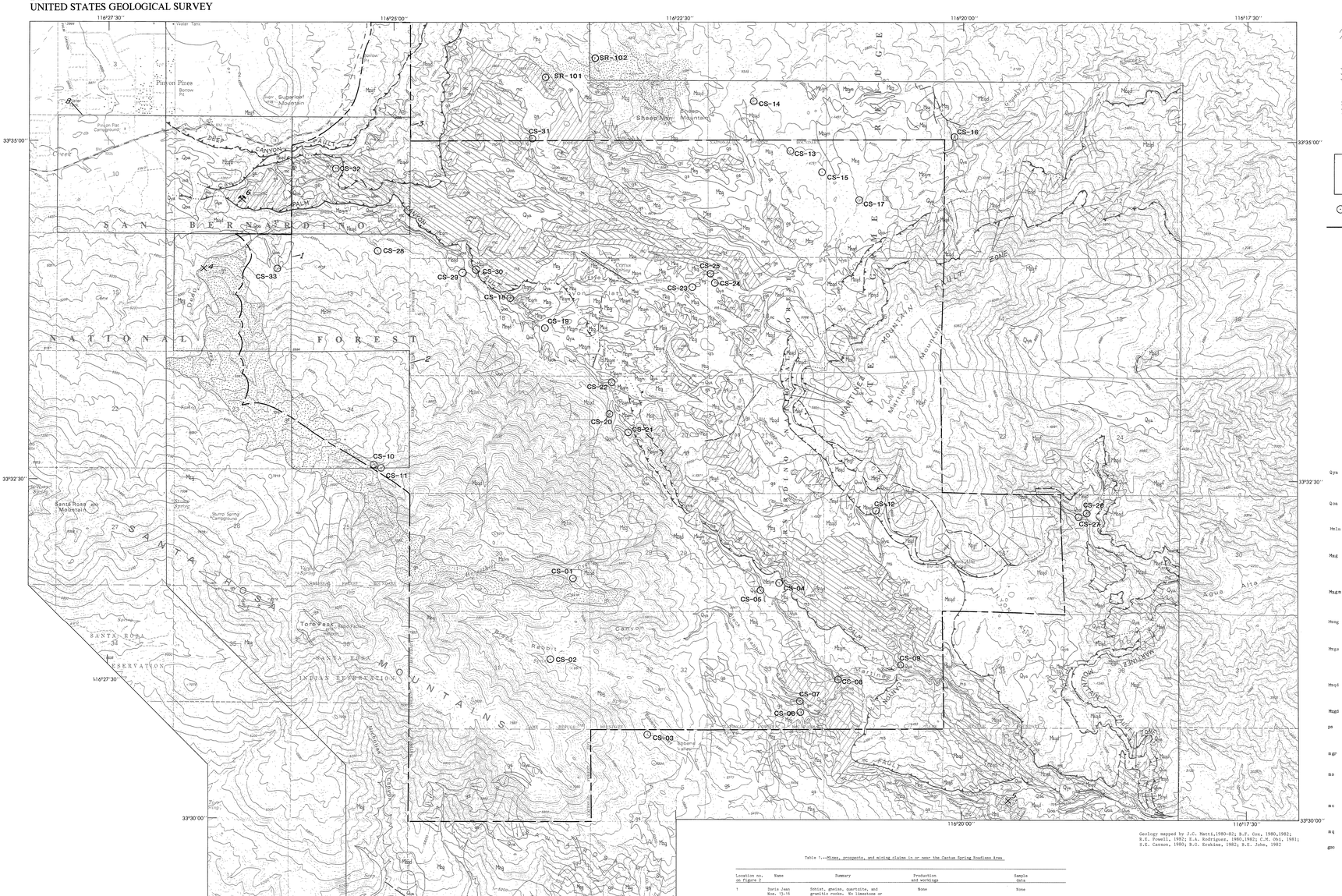
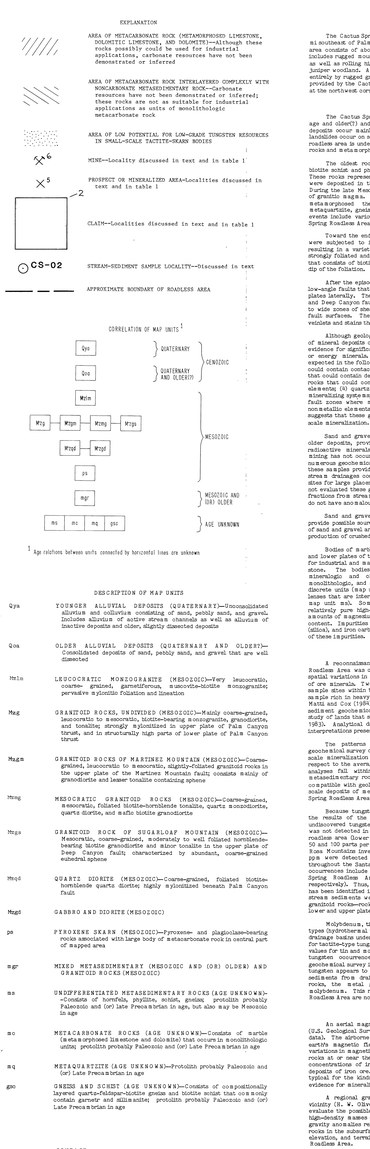
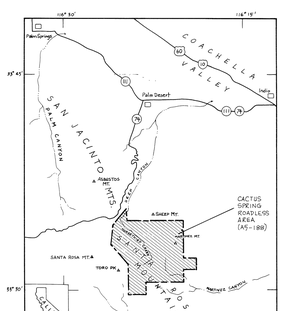


Geology mapped by J.C. Matti,1980-82; B.F. Cox, 1980,1982; R.E. Powell, 1982; E.A. Rodriguez, 1980,1982; C.M. Obi, 1981; S.E. Carson, 1980; B.C. Erskine, 1982; S.E. John, 1982

Table 1.--Mines, prospects, and mining claims in or near the Cactus Spring Roadless Area.

