

INTRODUCTION
The Sugarloaf Roadless Area is located in the central San Bernardino Mountains of San Bernardino County, southern California (Fig. 1). Sugarloaf Mountain (9202 feet), at the center of the area, lies about 5 mi southeast of Big Bear Lake and 21 mi east-southeast of San Bernardino. The roadless area, encompassing about 14 mi² (3500 acres) within the San Bernardino National Forest, is approximately bounded to the south by the Santa Ana River and Orange Cove roads, to the north by Base Hill to the northeast by Green Canyon and Wilhorse Road, and to the west by Staircase Canyon.

GEOLOGY
The Sugarloaf Roadless Area lies within a terrane of Precambrian to Mesozoic crystalline rocks that has been investigated previously by Vaughan (1922), Riddle (1941), Cameron (1952), and Salter (1961). The mapped study area extends beyond the boundary of the roadless area. The study area includes Mesozoic and Paleozoic plutonic rocks and parts of a large province in which Precambrian gneiss is unconformably overlain by a section that includes Precambrian gneiss and Paleozoic carbonate rocks. The contact between the Precambrian gneiss and the overlying metamorphic section is faulted at a low angle to the southeast and is intersected by faults at a low angle to bedding through the metamorphic section show the basal structure. These faults are folded and are intersected by faults in the Mesozoic rocks. Along the southern margin of the study area, the crystalline rocks are faulted against folded Miocene conglomeratic rocks and basalt. The Miocene rocks rest deponently on Mesozoic quartz diorite that contains inclusions of quartzite, schist, and marble. Extensive glauconitic laminating has occurred within the study area.

We did not observe concentrations of ore minerals along any of the faults or intrusive contacts, or within any units in the roadless area. Although carbonate rocks in the area are extensively intersected by faults and intermediate plutonic rocks, we observed no significant concentration of skarn minerals. We observed no prominent veining.

GEOCHEMISTRY
A reconnaissance geochemical survey in the study area was conducted by analyzing each of 22 samples for 32 elements in order to determine spatial variations of mineral resources that might reflect local concentrations of ore minerals.

Within the study area, five elements (As, Au, Bi, Cd, Sb) were not detected in any sample. Most elements (Fe, Mg, Ca, Ti, Mn, B, Ba, Be, Co, Cu, Cr, La, Pb, Ni, Pt, Sr, Zn, V, Y, Zr) were detected in concentrations that are compatible with the ranges of estimated average elemental abundances for the types of rocks exposed in the roadless area. The presence of these elements in the stream-sediment samples of rock-core minerals that we have observed in the rocks. The remaining elements (Ag, Al, Ga, In, K, W, Mo) were detected only in some samples in slightly elevated concentrations within the lower reported intervals of their respective spectrographic detection ranges.

An association of elements (Al, Mn, Be, Sr, Th, U) that tend to be partitioned into the melt phase of magma is consistently correlated with the presence of late-crystallizing allanite in some of the plutonic rocks of the area.

GEOPHYSICS
An aeromagnetic survey of the Sugarloaf Roadless Area (U.S. Geological Survey, 1962) reveals a magnetic high of about 1,500 gamma located over mafic plutonic rocks exposed in the Sugarloaf Mountain. A gravity survey reveals a nearly coincident gravity high of about 14 milligals (Bisher and others, 1962; see also Tang and Ponce, 1962). Magnetic susceptibility and density measurements of samples of mafic rocks show average values of 8 emu (electromagnetic unit/cm³) and 3.0 g/cm³, respectively. These values are significantly greater than averages for the surrounding granitic rocks of about 1 emu/cm³ and 2.7 g/cm³, respectively. Thus, we conclude that the magnetic and gravity anomalies are caused by mafic plutonic units, rather than an undiscovers ore deposit. The geophysical surveys provide no evidence for ore deposits.

MINING DISTRICTS AND MINERALIZATION AREAS
Early claims in the study area were related to the discovery of graphite in 1850 near the confluence of Orange Cove and the Santa Ana River and in Green Canyon. Demand for crushed stone during the 1920's and 1930's attracted prospecting for carbonate rocks on the north flank of the Sugarloaf Mountain ridge and near the confluence of Orange Cove and the Santa Ana River.

