Junipero Serra Peak, with an elevation of 5,862 ft, is the highest peak in the Santa Lucia Range. Much of the area is covered by brush, with stands of oak, madrone, and pine in more moist locations and at higher elevations. Redwoods occur in valleys near the coast. The large Marble Cone fire of 1977 burned much of the study area north of The Indians ranch, temporarily eliminating a great deal of nearly impenetrable brush. Annual precipitation ranges from more than 100 in. near the coast to about 20 in. inland, falling mainly between December and April (Pearson and others, 1967).

Previous investigations

Numerous reports deal with the geology of the study area. Geologic maps with discussions of the mineral resources of parts of the area have been published by Reiche (1937), Fiedler (1944), and Durham (1963, 1970, 1974). Other geologic maps are published by Dibblee (1974), Dickinson (1965), Wiebe (1970), Graham (1979), and Ruetz (1976). The area is included in maps of the northern Santa Lucia Range showing reconnaissance geology (Ross, 1976a) and the distribution of metamorphic rocks and minerals (Ross, 1976b). The economic geology of the area is included in Hart's (1966) study of the mines and mineral resources of Monterey County. Limestone and dolomite resources are described by Hart (1978). Gribi (1963) discusses the petroleum geology of the region. The mineral resources of the original Ventana Wilderness adjoining the present study area have been investigated by Pearson and others (1967).

Present investigation

The U.S. Geological Survey conducted geologic, geochemical, and geophysical investigations to evaluate the mineral resource potential of the area. Previous geologic mapping was compiled and modified by additional observations to produce a geologic map of the study area at a scale of 1:50,000 (Seiders and others, 1983). Geochemical studies chiefly involved the collection and semiquantitative analysis of stream-sediment samples. The analytical results were examined statistically to reveal anomalous concentrations of elements. An aeromagnetic survey was conducted by R. J. Blakely, (unpub. data, 1982). The U.S. Bureau of Mines reviewed Monterey County records to determine claim locations. An attempt was made to locate and examine all claims and prospects in the field. Chip and grab samples were taken from outcrops, dumps, and float, and placer samples were taken from streambeds and slopewash. Scintillometers were carried during fieldwork in an attempt to detect anomalous radioactivity. Lode and placer samples were also checked for radioactivity and fluorescence.

GEOLOGY, GEOCHEMISTRY, AND GEOPHYSICS PERTAINING TO MINERAL RESOURCE ASSESSMENT

Geology

The study area is underlain by various igneous, metamorphic, and sedimentary rocks. Figure 2, a map showing the mineral resource potential, may be read as a highly simplified geologic map. Unpatterned areas (low potential for metallic-mineral deposits) are underlain by igneous and metamorphic rocks, whereas ruled areas (low and very low potential for oil and gas) correspond to sedimentary rocks.

Most of the metamorphic rocks are high grade, but at the southwest edge of the study area, a complex fault system juxtaposes low-grade metamorphic rocks of the Franciscan assemblage (Gilbert, 1973). The Franciscan assemblage occupies only a small part of the study area. The high-grade metamorphic rocks are chiefly quartzofeldspathic biotite gneiss, some with layers containing sillimanite and (or) garnet. Subordinate rock types are biotite-feldspar quartzite, amphibolite, calc-silicate rock, and sillimanite-biotite schist. Lenses and layers of locally graphite bearing marble make up a small part of the metamorphic sequence and are most abundant in the southwestern part of the area. Gneiss containing graphite and pyrite occurs near Tassajara Hot Springs (fig. 1) and northwestward, where Wiebe (1970) mapped it as a marker unit with a map pattern that indicates refolding. Graphitic gneiss is also moderately abundant in the southwestern part of the area but is rare elsewhere. The age of the metamorphic rocks is not known with certainty. The protoliths may be Paleozoic in age and were probably metamorphosed during the Cretaceous.