Location no. on figure 2	Name	Summary	Production and workings	Sample data
1	Doris Jean Nos. 13-16 (claims)	Schist, gneiss, quartzite, and granitic rocks. No limestone or tactite observed.	None	None
2	Doris Jean Nos. 17-20 (claims)	Schist, gneiss, quartzite, and granitic rocks. No limestone or tactite observed.	None	None
3	Helen Ann Nos. 1-4 (claims)	Schist, gneiss, marble, and granitic rocks.	None	None
4	Pigeon Creek (prospect)	Tactite lens containing scheelite and molybdenite exposed for 40 ft along contact with granitic intrusive rock; minor shearing at the contacts. Tactite float from the lens can be traced about 200 ft in a N. 75° E. direction. Tactite boulders ranged from 2 ft to 10 ft in diameter.	No recorded production; adit 20 ft long; pits 5 ft to adit, about 10 ft, trending N. 75° E.; pit 5 ft by 5 ft.	One chip sample from portal of caved adit contained 0.08 percent molybdenite. Float samples gave grab sample contained 0.01 percent WO_3; three select high-grade samples contained 0.04, 0.31, and 0.65 percent WO_3.
5	Miller Ranch (prospect)	Tungsten-bearing tactite in gneissic metasedimentary rock striking N. 45° W. and dipping 45° NE. Spotty mineralization occurs between schist and gneiss.	No recorded production. Adit 25 ft; raise 20 ft; trench 30 ft; pit 10 ft by 10 ft.	Four chip samples contained WO_3 ranging from 0.024 to 0.098 percent; one select stockpile sample contained 0.279 percent WO_3.
6	Dolomite mine (quarry)	Calcitic and dolomitic marble exposed, greater than 80 ft thick; layers of different crystalline size. Marble weathers to buff color and is friable.	No recorded production, although quarry workings indicate that a small amount of rock has been removed. Quarry, 200 ft by 80 ft, with a highwall of 80 ft.	None


EXPLANATION
AREA OF METACARBONATE ROCK (METAMORPHOSED LIMESTONE, DOLOMITIC LIMESTONE, AND DOLOMITE)—Although these rocks possibly could be used for industrial applications, carbonate resources have not been demonstrated or inferred
AREA OF METACARBONATE ROCK INTERLAYERED COMPLEXLY WITH NONCARBONATE METASEDIMENTARY ROCK—Carbonate resources have not been demonstrated or inferred; these rocks are not suitable for industrial applications as units of monolithologic metacarbonate rock
AREA OF LOW POTENTIAL FOR LOW-GRADE TUNGSTEN RESOURCES IN SKARN-, AND TACTITE-BEARING ROCKS
MINE—Locality discussed in text and in table 1
PROSPECT OR MINERALIZED AREA—Localities discussed in text and in table 1
CLAIM—Localities discussed in text and in table 1
STREAM-SEDIMENT SAMPLE LOCALITY—Discussed in text
APPROXIMATE BOUNDARY OF ROADLESS AREA
CORRELATION OF MAP UNITS[1]
Qyo QUATERNARY
Qoa QUATERNARY AND OLDER(?)