Uranium occurrences in the vicinity of the study area came under scrutiny in the 1950's; the first commercial shipment of uranium from the state of California came from the Thimble Mine 1 mi northeast of the roadless area in 1954 (Trowel and others, 1971). At this locality, uranium is associated with primary hydrothermal deposits in a pegmatite dike in the Precambrian gneiss. Uranium occurrences in the roadless area are associated with secondary uranium deposits (Robert, 1961). Portland General Electric Company and Great Lakes Chemical Corporation have been conducting uranium during the late 1970's. Gold and silver occur in trace amounts in contact areas between carbonate rocks and Precambrian gneiss. A strong prospect just outside the northern boundary of the roadless area.

Approximately 300 lode claims have been recorded in or adjacent to the study area; 13 placer claims for carbonate rocks also have been located. There are no patented claims or active mineral leases in the roadless area. Descriptions of individual mines and prospects are presented in table 1.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL
Identified Mesozoic and Paleozoic mineral resources in the Sugarloaf Roadless Area consist of low-grade graphite, one and magnesian marble, and uranium. About 700,000 tons of graphite resources and 1.7 billion tons of magnesian marble resources are located within the roadless area. About 70,000 tons of graphite and 0.5 billion tons of magnesian marble are nearby, but outside the area. Resources at individual mines and prospects are listed in table 1. In the mafic schist, phyllite, and sillite units within the roadless area, there is low potential for additional low-grade graphite resources. Any undetected occurrences are most likely to contain graphite resources in grade to that of the known occurrences. Because all magnesian marble in the roadless area was used to calculate the magnesian marble resources in the area, there is no potential for additional magnesian marble resources within the area, although additional resources are present outside the area.

No uranium resources have been identified in the area, although 900,000 tons of subeconomic uranium resources occur nearby, but outside the area. Undiscovered uranium occurrences may occur within the roadless area, but any such occurrences are most likely to contain uranium resources of similar or lower grade to that of the known deposit. We assign a low to moderate potential for additional low-grade uranium resources in the Precambrian gneiss within the roadless area. We found no evidence for energy mineral resources other than uranium.

Sand, gravel, and abundant stone occur near magnesian marble occur in the area, but deposits of similar or better quality, both developed and undeveloped, are available and accessible outside the area.

Concentrations of gold and silver at the Fambly-Strong prospect are so low that no resources or prospects are shown. The presence of similar or lower grade gold and silver deposits are known to occur elsewhere in the Transverse Ranges, geologic and geophysical evidence for gold mineralization is much stronger and mining more extensive than they are in the immediate vicinity of the study area.

None of the elemental concentrations detected in stream sediments of the study area indicate the presence of a metallic mineral deposit. Most of the analyses fall within ranges that are reasonable for stream sediments derived from nonmetallized igneous rocks, carbonate rocks, and sandstones. The maximum concentrations that were measured for all elements are low in comparison to values that have been reported in stream-sediment studies for nearby areas where mineral deposits are present.

No previously unknown mineral occurrence was located during this study.

The principal magnetic anomaly and a coincident gravity anomaly correspond to a mafic plutonic unit with high magnetic susceptibility and density relative to surrounding units, rather than to an undiscovered mineral deposit.

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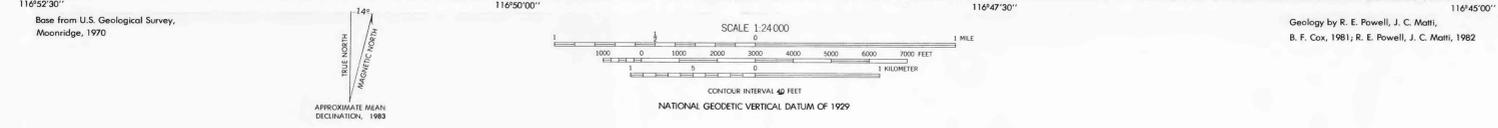
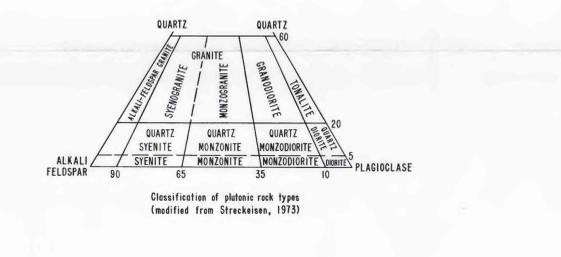
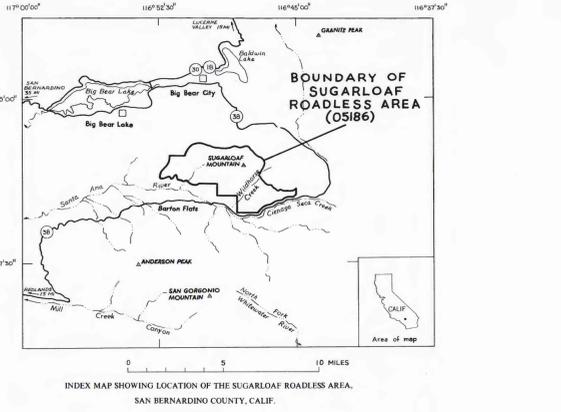