The outcrop area of the intrusive igneous rocks is about half that of metamorphic rocks. These igneous rocks are mainly granodiorite, quartz monzonite, and quartz diorite, but diorite and gabbro bodies also occur. The largest intrusive bodies are near Junipero Serra and Pinyon Peaks (fig. 1). A few small ultramafic intrusions, some with unusual zoned structure, are spaced widely within the granitic and high-grade metamorphic rocks. Charnockitic tonalite is found in the southwestern part of the area (Compton, 1960). Both the igneous and the metamorphic rocks contain abundant dikes and pods of pegmatite. Radiometric dating suggests an emplacement age of 100-110 m.y. (middle Cretaceous) for the granitic rocks of the northern Santa Lucia Range (Mattinson, 1978; Ross, 1978).

The igneous and metamorphic rocks are overlain unconformably by sedimentary rocks, mainly sandstone, mudstone, and conglomerate. These rocks show complex stratigraphic relations and have been assigned various stratigraphic names (Durham, 1974; Graham, 1979). South and west of The Indians the sedimentary rocks are mainly Late Cretaceous and Paleocene in age. North and east of The Indians, Paleocene to Miocene age rocks are present. The Monterey Formation (Miocene) is a distinctive mudstone unit rich in foraminifers and containing porcelaneous and diatomaceous beds. Many rock samples of the Monterey emit a fetid petroliferous odor when freshly broken. In the study area the Monterey is the youngest sedimentary unit exposed.

Sand and gravel occur in alluvium and alluvial terraces along most streams. These bodies are generally small, but near The Indians two broad tongues of bouldery alluvium extend 1 and 3 mi into the mountains along minor streams.

Geochemistry

Stream-sediment samples were collected at 167 localities. An attempt was made to sample sediment from each drainage basin with an area of about 1 mi^2 and to collect samples along trunk streams at 2 mi intervals. The minus-80-mesh fraction of each sample was analyzed by semiquantitative spectrographic methods (Motooka and Grimes, 1976) for 31 elements (Ag, As, Au, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, La, Mg, Mn, Mo, Nb, Ni, Pb, Sb, Sc, Sn, Sr, Ti, V, W, Y, Zn, Zr, and Th). Each sample was also analyzed by instrumental methods for mercury (limit of determination, 0.02 ppm (parts per million). Eleven samples representing large drainage areas were analyzed by atomic-absorption spectrophotometry for gold (limit of determination 0.05 ppm). The analytical results for each element were grouped by computer (Van Trump and Miesch, 1977), and the cumulated frequencies were plotted on probability-log graph paper, in order to distinguish anomalous from background values (Lepeltier, 1969).

Anomalous values of six elements were found in nine stream-sediment samples (samples 1-9, fig. 2). Thorium and molybdenum occur in determinable amounts in only two samples each. Thorium occurs in samples 2 and 4 with values at or near the lower limit of determinability (100 and 150 ppm, respectively; determinable at 100 ppm and more). Thorium is found in the mineral monazite, a common accessory mineral in granitic rocks and gneisses. Monazite resists weathering, may be concentrated by fluvial processes, and is the likely source of the thorium anomalies. Molybdenum, determinable at 5 ppm and more, occurs in samples 3 and 7 at 20 and 15 ppm, respectively. The drainage area of sample 3, which also contains anomalous nickel, is largely underlain by the Monterey Formation. Since both molybdenum and nickel are commonly concentrated in organic-rich sediments (Goldschmidt, 1954; Schultz and others, 1980), the organic-rich mudstone of the Monterey is the likely source of the anomalies. The Monterey is also phosphatic in the area of sample 3 (Durham, 1970). The source of the molybdenum in sample 7 is not known.

Anomalous chromium occurs in samples 1 and 6; anomalous nickel in sample 1. Chromium and nickel are most abundant in ultramafic rocks. Pearson and others (1967) reported high values in ultramafic rocks of the original Ventana Wilderness. The drainage area of sample 1 contains small ultramafic bodies which are the likely source of the anomalies. Sample 6 represents an area underlain largely by granitic rocks, but a small undetected body of ultramafic rocks could be the source of the anomalous chromium.

Boron is anomalous in sample 9. Since the drainage area is largely underlain by igneous and metamorphic rocks, a possible source of the boron is tourmaline and possibly dumortierite, both common minerals of pegmatites and granitic and metamorphic rocks.