GENOZOIC
Mzin
Mzg Mzgm Mzmg Mzgs
MESOZOIC
Mzsd Mzqd
ps
mgr
MESOZOIC AND (OR) OLDER
ms mc mq gso
AGE UNKNOWN
[1] Age relations between units connected by horizontal lines are unknown
DESCRIPTION OF MAP UNITS
Qya YOUNGER ALLUVIAL DEPOSITS (QUATERNARY)—Unconsolidated alluvium and colluvium consisting of sand, pebbly sand, and gravel. Includes small areas of active stream channels as well as alluvium of inactive deposits and older, slightly dissected deposits
Qoa OLDER ALLUVIAL DEPOSITS (QUATERNARY AND OLDER)—Consolidated deposits of sand, pebbly sand, and gravel that are well dissected
Mzin LEUCOCRATIC MONZOGRANITE (MESOZOIC)—Very leucocratic, coarse-grained, garnet-bearing, muscovite-biotite monzogranite pervasive plumitic foliation and lineation
Mzg GRANITOID ROCKS, UNDIVIDED (MESOZOIC)—Mainly coarse-grained, leucocratic to mesocratic, biotite-bearing monzogranite, granodiorite, and tonalite; strongly mylonitized in upper plate of Palm Canyon thrust, and in structurally high parts of lower plate of Palm Canyon thrust.
Mzgm GRANITOID ROCKS OF MARTINEZ MOUNTAIN (MESOZOIC)—Coarse-grained, leucocratic to mesocratic, slightly-foliated granitoid rocks in the upper plate of the Martinez Mountain fault; consists mainly of granodiorite and lesser tonalite containing sphene
Mzmg MESOCRATIC GRANITOID ROCKS (MESOZOIC)—Coarse-grained, mesocratic, foliated biotite-hornblende tonalite, quartz monzodiorite, quartz diorite, and mafic biotite granodiorite
Mzgs GRANITOID ROCK OF SUGARLOAF MOUNTAIN (MESOZOIC)—Mesocratic, coarse-grained, moderately to well foliated hornblende-bearing biotite granodiorite and minor tonalite in the upper plate of Deep Canyon fault; characterized by abundant, coarse-grained euhedral sphene
Mzqd QUARTZ DIORITE (MESOZOIC)—Coarse-grained, foliated biotite-hornblende quartz diorite; highly mylonitized beneath Palm Canyon fault
Mzgd GABBRO AND DIORITE (MESOZOIC)
ps PYROXENE SKARN (MESOZOIC)—Pyroxene- and plagioclase-bearing rocks associated with large body of metacarbonate rock in central part of mapped area
mgr MIXED METASEDIMENTARY (MESOZOIC AND (OR) OLDER) AND GRANITOID ROCKS (MESOZOIC)
ms UNDIFFERENTIATED METASEDIMENTARY ROCKS (AGE UNKNOWN)—Consists of hornfels, phyllite, schist, gneiss; protolith probably Paleozoic and (or) Late Precambrian in age, but also may be Mesozoic in age
mc METACARBONATE ROCKS (AGE UNKNOWN)—Consists of marble (metamorphosed limestone and dolomite) that occurs in unidiologic units; protolith probably Paleozoic and (or) Late Precambrian in age
mq METAQUARTZITE (AGE UNKNOWN)—Protolith probably Paleozoic and (or) Late Precambrian in age
gso GNEISS AND SCHIST (AGE UNKNOWN)—Consists of compositionally layered quartz-feldspar-biotite gneiss and biotite schist that contains only contain garnet and sillimanite; protolith probably Paleozoic and (or) Late Precambrian in age
CONTACT
FAULT—Dashed where approximately located; dotted where concealed. Bar and ball on downthrown block; barbs indicate scarp
LOW-ANGLE FAULT—Dashed where approximately located; dotted where concealed. Sawteeth on upper plate
LANDSLIDE DEPOSIT—Arrows show inferred direction of movement
STUDIES RELATED TO WILDERNESS
The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands to determine their mineral resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral resource potential survey of the Cactus Spring Roadless Area (RA-1650) San Bernardino National Forest, Riverside County, California. The Cactus Spring Roadless Area was classified as a further planning area during the Second Roadless Area Review and Evaluation (RARE-II) by the U.S. Forest Service, January 1979.
SUMMARY
Geologic, geochemical, and geophysical studies, together with an investigation of mines, claims, and prospects, indicate that the Cactus Spring Roadless Area has no demonstrated or inferred mineral resources[1] or energy resources. Throughout most of the roadless area, we did not observe indications of potential for these resources. However, a metasedimentary pendant in the southwest part of the roadless area has low potential for low-grade tungsten resources. At nearby localities outside of the roadless area, the tungsten-bearing mineral scheelite has been identified in metasedimentary tactite lenses where metasedimentary rocks have been intruded by granitoid rock. In the Cactus Spring Roadless Area, undiscovered occurrences of tungsten-bearing tactite may be present but are not likely to be economically significant because they would probably be small in size and probably would contain low-grade tungsten resources. Marble units that contain tungsten-bearing tactite occurrences identified elsewhere in the Santa Rosa Mountains.
Bodies of marble (metamorphosed limestone and dolomite) in the northern part of the roadless area constitute possible nonmetallic resources. The marble bodies could provide (1) crushed aggregate for roofing granules, road base, riprap, and decorative stone, and (2) lime and magnesium for cement and for industrial and manufacturing applications. Many marble units are interlayered complexly with non-carbonate metasedimentary rocks, have variable magnesium content, and contain variable amounts of impurities in the form of chert nodules, calc-silicate minerals, and iron. Other marble units are monolithologic and consist of relatively pure high-calcium carbonate. We have not evaluated the quality, quantity, or applicability of resources represented by the metacarbonate rocks.
