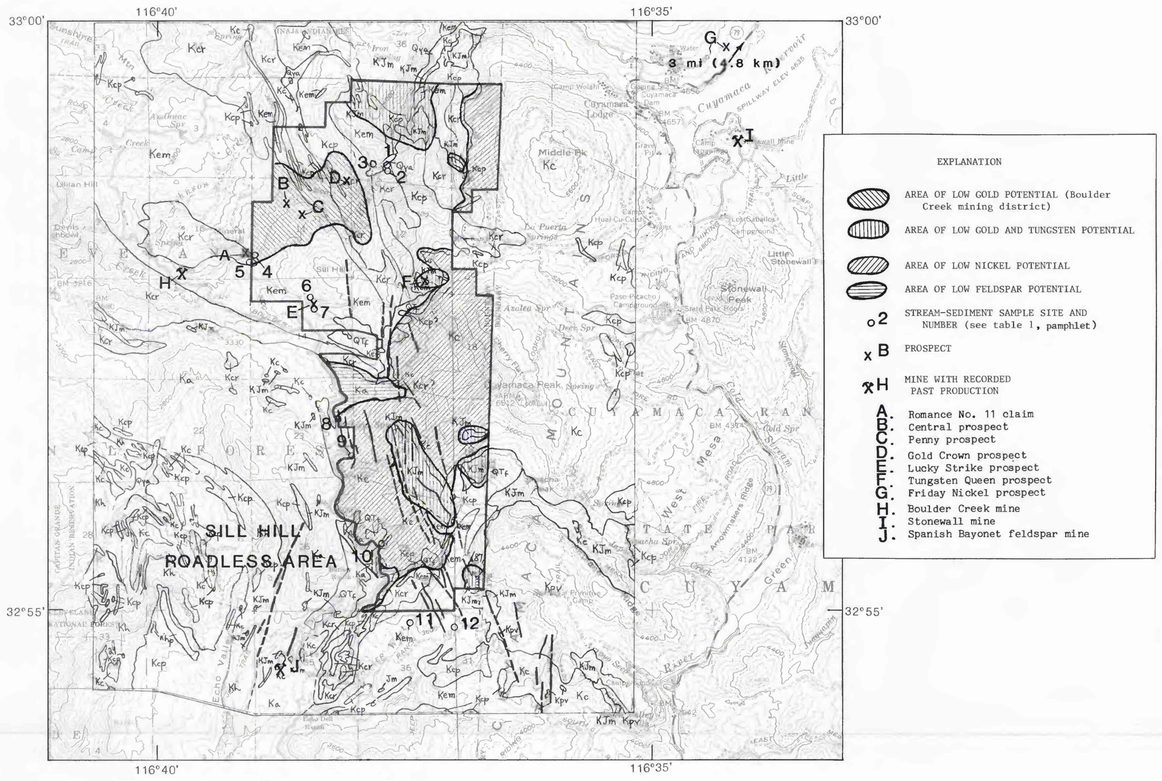
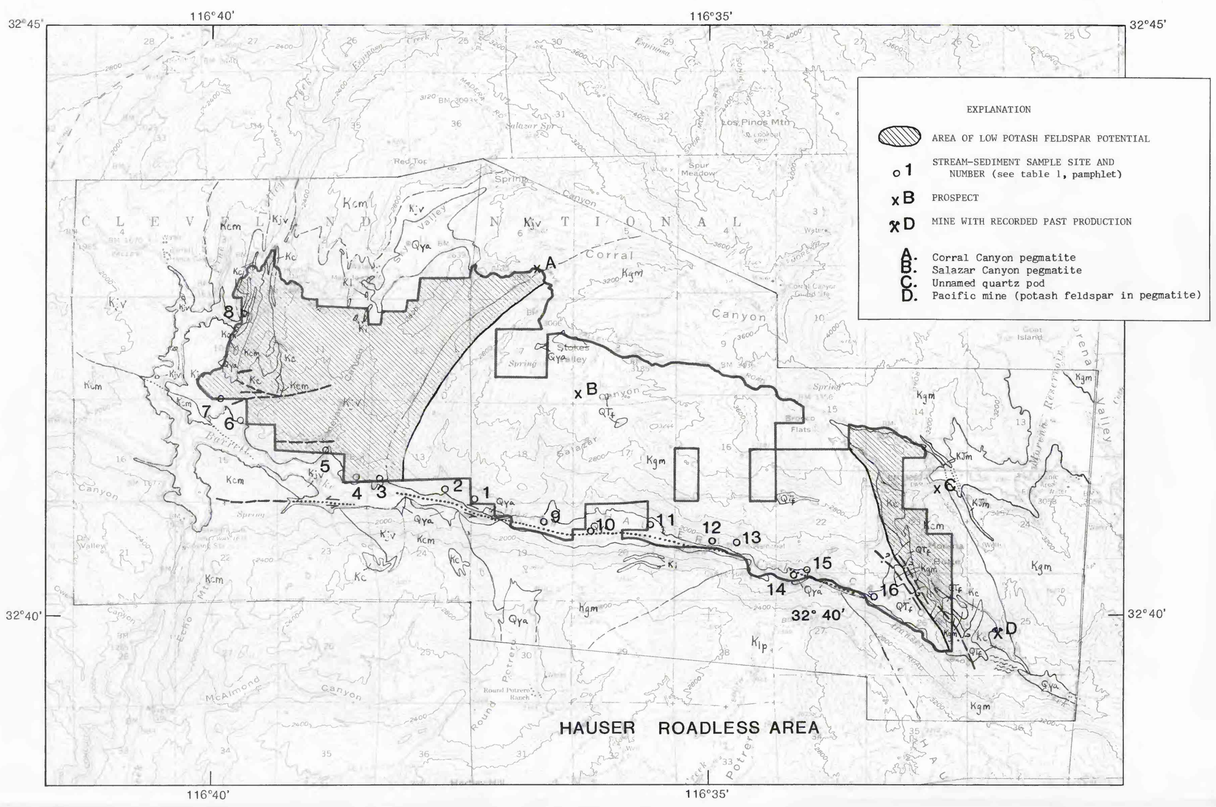
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1547-A