Mercury values of 0.3 and 0.26 ppm were found in samples 5 and 8. These values are anomalously high with respect to the 167 analyzed stream-sediment samples from the study area. However, similar values are more numerous among Pearson and others' (1967) 186 analyses from the original Ventana Wilderness. If Pearson and others' (1967) data are included, there are no anomalous mercury values.

Geophysics

An aeromagnetic map of the study area (R. J. Blakely, unpub. data, 1982) shows a very weak magnetic expression except near Junipero Serra and Pinyon Peaks, where strong northwest-trending anomalies exist. The steep gradients of these anomalies indicate a near-surface source corresponding to exposures of granitic rocks. It is not yet known what minerals in the granitic rocks are responsible for the magnetization.

METALLIC-MINERAL DEPOSITS AND MINERALIZATION

The Coast Ranges of central California have been the site of considerable and varied mineral production but there has been no significant activity within the study area. Most mining of metallic-mineral deposits has been from the Franciscan assemblage. These rocks occur mainly southwest of the study area but also include a very small part of the study area.

Mercury

Mercury has been obtained from important mining districts located within a 65-mi radius outside the study area, including the New Almaden district to the north (Bailey and Everhart, 1964), the New Idria (Eckel and Meyers, 1946) and Parkfield (Bailey, 1942) districts to the east, and various mines in San Luis Obispo and southern Monterey Counties to the south (Eckel and others, 1941). At the present time none of the mines in central California are active. The greatest production has been from silica-carbonate rocks formed from the alteration of serpentinite within the Franciscan assemblage. Because the age of mercury mineralization is very young (Bailey and Everhart, 1964), nearly all rocks of the region are potential hosts. Nevertheless, there has been very little production outside of areas of the Franciscan. The Botts deposit (Hart, 1966; Eckel and others, 1941), 20 mi southeast of the study area, however, is in Upper Cretaceous or lower Tertiary sedimentary rocks which probably overlie a basement of crystalline rocks like those of the study area. Two miles northeast of the Black Butte Roadless Area a mercury prospect occurs in Tertiary sandstone.

The only evidence of mercury mineralization within the study area is the two stream-sediment analyses with anomalous mercury values (0.3 and 0.26 ppm), each representing drainage areas of about 1 mi^2 (fig. 2). By comparison, a mercury content of 0.55 ppm was obtained from a sediment sample from San Carpoforo Creek, 18 mi south of the study area, a much larger drainage (25 mi^2) with two known mercury deposits.

Gold

The principal gold production in the region has been from the Los Burros district, 8 mi south of the study area. Both lode and placer claims were worked, mainly between 1887 and 1892. Hart (1966) estimated total production at only $150,000. The area is underlain by the Franciscan assemblage. Intermittent placer mining near Jolon, 8 mi southeast of the area, has produced small amounts of gold. Some placer gold has been obtained from the upper part of the Carmel River (Hart, 1966) which includes part of the Ventana Wilderness in the northwestern part of the study area. Geochemical sampling for the present study showed no gold determinable at 10 ppm in 167 stream-sediment samples. Eleven sediment samples showed no gold determinable at 50 ppb (parts per billion). Placer samples concentrated in the laboratory showed flour gold in 20 out of 57 samples, with an estimated average value of $0.05 per yd^3 (roughly 1.5 ppb). Pearson and others (1967) reported finding a small prospect in pegmatite along the Arroyo Seco (loc. 16, fig. 2) but noted that it is not visibly mineralized, and analyses showed no anomalous concentration of gold or other metals.

Other metallic minerals

Chromium has been produced in the region from ultramafic rocks associated with the Franciscan assemblage. Small ultramafic bodies in the study area may be responsible for the geochemical anomalies in chromium and nickel, but because of their small size, they are not likely to contain recoverable amounts of these metals.