[1]The definition of resources follows established usage of the U.S. Bureau of Mines and U.S. Geological Survey (1980): "A concentration of naturally occurring solid, liquid, or gaseous material in or on the Earth crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible." Defined in this broad fashion, a resource can contain extractable material (reserves) that can be delayed, now, and (or) additional material (marginal reserves, subeconomic resources) that feasibly may be developed in the future under more favorable market conditions and (or) with more advanced technological capability.
INTRODUCTION
The Cactus Spring Roadless Area is located in the Santa Rosa Mountains, about 25 mi southeast of Palm Springs and about 10 mi south of Palm Desert, Calif. The roadless area consists of about 30 mi² of land within the San Bernardino National Forest, and includes rugged mountainous terrain covered with coniferous forest and dense chaparral as well as rolling high-desert terrain that supports a blend of desert scrub and pinyon-juniper woodland. Access to the roadless area is limited because it is surrounded almost entirely by rugged ground that has no roads and few established trails. Limited access is provided by the Cactus Spring Road, a dirt road that originates near California State Highway 74 at the northwest corner of the roadless area.
GEOLOGY
The Cactus Spring Roadless Area is underlain by surficial deposits of Quaternary age and older(?) and by crystalline bedrocks of Mesozoic and older age. The surficial deposits occur mainly in stream valleys that contain thin deposits of sand and gravel; landslides occur on some hillslopes, especially in the vicinity of Martinez Mountain. The crystalline rocks are underlain mainly by crystalline bedrocks that consist of plutonic igneous rocks and metamorphosed sedimentary rocks.
The oldest rocks in the area are metasedimentary units that include hornfels, biotite schist and gneiss, quartzite, and calcareous and dolomitic marble. These rocks represent accumulations of clay, silt, sand, and calcareous sediment that were deposited in the sea, probably during the Paleozoic and (or) Late Precambrian. During the late Mesozoic, the sedimentary rocks were intruded by large plutonic bodies of granitic magma. High temperature and pressure associated with these igneous events metamorphosed the sedimentary rock to amphibolite-grade schist, phyllite, metaquartzite, gneiss, and marble. The igneous bodies produced during these plutonic events include various types of granitoid rock that crop out over much of the Cactus Spring Roadless Area (rock classification follows Streckeisen, 1973).
Toward the end of the plutonic and metamorphic events, some parts of the region were subjected to intense ductile shearing that pulverized and flattened the rocks, resulting in a variety of deformational fabrics. In the deformed zones, the rocks are strongly foliated and mylonitized and exhibit a conspicuous northeast-plunging lineation that consists of biotite and quartz concentrations that have been streaked out down the dip of the foliation.
After the episodes of ductile deformation, episodes of brittle deformation produced low-angle faults that broke rocks in the study area into slabs or plates and carried these plates laterally. These low-angle faults include the Palm Canyon, Martinez Mountain, and Deep Canyon faults. The brittle faults and fault zones are characterized by narrow to wide zones of sheared, crushed, and fractured rock that contain one or more distinct fault surfaces. The fault zones exhibit chloritic alteration, and locally contain pink mylonite and stains that appear to be potassic feldspar.
Although geologic environments that commonly are favorable for the development of mineral deposits occur in the Cactus Spring Roadless Area, we did not observe field evidence for significant occurrences of precious and base metals, nonmetallic minerals, or energy minerals. Favorable sites for mineralization in the study area might be expected in the following generalized geologic settings: (1) metasedimentary rocks that could contain contact-metamorphic or metasomatic replacement deposits; (2) injection paragenesis that could contain deposits of metallic or radioactive elements; (3) hydrothermal granitoid rocks that could contain disseminated deposits of metallic, radioactive, or rare-earth elements; (4) quartz veins or other vein-type deposits that result from hydrothermal mineralizing systems; and (5) granitic rock and crushed, sheared, and fractured rock of fault zones where mineralizing systems may have produced deposits of metallic and nonmetallic minerals. Our examination of rocks within the Cactus Spring Roadless Area suggests that these generalized geologic environments have not been the sites of large-scale mineralization.
Sand and gravel deposits, including younger alluvial deposits as well as dissected older deposits, provide potential sites for placer accumulations of precious metals, radioactive minerals, or minerals containing rare-earth elements. However, placer mining has not occurred in the Cactus Spring Roadless Area historically. We obtained nineteen geochemical samples of fresh sediment deposited by active stream; none of these samples provides geochemical evidence of placer accumulations, and none of the stream drainages contains large areas of alluvium. Most of the alluvium is in small areas of thin sand and gravel. We did not sample the older gravel units and thus have no data for these deposits. Areas of alluvium adjacent to areas underlain by other gravel deposits do not have anomalous elemental abundances.