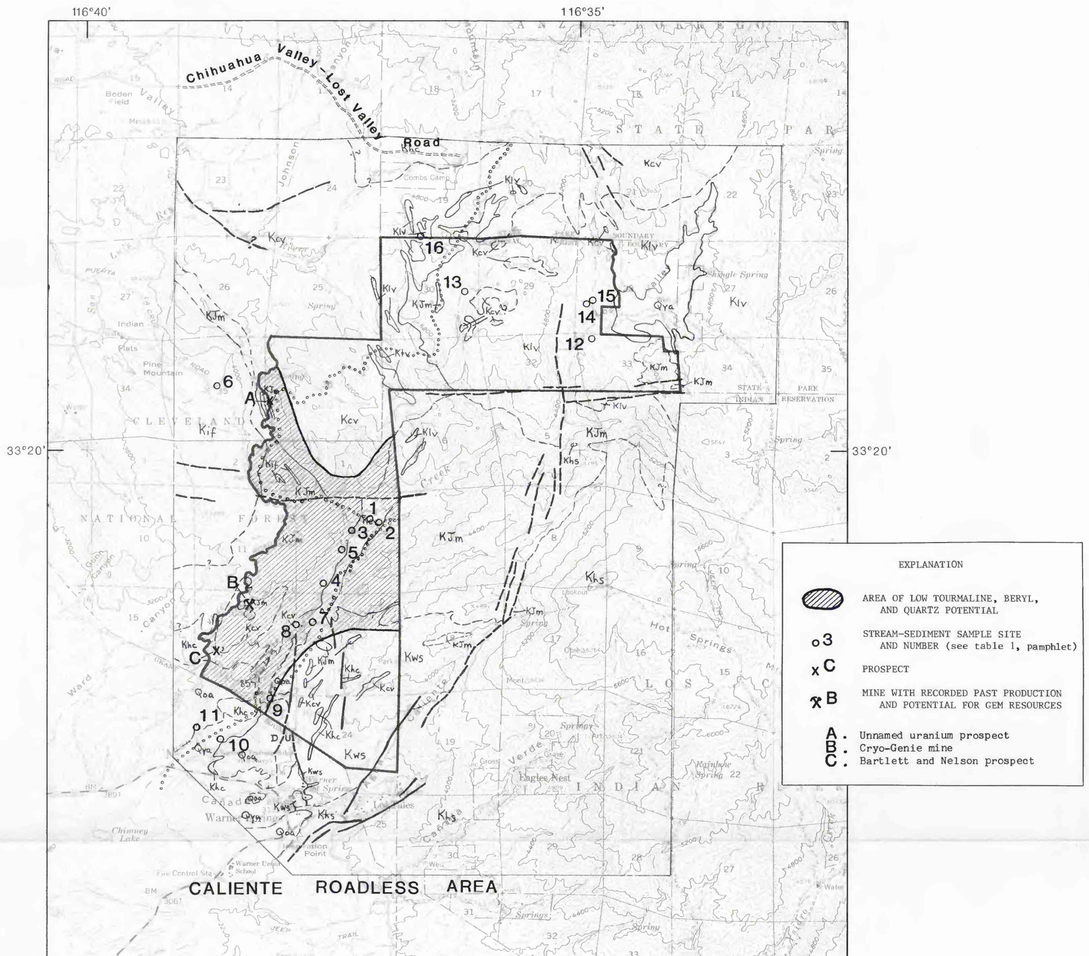
Base from U.S. Geological Survey,
Cuyamaca Peak Quadrangle, 1960