A shallow adit driven for molybdenum (Hart, 1966) is found on the road between Arroyo Seco and The Indians (loc. 17, fig. 2). Four samples from the adit showed less than 0.01 percent molybdenum and minor amounts of other metals. Two stream-sediment samples contain measurable molybdenum. No evidence of mineralization was observed in the drainage areas of these samples.

Eighty-nine rock samples were assayed for gold and silver, and selected samples were analyzed for other elements. Evidence of metallic mineralization was found in only two samples. One of the samples is a rusty altered granitic (?) rock collected from float on the ridgecrest 2 mi northwest of Junipero Serra Peak (loc. 10, fig. 2). Semiquantitative spectrographic analyses show anomalous amounts of the following elements: silver (50 ppm), arsenic (500 ppm), bismuth (30 ppm), copper (100 ppm), and lead (1,500 ppm). The extent of the mineralization is not known but does seem to be limited. There are no anomalies in stream-sediment analyses of this area.

The other mineralized rock sample is a rusty graphitic gneiss exposed in a tributary of Church Creek (loc. 11, fig. 2). This rock contains anomalous vanadium (1,500 ppm), copper (500 ppm), molybdenum (50 ppm), and silver (3 ppm). Pearson and others (1967) also reported high metal contents, especially in vanadium and molybdenum, from sulfidic graphitic gneiss in parts of the original Ventana Wilderness. They noted that although the metal contents are presently below ore grade there may be some potential for these metalliferous gneisses. Goldschmidt (1954) observed that vanadium and molybdenum are concentrated in bituminous sediments. Such sediments may have been the protolith of the graphitic gneiss. Pyritic graphitic gneiss, quartzite, and calc-silicate rock form a mappable rock unit at Tassajara Hot Springs and northwestward (Wiebe, 1970). There are no associated anomalies in stream-sediment analyses in the study area.

OIL AND GAS, NONMETALLIC-MINERAL DEPOSITS, AND GEOTHERMAL ENERGY

Petroleum and natural gas

There is no oil or gas production within the study area. The study area beyond the known limits of productive sandstone and has a low potential for oil and gas. However, considerable oil and gas is obtained from the Salinas Valley east and southeast of the study area. The bulk of the production is from the San Ardo field, 25 mi southeast of the study area, but some oil is produced from the Quinado Canyon and King City fields, 8 mi east, and the Monroe Swell field, 5 mi northeast of the Bear Mountain Roadless Area. Most production is from sandstone in the Monterey Formation (Gribi, 1963; Hart, 1966; Durham, 1974). The fields are located along a northwest-trending line, called the King City hinge line by Gribi (1963), where deep-water mudstone of the Miocene Salinas basin interfingers with sandstone derived from the Gabilan shelf to the northeast. This line lies entirely east of the study area.

Within the Salinas basin a small Miocene basement high, the Lockwood high, is centered 15 mi southeast of the Bear Canyon Roadless Area and trends northwest toward the area. The Lockwood high contributed some sand to the Monterey Formation (Gribi, 1963; Graham, 1976) but, so far, there has been little production of oil or gas near the high.

Phosphate rock

Thin beds rich in phosphate have been reported in the Monterey Formation of the Black Butte Roadless Area 2 mi north of Arroyo Seco (fig. 1; Durham, 1970) and in Vaqueros and Reliz Canyons just north and east of the Bear Mountain Roadless Area (Durham, 1974; Hart, 1966). Phosphate occurs both in the Monterey and in the upper part of the underlying Tertiary sandstone 8 mi south of the east edge of the Bear Canyon Roadless Area. Here the occurrence of phosphate has been related to special conditions of sedimentation associated with the Lockwood high (Graham, 1976; Garrison and others, 1979). There has been no production of phosphate from the region nor have studies been done to determine its abundance.

Diatomite

Diatomite has been mined from the upper part of the Monterey Formation in nearby areas, chiefly in Hames Valley, 30 mi southeast of the study area (Hart, 1966). There has been no production since 1942. Similar deposits are not known to occur in the Monterey Formation of the study area.