Sand and gravel deposits and granitic rocks in the Cactus Spring Roadless Area provide possible sources of aggregate and riprap for construction uses, although deposits of sand and gravel are thin and limited in extent in the study area. Granitic rock for the production of crushed aggregate, decorative granite, and riprap is abundant.
Bodies of marble (metamorphosed limestone and dolomite) that occur in the upper and lower plates of the Palm Canyon fault are possible sources of (1) lime and magnesia for industrial and manufacturing applications, and (2) crushed aggregate and construction stone. The bodies of metacarbonate rock vary in thickness, lateral continuity, mineralogy, and chemical composition, and partly. Some marble units are monolithologic, and are so thick and laterally continuous that they can be mapped as discrete units (map unit) other marble outcrops consist of discontinuous layers and lenses that are interlayered complexly with schist, gneiss, and metaquartzite (parts of map unit ms). Some lenses and bodies of marble are white to light gray, and are relatively pure high-calcium marble. Other marble layers and bodies have varying amounts of magnesium, culminating in brownish-colored dolomite having high magnesium content. Impurities such as calc-silicate minerals (garnet, tremolite, scrotolite), chert (silica), and iron carbonate occur in some marble bodies, although many appear to be free of these impurities.
GEOCHEMISTRY
A reconnaissance geochemical survey of stream sediment in the Cactus Spring Roadless Area was conducted for 32 major, minor, and trace elements to identify any spatial variations in stream-sediment chemistry that might reflect local concentrations of ore minerals. Two samples of sandy stream alluvium were collected from each of 13 sample sites within the study area: a bulk-sediment sample, and a panned-concentrate sample rich in heavy minerals. The results of the geochemical survey are discussed by Watts and Cox (1984, The U.S. Geological Survey conducted a more extensive stream-sediment geochemical survey in the Santa Rosa Mountains during a mineral resource study of lands that surround the Cactus Spring Roadless Area (D. Madden, unpubl. data, 1983). Analytical data from the broader based Santa Rosa Mountains study reinforce interpretations presented herein.
The patterns of chemical composition determined by the stream-sediment geochemical survey of the Cactus Spring Roadless Area do not indicate significant large-scale mineralization within the study area. Few elemental values are anomalous with respect to the average geochemical background for the study area; instead, most of the analyses fall within ranges that are reasonable for nonmineralized rocks and stream sediments derivative stream sediment. Geochemical evidence that is compatible with geologic evidence: both reconnaissance techniques suggest that large-scale deposits of metallic or nonmetallic minerals probably do not occur in the Cactus Spring Roadless Area.
Because tungsten-bearing tactite occurs elsewhere in the Santa Rosa Mountains, the results of the geochemical survey could have bearing on the distribution of undiscovered tungsten occurrences within the Cactus Spring Roadless Area. Tungsten was not detected in bulk-sediment or panned-concentrate samples collected within the roadless area (lower detection limits in bulk-sediment and panned-concentrate media = 50 and 100 parts per million, ppm). However, analytical results from the adjacent Santa Rosa Mountains study indicate that tungsten was detected in samples as low as 50 ppm were detected in panned-concentrate fractions from several localities scattered throughout the Santa Rosa Mountains (D. Madden, unpubl. data, 1983). These tungsten occurrences include two panned-concentrate samples collected adjacent to the Cactus Spring Roadless Area (localities SR-101 and SR-102, 200 ppm and 300 ppm, respectively). Thus, although tungsten was not detected in the roadless area, the metal has been identified in stream sediments elsewhere in the Santa Rosa Mountains. These stream sediments were derived from calcareous metasedimentary rocks and associated granitoid rocks--rock types similar to those that crop out in the roadless area in the lower and upper plates of the Palm Canyon fault.
Molybdenum, tin, copper, and gold can be associated with tungsten in some deposit types (hydrothermal veins and tactite bodies). Localities CS-08, CS-25, and CS-32 are in drainage basins underlain by metasedimentary and granitoid rocks that are possible sites for tactite-type tungsten occurrences, and samples from these localities contain elevated values for tin and molybdenum. Although these elements are known to be pathfinders for tungsten occurrences in other regions, results from the Santa Rosa Mountains geochemical survey indicate that in the lower and upper plates of the Palm Canyon fault, tungsten appears to be a pathfinder for itself: where tungsten was detected in stream sediments from drainage basins that might contain tactite-bearing metasedimentary rocks, the metal generally is not associated with elevated values of tin and molybdenum. This relationship suggests that tin and molybdenum in the Cactus Spring Roadless Area are not pathfinders for tungsten but instead have a separate source.