Geology by V.R. Todd
1979-80



Base from U.S. Geological Survey,
Potrero Quadrangle, 1960

Geology by V.R. Todd
1979-80



Base from U.S. Geological Survey,
Warner Springs Quadrangle, 1960

Geology by V.R. Todd
1979-80

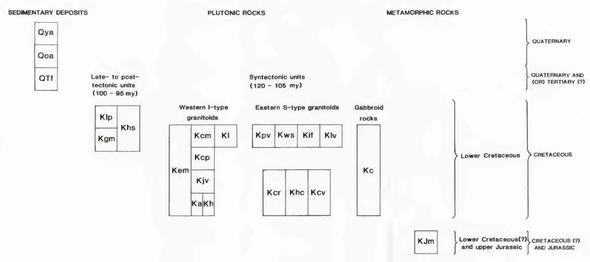
SCALE 1:62500

CONTOUR INTERVAL 80 FEET
DOTTED LINES REPRESENT 40 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

APPROXIMATE MEAN DECLINATION, 1982

AREA OF MAPS

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS*

SEDIMENTARY DEPOSITS

Qya YOUNGER ALLUVIUM (QUATERNARY)

Qoa OLDER ALLUVIUM (QUATERNARY)

QTf FANGLOMERATE (QUATERNARY AND (OR) TERTIARY ?)

PLUTONIC ROCKS

Late- to post-tectonic units

Klp TONALITE OF LA POSTA (CRETACEOUS)--Hornblende-biotite tonalite and grandiorite

Khs TONALITE OF HOT SPRINGS MOUNTAIN (CRETACEOUS)--Hornblende-biotite tonalite

Kgm TONALITE OF GRANITE MOUNTAIN (CRETACEOUS)--Biotite-hornblende tonalite

Syntectonic units (western I-type granitoids)

Kem QUARTZ DIORITE OF EAST MESA (CRETACEOUS)--Hypersthene-augite quartz diorite and biotite-hornblende tonalite

Kcm GRANITE OF CORTE MADERA (CRETACEOUS)--Biotite leucogranite and leucogranodiorite

Kl LEUCOGRANITE (CRETACEOUS)--Dikes of leucogranite, pegmatite, alaskite, and aplite