Crystalline limestone (marble)

Layers and lenses of marble make up a small part of the metamorphic rock sequence. Marble is widely distributed but occurs most abundantly in the southwestern part of the study area. Some marble bodies can be traced as far as 4 mi on aerial photographs. Thicknesses are difficult to estimate but are probably small. Hart (1966) reported maximum thicknesses of 150 to 200 ft, but the average is much less. The bodies of marble may include septa of other metamorphic rocks. The marble is commonly white to light gray, finely to coarsely crystalline, and contains variable amounts of calc-silicate minerals and flakes of graphite. Published analyses (Hart, 1966, 1978; Pearson and others, 1967) show that some samples are relatively uncontaminated and rich in calcium; other rocks are dolomitic or siliceous.

There has been no significant mining of marble in the study area and very little nearby. During the 1880's crystalline limestone was burned for lime at Limekiln Creek, near the coast west of the southern tip of the area. Four kilns still remain.

Hot springs

Four hot springs occur just outside the study area, but none are known within the area. The Tassajara Hot Springs (loc. 12, fig. 2) is the largest occurrence of the four. Waring (1915) reported about 17 separate thermal springs at Tassajara, with temperatures between 100° and 140°F, and an estimated flow of 100 gal/min. Slates Hot Springs (loc. 13, fig. 2) issue from the sea cliff at the coast, have temperatures between 110° and 121°F, and have a total flow of about 50 gal/min (Waring, 1915). Dolans Hot Spring (loc. 14, fig. 2) is much smaller, with an estimated temperature of 100°F and a flow of 5 gal/min (Waring 1915). Reiche (1937) reported a small spring on the lower part of Lost Valley Creek (loc. 15, fig. 2) with a temperature of 102°F and a flow of 1.5 gal/min. Both Tassajara and Slates Hot Springs have bath facilities operated by private organizations. They are open to the public on a limited basis.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

General

A low potential for metallic-mineral deposits is assigned to parts of the study area underlain by high-grade metamorphic and intrusive igneous rocks. The low potential is assigned, in part, because there have been no previous discoveries of significantly valuable deposits in the study area, nor have similar rocks anywhere in the region shown significant deposits.

Geochemical anomalies of certain elements were found in nine stream-sediment samples. However, most of these anomalies seem to correlate with minerals in the rocks exposed within the drainage areas of the samples that are not abundant enough to indicate resource potential. Mercury is anomalous in two stream-sediment samples, but the values are not very high when compared with samples from the original Ventana Wilderness (Pearson and others, 1967) or with a sample from an area to the south with known mercury mineralization. Anomalous molybdenum occurs in two stream-sediment samples. Organic rich mudstone of the Monterey Formation may be the source of one of the anomalies (loc. 3, fig. 2); the source of the other (loc. 7, fig. 2) is not known.

Field examination and chemical analyses of rocks showed little evidence of mineralization in the study area. One rock sample contained anomalous values of silver, arsenic, bismuth, copper, and lead (loc. 10, fig. 2), but the area of mineralization seems to be limited and there is no anomaly in stream-sediment samples of the area. A unit of sulfidic, graphitic gneiss in the northwestern part of the study area shows anomalous values of vanadium, molybdenum, copper, and silver, but not enough for resource potential. Flour gold was detected in some placer samples but not in significant amounts.

The very small part of the area underlain by low-grade metamorphic rocks of the Franciscan assemblage shows a low potential for metallic-mineral deposits. There is no potential for oil and gas in any of the metamorphic or igneous rocks of the area. Likewise, the sedimentary rocks have no potential for metallic-mineral deposits, except for a very low potential for mercury.

Deposits of crystalline limestone occur in the metamorphic rock sequence but have a low potential because of their minimal thickness and inaccessibility. Sand and gravel occur in alluvium and alluvial terraces, but the deposits are rather small and remote. Larger deposits occur just outside the study area.