Table 1.—Mines and Prospects in the Sugarloaf Roadless Area and vicinity (Underlined name indicates that the mine or prospect is outside the roadless area)

No.	Name (commodity)	Summary	Workings and production	Assessment of deposit
1	<u>Big Bear prospect</u> (uranium)	Leases and pods in anastetic pegmatite within Precambrian gneiss contain uranium minerals along the pegmatite contacts with a mafic dike.	A large bulldozer excavation about 150 ft long ranges from 10 to 40 ft wide and is up to 40 ft deep. Approximately 10 tons of pegmatite ore were sampled in 1971. A 10 ft x 10 ft x 10 ft sample of the pegmatite was analyzed for uranium (Bisher and others, 1962, p. 11). Three diamond-drill holes have been drilled.	Most of the original uranium deposit has been mined and stockpiled. Based on geologic characteristics, the Thimble deposit, undiscovered resources may exist in primary or secondary uranium resources within the Precambrian gneiss that occur out extensively in the property. A low uranium resource potential is identified in the property.
2	<u>Fambly-Strong prospect</u> (gold, silver)	Highly oxidized tuffite (sand) zone occurs between a Mesozoic quartz diorite intrusion and Paleozoic carbonate rocks. Reported contact some about 5 ft wide originally contained massive magnetite.	A bulldozer cut is 10 ft wide, 25 ft long, and 5 ft deep. More than 50 ft of bedrock trenches are up to 6 ft deep.	The deposit is poorly exposed. Three dip samples of altered rock and one sample contain trace gold and silver per ton. No resource or resource potential is identified.
3	<u>Princes prospect</u> (graphite)	"Amorphous" graphite occurs in Precambrian and (or) Paleozoic metamorphic rocks. Reported contact rock crop out discontinuously for about 1,400 ft along both sides of Orange Cove.	Seven bulldozer trenches, four pits (three covered), and numerous pits. The accessible sill has 90 ft of workings.	An estimated 130,000 tons of indicated and 150,000 tons of inferred subeconomic "amorphous" graphite resources were identified. If percent fixed carbon of which 130,000 tons of indicated and 83,000 tons of inferred subeconomic resources are available.
4	<u>Green Quarry prospect</u> (magnesian marble)	Massive Paleozoic carbonate rocks crop out on the property and over more than 1 sq mi of adjacent land. The deposit consists of medium-grained crystalline, magnesian marble out by weathered diorite dike.	A quarry with a face 250 ft long and 70 ft high has two benches. A small loop of roofing granules was mined during 1960-62 (Cotton, 1964).	An estimated 1.2 million tons of indicated and 1.7 billion tons of inferred magnesian marble resources are inside the roadless area. An additional 900 million tons of inferred resources are outside the area. Composition of estimated resources is 34 percent CaO, 11 percent MgO, 5 percent loss on ignition, 4 percent SiO ₂ , 1.5 percent Fe ₂ O ₃ , and less than 1 percent Al ₂ O ₃ , K ₂ O, and P ₂ O ₅ .
5	<u>Thimble mine</u> (uranium)	Hydrothermal uranium deposits are associated with mafic schist pegmatite in Precambrian gneiss. Leaching of primary hydrothermal deposits by ground-water solution has formed low-grade supergene deposits.	Five large bulldozer trenches, ten drill pits with access roads, and several pits. Approximately 7 tons of uranium ore averaging 0.5 percent U ₃ O ₈ have been produced.	An estimated 320,000 tons of indicated and 400,000 tons of inferred subeconomic uranium resources averaging 0.5 percent U ₃ O ₈ .
6	<u>Thirty King prospect</u> (uranium)	Small bodies of anastetic pegmatite in Precambrian gneiss locally show anomalous levels of radioactivity.	Small discovery pit.	Scintillation readings up to five times background (300 counts per second) were obtained on the prospect. One gram sample of pegmatite material contains 0.26 percent U ₃ O ₈ and 0.040 percent K ₂ O. Based on the results of the Thimble and Big Bear deposits suggest a low potential for undiscovered uranium resources on the Thirty King prospect.
7	<u>St. Francis graphite upper prospect</u> ("amorphous" graphite)	Precambrian and (or) Paleozoic metamorphic rocks occur as elongate pods within Mesozoic quartz diorite.	Three bulldozer cuts and one pit expose graphite-bearing rock.	An estimated 16,000 tons of indicated and 20,000 tons of inferred subeconomic "amorphous" graphite resources averaging 11 percent fixed carbon.
8	<u>Sugarloaf Mountain prospect</u> (magnesian marble)	Small pod of Paleozoic massive magnesian marble in Mesozoic quartz diorite crops out over approximately 20 acres.	Small discovery pit on northwest side of the pod. The deposit is extensive but undeveloped.	An estimated 3.2 million tons of indicated and 400,000 tons of inferred resources averaging 38 percent CaO, 14 percent MgO, 5 percent loss on ignition, 1 percent SiO ₂ , 2 percent Fe ₂ O ₃ , and less than 1 percent Al ₂ O ₃ , K ₂ O, and P ₂ O ₅ .
9	<u>St. Francis graphite lower prospect</u> ("amorphous" graphite)	Precambrian and (or) Paleozoic metamorphic rocks occur in an elongate zone of pods outcropped by Mesozoic quartz diorite.	Sixteen bulldozer cuts and four pits.	An estimated 15,000 tons of indicated and 50,000 tons of inferred resources averaging 11 percent fixed carbon.