GEOPHYSICS
An aeromagnetic survey of the Cactus Spring Roadless Area was flown in 1981 (U.S. Geological Survey, 1982). The data have been analyzed by H. W. Oliver (unpub. data). The airborne magnetic survey measured variations in the total intensity of the earth's magnetic field over the Cactus Spring Roadless Area and vicinity. Slight variations in magnetic intensity are caused by uneven distribution of iron-rich minerals in rocks at or near the earth's surface. Therefore, a magnetic survey can help identify concentrations of iron-rich minerals or other minerals that may be associated with deposits of iron ore. The magnetic patterns and anomalies within the study area are typical for the kinds of crystalline rocks exposed here, and there is no aeromagnetic evidence for mineralization within the Cactus Spring Roadless Area.
A regional gravity survey was made of the Cactus Spring Roadless Area and vicinity (H. W. Oliver, unpub. data, 1983). The purpose of the limited survey was to evaluate the possible existence of unexposed bodies of metasedimentary rock or other high-density masses caught up as xenoliths within the granitoid rocks. The presence of gravity anomalies related to such unexposed rocks might indicate mineralized bodies of rocks in the subsurface of the study area. After correction for differences in latitude, elevation, and terrain effects, gravity is nearly constant throughout the Cactus Spring Roadless Area.
Magnetic and gravity measurements both suggest that granitoid and metasedimentary rocks within the Cactus Spring Roadless Area are relatively homogeneous. Both sets of geophysical data argue against the presence of rock bodies having unusually high or low values of magnetics or density.
MINING DISTRICTS AND MINERALIZATION
Personnel from the U.S. Bureau of Mines Western Field Operations Center, Spokane, Washington, studied mineral resources of the Cactus Spring Roadless Area in 1982 (Kuizon, 1983). County mining records were examined to determine claim locations; and library research was done to provide historical, geologic, and mineral resource data. Field studies included examination and mapping of claims, mines, and prospects. Mines, prospects, and claims examined in the Cactus Spring Roadless Area are described in table 1.
No mines were active in the vicinity of the Cactus Spring Roadless Area in 1982, and there is no record of mineral production from the area. Twelve placer claims located for tungsten occur within the study area (Loc. 1, 2, 3). These claims and several adjacent claims (in Secs. 4, 5, 8, 9, 10, and 11 (T. 7S., R. 3E.)) were located across a narrow belt of metacarbonate rock informally referred to in local usage and in some unpublished reports as the "Nightingale Limestone" or known as the Beckerman-Lucas limestone deposit, named for some of the principals involved. A small belt of marble occurs at the Helen Ann claims (reported by Wright, 1945, p. 11), but we did not observe marble at any other claims in the study area. The Dolomite mine has produced calcitic and dolomitic marble for roofing granules and decorative stone. Chemical-grade high-calcium limestone and marble occur in other claims of the Nightingale group (unpublished report on the mineral resources of Riverside County, reproduced with the California Division of Mines and Geology); however, all of these claims were inactive in 1982. Claims in the study area located for limestone probably were located to cover possible extensions of the marble deposits beyond their known or identified occurrence.
In the Santa Rosa Mountains, numerous old prospects were located for gold and tungsten between Toro Peak and the Garnet Queen mine (about 3.5 mi. west of the roadless area). The tungsten mineral scheelite occurs in small-scale, calc-silicate tactite-skarn lenses along the contact between metasedimentary and granitic rocks. Most of the known tactite lenses are associated with a large northwest-trending metasedimentary pendant that occurs southwest of the study area; this pendant does not enter the roadless area. However, similar metasedimentary pendants intruded by granitoid rock occur within the roadless area, and two small tungsten-bearing tactite occurrences within these pendants have been identified by prospectors just outside of the roadless-area boundaries (the Pigeon Creek and Miller Ranch prospects, locs. 4, 5).
ASSESSMENT OF MINERAL RESOURCE POTENTIAL
Geologic, geochemical, and geophysical studies, together with an investigation of mines and prospects, indicate that the Cactus Spring Roadless Area has no demonstrated or inferred mineral or energy resources. Throughout most of the roadless area we did not observe indications of potential for these resources. However, a metasedimentary pendant that enters the roadless area from the southwest has low potential for low-grade tungsten resources in small-scale tactite occurrences. Bodies of marble (metamorphosed limestone and dolomite) crop out extensively in the northern part of the roadless area, and these rocks possibly could be used for industrial applications. These mineral resource assessments are based on the following considerations:
(1) Geologic mapping within the Cactus Spring Roadless Area revealed several geologic environments potentially favorable for metallic and nonmetallic mineralization. However, we did not observe evidence of significant mineral occurrences that might have formed in these geologic environments.
(2) Generally low concentrations of metallic, nonmetallic, and radioactive elements, determined by chemical analyses from 33 bulk-sediment and panned-concentrate samples, indicate that significant mineralization did within not occur exposed in the roadless area. Results from the geochemical survey of the Santa Rosa Mountains indicate that tungsten values (50 to 700 ppm) in panned-concentrate samples derived from granodiorite in the upper plate of the Martinez Mountain fault reflect a tin-molybdenum association that characterizes the Martinez Mountain terrane. Values for these metals represent relatively high background probably related to rock-forming non-ore minerals like sphene and magnetite. Tin values (50 to 70 ppm) in panned-concentrate samples derived from the lower and upper plates of the Palm Canyon fault also reflect regionally high background levels for tin.