Kcp GRANITE OF CHIQUITO PEAK (CRETACEOUS)--hornblende-biotite granite and granodiorite

Kjv TONALITE OF JAPATUL VALLEY (CRETACEOUS)--Biotite-hornblende tonalite

Ka TONALITE OF ALPINE (CRETACEOUS)--Biotite-hornblende tonalite and pyroxene tonalite

Kh HYBRID MAFIC-GRANITIC ROCKS (CRETACEOUS)

Syntectonic units (eastern S-type granitoids)

Kpv GRANITE OF PINE VALLEY (CRETACEOUS)--Biotite leucogranite and leucogranodiorite

Kws LEUCOGRANITE OF WARNER SPRINGS (CRETACEOUS)--Leucogranite

Kif LEUCOGRANITE OF INDIAN FLATS (CRETACEOUS)--Leucogranite

Klv LEUCOGRANITE OF LOST VALLEY (CRETACEOUS)--Leucogranite

Kcr GRANODIORITE OF CUYAMACA RESERVOIR (CRETACEOUS) --Biotite granodiorite and hornblende-biotite tonalite

Khc GNEISS OF HARPER CREEK (CRETACEOUS)--Two-mica granodiorite gneiss

Kcv GRANODIORITE AND TONALITE OF CHIHUAHUA VALLEY (CRETACEOUS)--granodiorite, tonalite, and leucogranite

Syntectonic units (gabbroid rocks)

Kc CUYAMACA GABBRO (CRETACEOUS)--Peridotite, olivine gabbro, hornblende gabbro, and norite

METAMORPHIC ROCKS

Kjm METAMORPHOSED PREBATHOLITHIC SEDIMENTARY AND VOLCANIC ROCKS (LOWER CRETACEOUS? AND UPPER JURASSIC)

CONTACT--Dashed where approximately located, queried where indefinite, dotted where concealed

FAULT--Dashed where approximately located or inferred, queried where probable, dotted where concealed. Arrows indicate relative lateral displacement; U on upthrown side; D on downthrown side.

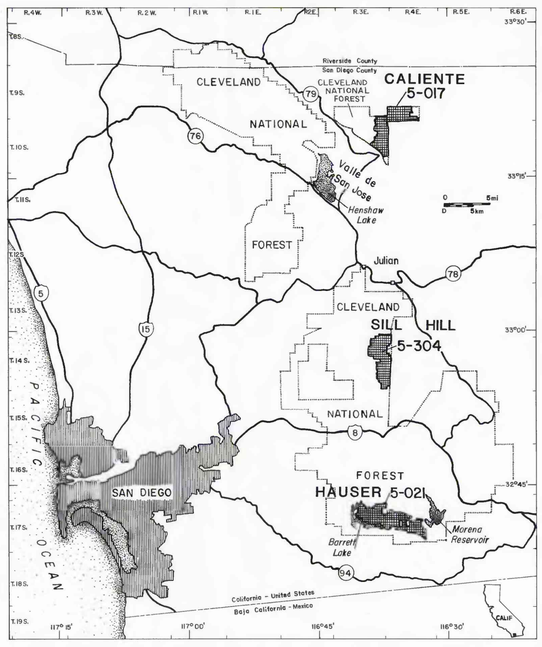
SHEAR ZONE

PACIFIC CREST TRAIL (approximate)

BOUNDARY OF GEOLOGIC MAPPING

APPROXIMATE BOUNDARY OF ROADLESS AREA

*Not all map units present in any one mapped area.