The sedimentary rocks of the study area are possible sources of petroleum and natural gas. Nearby in the Salinas Valley area, all oil and gas is produced from sandstone of the Monterey Formation. Available data indicate that the Monterey in the study area is beyond the limits of these productive sandstones. Although undetected petroleum resevoirs within the study area cannot be ruled out, they seem unlikely. The Monterey of the study area has a low potential for oil and gas. Cretaceous through Miocene sedimentary rocks that underlie the Monterey have not been productive anywhere in the region nor do they show any favorable indications of oil or gas in the study area. The Cretaceous sedimentary rocks have been found to be low in total organic content and to have poor reservoir potential (Howell and Claypool, 1977). All sedimentary rocks older than the Monterey Formation are considered to have a very low potential for oil and gas.

Phosphate rock occurs in the region within the Monterey Formation, but its abundance is not known. As noted by Hart (1966), the large agricultural use of phosphate for fertilizer in California could indicate resource potential for relatively low grade deposits. Although data on abundance are lacking, the Monterey in the study area may have a low potential for phosphate rock.

Springs with moderate flows of hot water occur just outside the study area at Tassajara and Slates Hot Springs. They are utilized as hot baths, and expansion for space heating or other geothermal use might be possible. However, no similar springs are known to exist within the study area, and so there is a low potential for geothermal-energy resources within the study area.

Additions to Ventana Wilderness

Eighty-six mining claims, none of which are currently active, were reportedly located within the additions to the Wilderness. Occurrences of gold, graphite, limestone, molybdenum, phosphate, and monazite are cited in the literature (Hart, 1966). Field examinations by the U.S. Bureau of Mines indicate that gold, graphite, and limestone do occur but are of insufficient quantity or grade to constitute potential resources (Esparza and Sabine, 1981, 1982). Hence, there is a low potential for mineral deposits and geothermal energy. Sedimentary rocks have a very low potential for oil and gas, except for a small area containing the Monterey Formation, where the potential may be only slightly greater.

Black Butte Roadless Area

According to Monterey County records, eight lode claims have been located in this area since 1901. No evidence of prospects or active claims was found, and samples of outcrops and stream channels contained no mineral resource potential (Stebbins, 1981a, b). One small excavation visited by Pearson and others (1967) showed no evidence of mineralization. The potential for metallic-mineral deposits is low. Although part of the area is underlain by the Monterey Formation, which has produced oil and gas nearby, it is beyond the known limits of oil-bearing sandstone and therefore has a low potential for oil and gas. Phosphate has been reported in the area (Durham, 1970), but there is little data on abundance and the potential is low.

Bear Mountain Roadless Area

Only two mining claims were recorded, and no production was reported. Sample analyses do not indicate anomalous concentrations of any mineral commodity (Spear, 1981, 1982). The area has a low potential for mineral deposits and geothermal energy. Parts of the area underlain by the Monterey Formation have a low potential for oil and gas. The Monterey Formation may have a low potential as a phosphate source, but quantitative data are lacking.

Bear Canyon Roadless Area

Six 160-acre petroleum claims were located in this area in 1901. From 1916 to 1939, five lode claims were filed. There are no mineral, geothermal, or oil and gas leases. Field and aerial reconnaissance revealed no workings on any of the claims (Benham, unpubl. data, 1982a,b). The area has a low potential for metallic-mineral deposits. Parts of the area underlain by the Monterey Formation have a low potential for oil and gas, since the area is located beyond the known limits of oil-bearing sandstone. Phosphate rock has been found in the Monterey Formation, but the abundance is not known and there is only a low resource potential.