(3) Aeromagnetic and gravity patterns do not indicate anomalous concentrations of magnetic minerals or the presence of rock bodies having anomalously high or low density.
(3) Within the roadless area, prospecting activities have been limited and short-lived, no production has been reported, and no large or small occurrences of metallic, nonmetallic, or radioactive minerals have been discovered. Several claims for limestone have been located within the study area. Numerous old claims located for tungsten and gold occur in metasedimentary rocks and associated granitoid rocks adjacent to the roadless area, but no claims for metallic minerals have been located within the boundary of the area.
Discussion of nonmetallic resources
Sand and gravel and granitic rock
In the Cactus Spring Roadless Area, deposits of sand and gravel provide possible sources of aggregate and riprap for construction uses. However, both younger and older deposits of alluvium are thin and limited in areal extent. Thick, extensive, and easily accessible deposits of sand and gravel occur in the Coachella Valley; local sources of sand and gravel occur adjacent to the roadless area in the vicinity of Pinyon Flat. Granitic rocks provide possible sources of crushed or decomposed aggregate and riprap. However, granitic rocks of equal quality and better accessibility are widespread in the Santa Rosa and San Jacinto Mountains.
Metacarbonate rocks
Bodies of marble (metamorphosed limestone and dolomite) that occur in the upper and lower plates of the Palm Canyon fault are possible sources of (1) crushed aggregate for roofing granules, decorative stone, and road base; (2) riprap and building stone for construction purposes; and (3) lime for cement and chemicals, and lime and magnesia carbonate for industrial and manufacturing applications. We have not assessed the quality and quantity of carbonate-rock resources present in the Cactus Spring Roadless Area, nor have we identified which marble bodies are suitable for specific industrial applications (see Bowen and others, 1973, for a discussion of the types and uses of limestone-dolomite resources). However, we have noted the geologic features of marble units within the roadless area, and we have summarized what is known about the grade and quality of carbonate rocks that occur in prospects adjacent to the area.
Depending on their extent and quality, the different kinds of marble could be used for different purposes. All the marble units could be used for various kinds of crushed and quarried aggregate and stone. High-calcite marble possibly could be exploited for portland cement and for the manufacture of chemicals, and some magnesia-calcite marbles could be used for the latter flux. Because the metacarbonate units have variable composition, quality, thickness, and extent, and because many carbonate layers are associated with non-carbonate metasedimentary rocks, the entirety bulk of marble would have to be mapped and sampled carefully in order to evaluate the quantity and quality of specific resources.
The possible resource value of metacarbonate rocks within the Cactus Spring Roadless Area will be variable, and will depend on the specific application of the marble commodity. The physical characteristics and variable composition of the marble bodies may preclude their use except for crushed aggregate and building stone. Alternatively, the physical characteristics and composition of some of the marble bodies may permit them to be exploited for high-technology or high-demand applications like portland cement, chemicals, or similar flux.
The resource value of carbonate rocks that occur within the Cactus Spring Roadless Area must be evaluated within the context of antiquated needs nearby and farther afield, and within the context of carbonate-rock resources identified and developed elsewhere. Local demand for crushed and quarried aggregate derived from carbonate rocks can be met by nearby occurrences of marble at the Dolomite mine, at other claims within the Nightingale group, and at marble deposits in the Wildcat claim 5 mi west of the study area (Brown, 1980). Abundant alternative sources of crushed and quarried noncarbonate aggregate for local consumption are provided by granitic rocks outside the roadless area. Farther afield, demand for lime used in portland cement and other industrial applications could arise from urban expansion in the Coachella Valley and from expanding urban centers throughout southern California. Regional demand for carbonate-rock products historically has been met by production of carbonate-rock resources in southern California (see Carbonate-rock resources in the San Jacinto Mountains, Riverside County, California, and Carbonate-rock resources in the Santa Ana Mountains, Bowen and others, 1973, Bowen, 1980, Gray and Bowen, 1980, and Gray, 1962). The fact that carbonate deposits within the Cactus Spring Roadless Area previously have not been developed may reflect their physical setting and geologic character, high transportation and development costs, lack of abundant water, or insufficient market demand.
Discussion of tungsten potential
A pendant of a metasedimentary rocks in the southwestern part of the Cactus Spring Roadless Area has low potential for low-grade tungsten resources in isolated, small-scale tactite-skarn bodies. The potential is low for three reasons
(1) Geologic setting--We examined the rocks of this pendant along several traverses, and observed that the geologic setting generally is not conducive to large-scale mineralization by the metasomatic processes that produce skarn-type tungsten deposits. The metasedimentary body consists mostly of biotite schist, gneiss, and phyllite; the body contains only minor calcareous phyllite and thin discontinuous layers of metacarbonate rock that would be potential sites for skarn mineralization. Thus, any undiscovered lenses or bodies of tungsten skarn within this metasedimentary pendant are likely to be small.