Index map for Sill Hill, Hauser, and Caliente Roadless Areas, San Diego County, California

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 Sill Hill, Hauser, and Caliente Roadless Areas in the Cleveland National Forest, San Diego County, California. The Sill Hill (5-304), Hauser (5-021), and Caliente (5-017) 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 STATEMENT

The Sill Hill, Hauser, and Caliente Roadless Areas lie within the Peninsular Ranges batholith of southern California, and they have similar geologic settings and histories. No mineral resources of economic significance were identified in any of the three areas and all three have generally low potential for the occurrence of mineral resources. Parts of the Sill Hill Roadless Area have low potential for gold, tungsten, nickel, and feldspar. The Hauser Roadless Area has low potential for significant occurrences of potash feldspar. The Caliente Roadless Area has low potential for tourmaline, beryl, quartz, and possibly other specimen minerals and gemstones. In general, none of these areas have potential geothermal, hydrocarbon, or nuclear energy resources. Although the Caliente Roadless Area is located 3,000 ft (920 m) north of an area of hot springs, there is no evidence of hot springs activity within the roadless area and potential for geothermal resources is probably low.

Introduction

The Sill Hill, Hauser, and Caliente Roadless Areas comprise 6,500, 7,600, and 5,900 acres, respectively, of the Cleveland National Forest, San Diego County, California. The three areas are located within the Cretaceous Peninsular Ranges batholith of southern California, U.S.A., and Baja California, Mexico, and have similar geologic settings and mineral potential. Total relief in the areas ranges from about 2,200 to 3,400 ft. Major drainages are Boulder Creek (Sill Hill), Cottonwood Creek (Hauser), and Agua Caliente Creek (Caliente). The roadless areas generally are characterized by rugged, brush-covered topography. Access to the areas is provided by light duty and unimproved dirt roads.

GEOLOGIC SETTING

The Sill Hill, Hauser, and Caliente Roadless Areas lie within the Cretaceous Peninsular Ranges batholith of southern California. The segment of the Peninsular Ranges batholith which lies within San Diego County accounts for approximately 1/20 of the total length of the batholith; the width of the segment here, 50 mi (80 km), is representative of the entire batholith. The western side of the batholith is concealed by Upper Cretaceous to lower Pleistocene(?) sedimentary rocks in western San Diego County. The original eastern extent is uncertain, although the batholith probably extended at least as far east as northwestern Sonora, Mexico, prior to offset by the San Andreas fault, beginning in Miocene time (Silver and others, 1979).

Batholithic rocks in San Diego County have been divided into a sequence of older plutonic rocks that formed contemporaneously with regional deformation (syntectonic sequence) and a sequence of later plutonic rocks that formed late in, or following, regional deformation (late- to post-tectonic sequence) (Hoggatt and Todd, 1977; Todd, 1977-82; Todd and Shaw, 1979). Uranium-lead zircon ages of selected rocks from the western part of San Diego County, rocks which we consider to belong to the syntectonic sequence, range from 120 to 105 m.y., whereas ages of two post-tectonic plutons are less than 100 m.y. (Silver and others, 1979). The older, syntectonic sequence was further subdivided into two belts of plutonic rocks which were derived by melting of different source materials at depth, a western belt derived from igneous source materials (I-type) and an eastern belt derived from sedimentary source materials (S-type) (Todd and Shaw, 1979).

Field relations indicate that plutons of the western part of the batholith were emplaced beneath a volcanic pile, the Lower Cretaceous Alisitos Formation in Northern Baja California and the Santiago Peak Volcanics of Late Jurassic and Early(?) Cretaceous age in San Diego County (Silver and others, 1963; Schoellhamer and others, 1981). The eastern plutons, which include plutons of middle Cretaceous age, were emplaced at greater depths, as indicated by the higher grade of metamorphism of the eastern wallrock screens and the occurrence with them of highly metamorphosed plutonic gneisses. These geologic relations are interpreted as a volcanic-plutonic-metamorphic arc which remained active from Late Jurassic to middle Cretaceous time. Sedimentary aprons, in part volcaniclastic, which had accumulated to the east of the early arc volcanoes were intruded and engulfed by plutons that show little deformation (late- to post-tectonic sequence).

GEOCHEMISTRY

Stream-sediment samples were collected from 44 locations in the three study areas, in order to determine the geographic distribution of major, minor, and trace elements which might reflect the presence of concealed mineral deposits.