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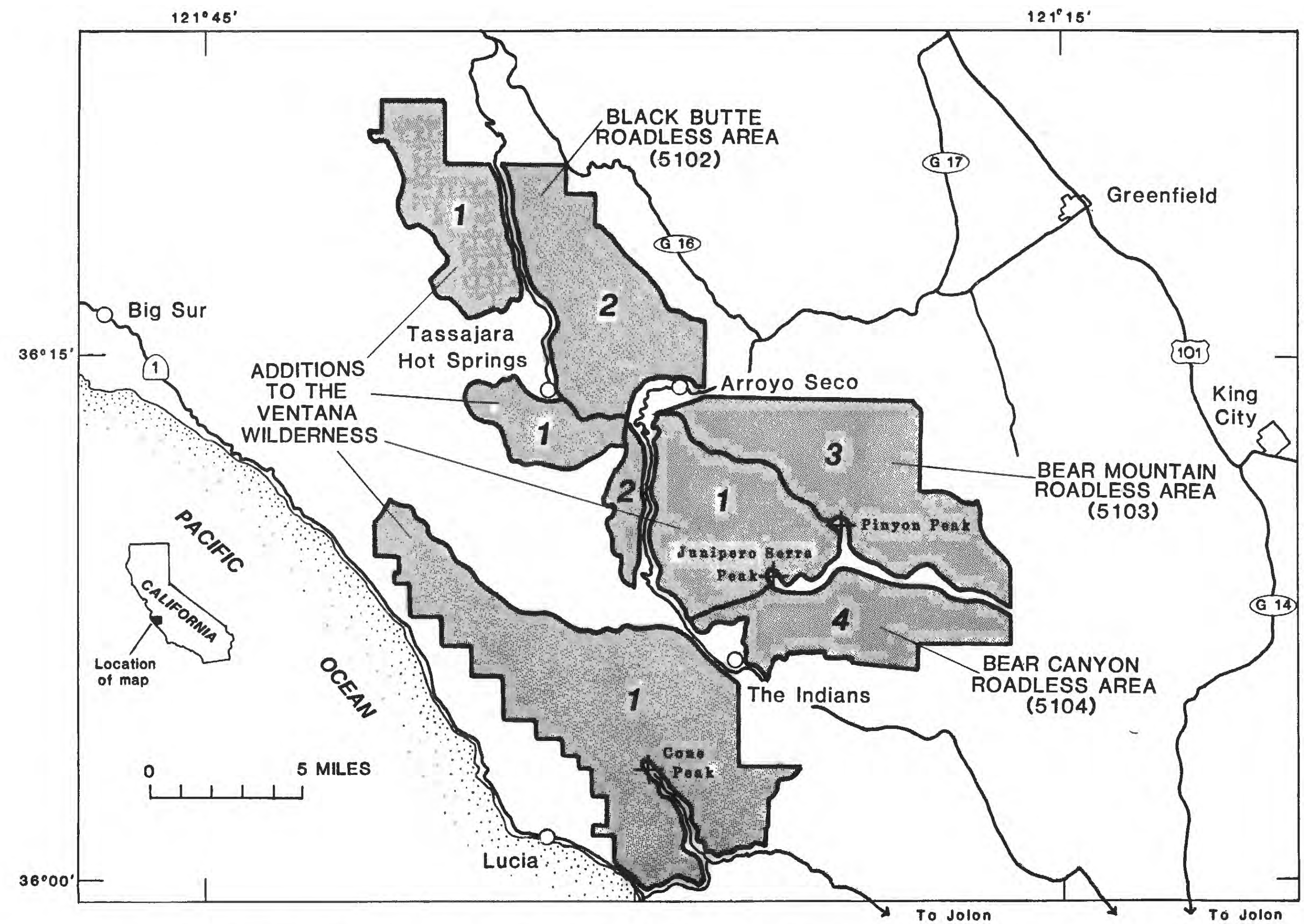

Figure 1.--Index map showing location of study area. 1, Additions to the Ventana Wilderness; 2, Black Butte Roadless Area; 3, Bear Mountain Roadless Area; 4, Bear Canyon Roadless Area.