¹A part of the property is outside the roadless boundary. ²U₃O₈ and SiO₂ refer to radiometrically determined equivalent weight percent of the oxide.



CONTACT—Dashed where displaced down by landsliding; dotted where conical. Arrows and B, D (up, down) indicate relative movement on right-angle faults; northwest indicate upper plate of faults at low angle to bedding.

FAULT—Dashed where displaced down by landsliding; dotted where conical. Arrows and B, D (up, down) indicate relative movement on right-angle faults; northwest indicate upper plate of faults at low angle to bedding.

BOUNDARY OF MOVEMENT OF LANDSLIDE DEPOSIT—Documented or inferred.

BOUNDARY OF ROADLESS AREA—Solid line.

BOUNDARY OF MAPPED AREA—Dashed line.

STUDIES RELATED TO WILDERNESS
The Wilderness Act (Public Law 95-97, 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 Sugarloaf Roadless Area (05186) in the San Bernardino National Forest, San Bernardino County, California. The Sugarloaf Roadless Area was classified as a further planning area during the Second Roadless Area Review and Evaluation (SARE II) by the U. S. Forest Service, January 1979.

SUMMARY
Geologic, geochemical, and geophysical investigations and a survey of mines and prospects indicate that the Sugarloaf Roadless Area contains subeconomic graphite and magnesian marble resources. Parts of the area have a low potential for the occurrence of additional graphite deposits, but there is no potential for additional magnesian marble resources within the roadless area. Sand, gravel, and construction stone other than carbonate rocks are found in the study area, but similar or better quality materials are abundant and more accessible outside the area. The roadless area has no identified energy mineral resources, but parts of the area have a low to moderate potential for low-grade uranium resources. There are no identified metallic resources within the area, and there is no evidence of a potential for the occurrence of such resources. No previously unknown mineral occurrence was located during this study.

¹Resource—a concentration of naturally occurring solid, liquid, or gaseous material in or on the Earth's crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible (U.S. Bureau of Mines and U.S. Geological Survey, 1980). Defined in this broad fashion, a resource may include material (reserves) that can be developed profitably under current market conditions or it may contain only material (marginal reserves, subeconomic resources) that requires more favorable market conditions or more advanced technological capability to be developed profitably.

EXPLANATORY PAMPHLET ACCOMPANIES MAP

MINERAL RESOURCE POTENTIAL MAP OF THE SUGARLOAF ROADLESS AREA, SAN BERNARDINO COUNTY, CALIFORNIA

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