Concentrations of most elements in most of the 12 stream sediments collected in the Sill Hill Roadless Area are low, within the range of geochemical background for crystalline rocks. Exceptions are: chromium, nickel, and vanadium, probably derived from the Cuyamaca Gabbro; gold associated with quartz veins in syntectonic granitic plutons; lead, tin, tungsten, and nickel, probably derived from small contact-type deposits between metasedimentary inclusions and intrusive rocks; boron from pegmatite minerals; and thorium, probably derived from zircon, allanite, and (or) monazite in granitic plutons or silicic dikes. Seven sample sites lie within the Boulder Creek mining district, which has low potential for gold. The history of mines and prospects in the study area suggests a low potential for tungsten and nickel. None of the stream-sediment samples have indicated any unknown deposits. Even though some of the known mineral occurrences are reflected in the samples, the intensity of prospecting over such a prolonged period in the past makes it very unlikely that any large unknown mineral deposits exist in the area.

Analytical results from most of 16 stream-sediment samples from the Hauser Roadless Area show no significant anomalies in elemental concentrations and therefore do not suggest the presence of significant mineralization in the study area. The lack of significant variations in geochemical abundances is consistent with the absence of identified mineral resources, indicating a low potential for the occurrence of significant mineral resources in the study area.

In the Caliente Roadless Area, the generally high, partly anomalous concentrations of boron, fluorine, uranium, yttrium, lanthanum, scandium, thorium, and zirconium in 16 stream-sediment samples probably reflect the presence of abundant tourmaline-bearing granitic pegmatite dikes and (or) the leucogranite plutons from which the dikes emanate. Generally high and locally anomalous concentrations of lead, and anomalous tungsten in one sample, may reflect the presence of tactite zones in metasedimentary remnants associated with granitic intrusive rocks. Five samples are anomalous in one or more of the elements molybdenum, silver, copper, zinc, and arsenic, a suite which is typically associated with sulfide mineralization. These samples are also anomalous in boron, fluorine, and uranium, which suggests that mineralization was associated with the development of pegmatite dikes and quartz veins. No prospects or mines in areas of sulfide mineralization have been reported in the study area, and no concentrations of sulfide minerals were observed during geologic mapping. Therefore, the anomalous concentrations probably represent small areas of low-grade mineralization in metasedimentary rocks cut by, and possibly hydrothermally altered by, granitic pegmatite and quartz dikes. The presence of anomalous gold in one sample and the show of low gold values in U.S. Bureau of Mines panned concentrates from samples south of the area do not represent a deposit of economic significance.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Sill Hill Roadless Area

Mineral occurrences within and near the Sill Hill area indicate that the study area has low potential for gold, tungsten, nickel with by-product copper, and potash feldspar. A geochemical survey of stream sediments revealed that concentrations of most major, minor, and trace elements are within the ranges expected for sediments derived from nonmineralized rocks. The overall mineral potential of the area is low, but this does not exclude the possibility of the occurrence of mineral deposits. There are known occurrences of feldspar, gold, nickel, and tungsten in and around the study area but none are even marginally viable under present or foreseeable market conditions.

In the Sill Hill roadless area, potential for specific mineral commodities is related to local geology. Areas underlain predominantly by Jurassic and Cretaceous(?) metasedimentary rocks have potential for gold deposits similar to those in the Julian mining district. Potential for tungsten deposits similar to the Tungsten Queen prospect exists in calc-silicate rocks. Local anomalous stream-sediment concentrations in lead, nickel, tungsten, and tin probably are related to similar small contact-type deposits. The part of the Boulder Creek District that lies within the study area has low gold potential.