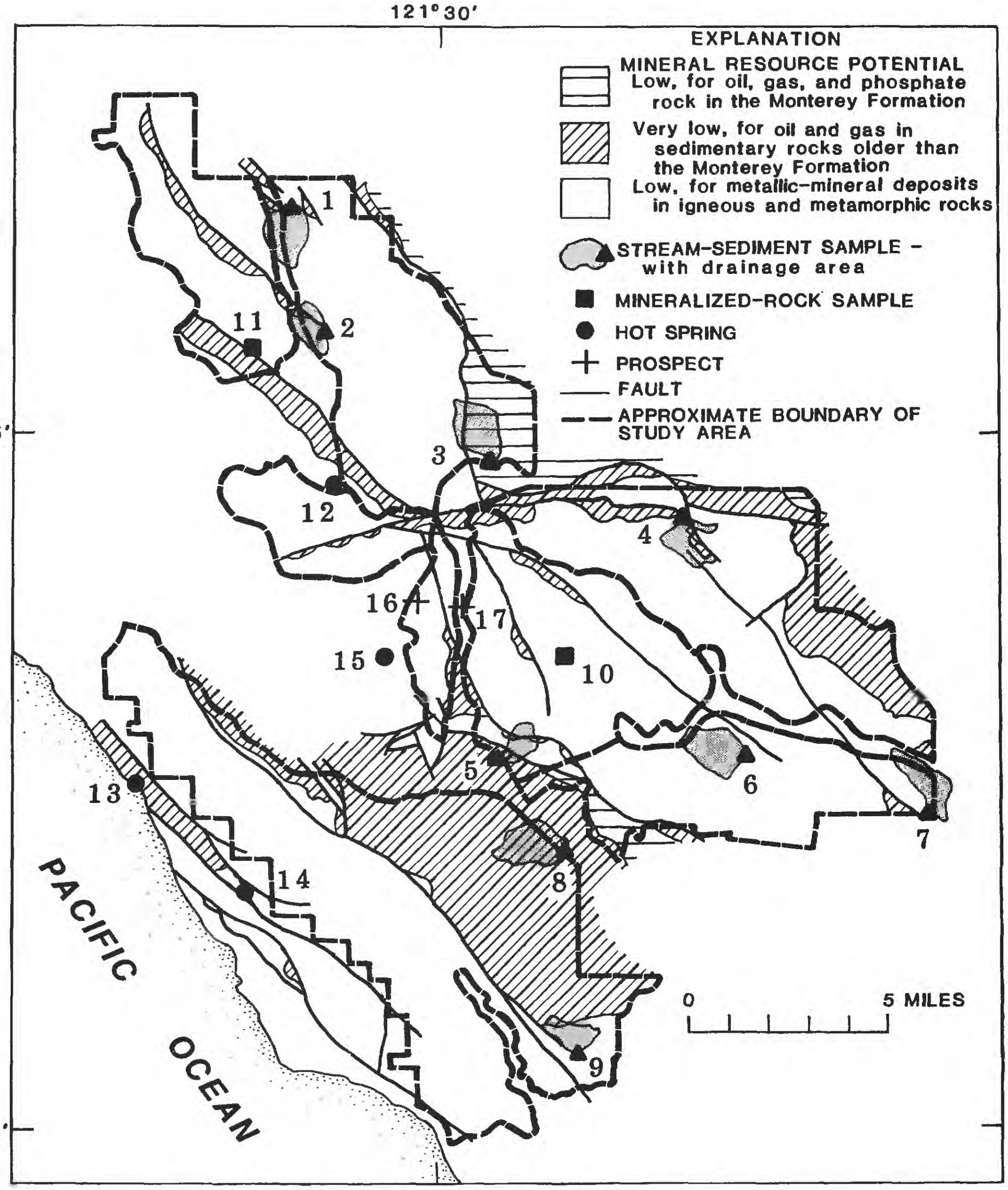

Figure 2.--Mineral resource potential of study area and location of anomalous stream-sediment samples, mineralized-rock samples, hot springs, and prospects. Stream-sediment samples with anomalous values in parts per million (ppm): 1, Cr, 1,500; Ni, 500. 2, Th, 100. 3, Mo, 20; Ni, 300. 4, Th, 150. 5, Hg, 0.3. 6, Cr, 1,000. 7, Mo, 15. 8, Hg, 0.26. 9, B, 500. Mineralized rock samples with anomalous values (in ppm): 10, Ag, 50, As, 500, Bi, 30, Cu, 100, Pb, 1,500. 11, Ag, 3, Cu, 500, Mo, 50, V, 1,500. 12, Tassajara Hot Springs. 13, Slates Hot Springs. 14, Dolans Hot Spring. 15, Unnamed hot spring. 16, Gold(?) prospect (Pearson and others, 1967). 17, Molybdenum prospect.