(2) Geochemical evidence--We collected four stream-sediment samples from drainages that contain outcrops of the metasedimentary pendant. None of these samples contained detectable tungsten, or anomalous values for metallic elements like tin and molybdenum that commonly are geochemical pathfinders for tungsten or occur in association with that metal.
(3) Analogy with identified occurrences--The Pigeon Creek tungsten prospect (loc. 4) occurs at the northwestern edge of the metasedimentary pendant, just outside the roadless-area boundary. Here, tungsten occurs in a small-scale tactite occurrence that contains no resources. The Miller Ranch prospect (loc. 5) and Garnet Queen mine (3.5 mi west of the roadless area) contain similar lenses of tungsten-bearing tactite that contain no resources. Using previous experience in the Santa Rosa Mountains as a guide, it is unlikely that large-scale mineral occurrences containing tungsten resources exist in the metasedimentary pendant containing the Pigeon Creek prospect.
Based on these three arguments, we conclude that the metasedimentary pendant containing the Pigeon Creek prospect has low potential for low-grade tungsten resources in small-scale tactite-skarn bodies. Any undiscovered mineral occurrences that might exist in this area probably are not important mineral deposits; instead, these occurrences probably will be similar to those at the Pigeon Creek and Miller Ranch prospects and the Garnet Queen mine.
Elsewhere in the Cactus Spring Roadless Area and in the Santa Rosa Mountains, marble and calcareous metasedimentary rocks that have been intruded by granitoid rocks provide geologic environments where tactite-type tungsten mineralization might be expected. Although our stream-sediment geochemical survey of the roadless area did not detect tungsten, a similar survey conducted by the U.S. Geological Survey for adjacent lands indicates that tungsten locally occurs in metasedimentary rocks of the lower and upper plates of the Palm Canyon fault (D. Madden, unpub. data, 1983). Adjacent to the roadless area we have identified two zones of low potential for tungsten. However, even though a generalized occurrence model for tungsten mineralization can be recognized in rocks of the Cactus Spring Roadless Area, we did not observe any indications of tungsten potential in metasedimentary rocks other than those having low potential.
REFERENCES CITED
Bowen, O. E, Gray, C. H., Jr., and Evans, J. R., 1973, The mineral economics of the carbonate rocks: limestone and dolomite resources of California: California Division of Mines and Geology Bulletin 194, 60 p.
Brown, A. R., 1980, Limestone deposits of the Desert Divide, San Jacinto Mountains, California, in Fife, D. L., and Brown, A. R., eds., Geology and mineral wealth of the California desert: Santa Ana, California, South Coast Geological Society, p. 288-293.
Gray, C. H., Jr., 1962, Limestone resources of southern California, Part 1: Mineral Information Services, California Division of Mines and Geology, v. 15, no. 5, p. 1-5.
Gray, C. H., Jr., and Bowen, O. E., 1980, The limestone and dolomite resources of the Mojave Desert province, California, in Fife, D. L., and Brown, A. R., eds., Geology and mineral wealth of the California desert: Santa Ana, California, South Coast Geological Society, p. 150-161.
Kuizon, Lucia, 1983, Mineral investigation of the Cactus Spring RARE-II Area (No. A5-180), Riverside County, California: U.S. Bureau of Mines Open-File Report MLA 25-83, 11 p.
Matti, J. C., and Cox, B. F., 1983, Geochemical map of the Cactus Spring Roadless Area, Riverside County, California: U.S. Geological Survey Miscellaneous Field Study Map MF-1650-B, (scale 1:24,000).
Sharp, R. V., 1973, Some characteristics of the eastern Peninsula Ranges mylonite zone: Analysis of actual fault zones in bedrock, U.S. Geological Survey Open-File Report 79-1239, p. 258-267.
Streckeisen, A. L., 1973, Plutonic rocks: classification and nomenclature recommended by the IUGS Subcommission on the Systematics of Igneous Rocks: Geotimes, v. 18, no. 10, p. 26-30
U.S. Geological Survey, 1982, Aeromagnetic map of the Cactus Spring Roadless Area, California: U.S. Geological Survey Open-File Report 82-456.
Wright, L. B., 1946, Geology of the Santa Rosa Mountain area, Riverside County, California: California Division of Mines and Geology, 42nd Report of the State Mineralogist, p. 9-15.



INDEX MAP

Explanatory pamphlet accompanies map

MINERAL RESOURCE POTENTIAL MAP OF THE CACTUS SPRING ROADLESS AREA, RIVERSIDE COUNTY, CALIFORNIA

By
Jonathan C. Matti, Brett F. Cox, Robert E. Powell, and Howard W. Oliver
U.S. Geological Survey
and
Lucia Kuizon
U.S. Bureau of Mines

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