Areas underlain by the Cuyamaca Gabbro have potential for nickel deposits. Stream sediments derived from the Cuyamaca Gabbro have relatively high geochemical backgrounds in nickel, chromium, and vanadium. There is no reason to expect that the potential for the presence of large nickel deposits within the study area is any greater than the potential within the same gabbro unit in the vicinity of the Friday Nickel prospect, 4.5 mi (7.3 km) northeast of the study area. Creasey (1946, p. 16-17) found a very low potential for a large, low-grade (syngenetic) nickel deposit, but believed that the area is worthy of consideration if a general investigation of nickel resources of the country was undertaken. Considering the limited amount of geologic terrain suitable for the occurrence of nickel within the United States, the Cuyamaca Gabbro could be an exploration target in case of a strategic need to locate domestic resources.

Areas in the southwest part of the study area underlain by the tonalite of Alpine have potential for feldspar deposits similar to the Spanish Bayonet feldspar mine located about 1 mi (1.6 km) southwest of the study area. Other granitic rocks have a low feldspar potential.

No hydrocarbon, geothermal, or radioactive energy occurrences are known in the area, and would not be expected in the rock types present.

Hauser Roadless Area

There is no evidence of potential mineral resources, either non-metallic or metallic, within the Hauser Roadless Area, with the possible exception of feldspar. Geochemical analyses of 16 samples of stream sediments showed no significant variations in concentrations of major, minor, or trace elements. Local slight geochemical anomalies in a few elements reflect the abundance of particular rock types in or near the study area.

The Hauser area has low potential for significant occurrences of potash feldspar. A field search of the area has disclosed two feldspar-bearing pegmatite occurrences. These pegmatite bodies are poorly exposed, but appear to be small and are remote from improved highways and markets. Their potential for feldspar resources is low. Potash feldspar has been defined commercially as containing 10 percent K_2O or more, but it is currently common to find 8 percent K_2O marketed (Potter, 1981). An occurrence in Corral Canyon qualifies as commercial-grade potash feldspar, but low apparent tonnage, high development costs, and remoteness from markets make it uncompetitive at this time. There is no indication of potential geothermal, hydrocarbon, or nuclear energy resources.

Caliente Roadless Area

The results of a geochemical survey of stream sediments and the absence of producing mines in the Caliente Roadless Area both indicate low potential for mineral resources. High geochemical backgrounds of boron, fluorine, uranium, yttrium, lanthanum, thorium, and zirconium are probably related to the presence of abundant granitic pegmatite dikes in the study area. An unknown, probably small quantity of mineral specimens and gemstones has been produced from the pegmatite dike at the Cryo-Genie mine. This mine produced principally tourmaline crystals, although beryl and quartz crystals also occur. The Cryo-Genie mine has potential for future, but probably limited, production of tourmaline, beryl, quartz, and possibly other mineral specimens and gemstones.

The Bartlett and Nelson prospect contains scheelite (calcium tungstate), but the potential for economic tungsten is very low, and no other mineral resources are indicated. Local anomalous concentrations of lead and tungsten in stream sediments probably were derived from tactite zones similar to that at the Bartlett and Nelson prospect. Anomalous concentrations of molybdenum, silver, copper, zinc, and arsenic in five samples probably represent low-grade sulfide mineralization in metasedimentary host rocks, perhaps small pyrite deposits associated with pegmatite and quartz dikes. An unnamed prospect in the study area contains minor uranium; no uranium resources are indicated.

Alluvial sand and gravel deposits in the study area contain only traces of placer gold. Sand and gravel are not considered to be important resources because transportation costs are a major part of total costs for these high-bulk, low-unit-value commodities.

Although there are several hot springs south of the area, there is no evidence of hot spring activity within the Caliente Roadless Area and the potential for geothermal resources is probably low. There is no evidence of potential hydrocarbon energy sources.

Explanatory pamphlet accompanies map

Interior—Geological Survey, Reston, Va.—1983

For sale by Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225

MINERAL RESOURCE POTENTIAL MAPS OF THE SILL HILL, HAUSER, AND CALIENTE ROADLESS AREAS, SAN DIEGO COUNTY, CALIFORNIA

By

V.R. Todd and R.E. Learned, U.S. Geological Survey and T.J. Peters and R.T. Mayerle, U.S. Bureau of Mines

1983