DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

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U.S. GEOLOGICAL SURVEY AND THE U.S. BUREAU OF MINES
FOR THE
U.S. BUREAU OF LAND MANAGEMENT

MISCELLANEOUS FIELD STUDIES
MAP MF-1584-A

Base from U.S. Geological Survey, 1:24,000 Castle Rock, Havasu Lake, Topock, 1970; Chemehuevi Peak, Monumental Pass, Savahia Peak NW and NE, Snaggletooth, Whale Mountain, 1971

SCALE 1:48 000

CONTOUR INTERVALS 20 AND 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Geology mapped by B. E. John, 1981-1982; assisted by M. Johnson and L. Berg, 1982

Explanatory pamphlet accompanies map

MINERAL RESOURCE POTENTIAL MAP OF THE CHEMEHUEVI MOUNTAINS WILDERNESS STUDY AREA (CDCA-310), SAN BERNARDINO COUNTY, CALIFORNIA

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[illegible] of the Pleistocene Chemehuevi Formation (Longwell, 1963) occur in the southeast corner of the study area. Unconsolidated to consolidated alluvium and colluvium, and dissected deposits of older alluvium consisting of sand and gravel, crop out in valleys throughout the study area.

Structure

The most conspicuous structural feature in the study area is the Tertiary low-angle detachment fault (the Chemehuevi Mountains detachment fault) that flanks the range and separates allochthonous Proterozoic(?) to Miocene rocks cropping out along the exterior parts of the range from autochthonous Proterozoic(?) to Mesozoic crystalline rocks in the interior. Although separation along the Chemehuevi Mountains detachment fault is poorly constrained in the Chemehuevi Mountains, the probably equivalent structure to the south, the Whipple Mountains fault, is inferred to represent tens of miles of northeastward relative movement of the upper plate. Structurally below the Chemehuevi Mountains detachment fault lies another low-angle fault, the Mohave Wash fault, which has approximately 2 mi of strike separation with northeastward relative movement of upper-plate rocks (John, 1982). Conspicuous steeply northeast dipping normal faults cut this structurally deeper fault and the crystalline rocks below it, in the interior of the study area. Gouge and (or) breccia of varying thickness (max 330 ft), associated with both of the Tertiary detachment faults, apparently acted as a locus for mineralization.

Potential sources for mineralization

Several geologic settings commonly favorable elsewhere for the occurrence of significant mineral deposits also occur in the Chemehuevi Mountains Wilderness Study Area. Nonetheless, large deposits of precious or base metals and energy minerals have not been found. Sites favorable for mineralization might be expected in the following geologic environments:

1. The layered gneiss and the deformed plutonic suites show no evidence of significant mineralization. In these rocks, zones of alteration, pegmatite, and quartz veins are rare. Geochemical analyses of rock and sediment samples from areas underlain by these rock units show no anomalous concentrations of metals.
2. Granitic rocks of the undeformed plutonic suite are not mineralized significantly within the study area. However, rare quartz veins carrying white mica±hematite occur along some joints cutting porphyritic granodiorite in the west half of the study area, north of Chemehuevi Peak. Sparse coarse-grained muscovite-garnet pegmatite dikes associated with the youngest intrusions might be expected to be enriched in rare-earth elements; however, no elevated concentrations were recognized in geochemical analyses of stream sediment collected from drainages underlain by these bodies.
3. Alteration and mineralization of Tertiary volcanic rocks is common in areas surrounding the wilderness study area. Rocks of this type within the study area are locally intensely fractured and altered to argillic rocks. However, the alteration is not spatially systematic, no associated mineralization has been recognized, and geochemical analyses of stream sediment derived from altered volcanic rocks show no anomalous concentrations.
4. Copper and manganese mineralization occurs locally along sheared zones and faults cutting all types of crystalline rocks, both above and below the major low-angle faults. Copper stain, rare copper hydroxide minerals, and reniform pyrolusite are typical of this local mineralization. Intense limonitic alteration is common just above the Chemehuevi Mountains detachment fault, where the fault surface is defined by brecciated copper- and manganese-bearing oxides cementing the main fault surface, and extends into a zone upward about 15 ft. Similar copper and manganese associations are developed rarely along northeast-dipping normal faults within the layered gneiss and the deformed plutonic suite in the vicinity of Whale Mountain.
5. Localized exposures of chalcedony, selenite, and associated calcareous material crop out unconformably above the Tertiary sequence in the southern part of the study area. These deposits may be remnants of deposits left by a now-inactive thermal-spring system and thus could be a source of gold and mercury mineralization. However, no associated mineralization or elevated concentrations of metals have been found to date; in fact, no data specifically indicate that the deposits are thermal in origin.
6. Gravel and sand adjacent to the Chemehuevi Mountains are locally being prospected for gold. The absence of any known gold source in the Chemehuevi Mountains and evidence that the fans surrounding the range are locally derived indicate that the likelihood of placer deposits in the study area is poor.

Geochemistry

A total of 160 geochemical samples were collected in and near the Chemehuevi Mountains Wilderness Study Area in a reconnaissance study by J. C. Antweiler to assess the mineral resource potential. These samples consisted of 65 fine-grained (minus 80 mesh) stream-sediment samples , 31 panned concentrates of stream-sediment samples, 53 rock samples, 7 mineralized-rock samples, and 4 water samples. In addition, 50 samples of stream sediment sieved to pass a 200-mesh sieve, 15 panned concentrates collected at the same sites, and 20 rock samples were collected by the USGS. During the geologic-mapping studies, one of us (B. E. John) collected about 25 additional rock samples.

Analyses of stream sediment and concentrates of stream sediment from the principal drainages resulted in identifying several source areas with apparently anomalous concentrations of Ba, Pb, Mo, Sn, Zn, and rare-earth elements, and a few with geochemically anomalous contents of Ag, W, and Th. Nearly all these anomalies were in samples of the heavy fraction of panned concentrates--all of them rather rich in barite. Water from springs near the Chemehuevi detachment fault in Mohave Wash and near the northeast corner of the study area was geochemically anomalous in U (35-45 ppb), but delayed-neutron-activation analysis of other samples failed to disclose anomalous uranium concentrations except along the east boundary of the study area in sec. 16, T. 4 N., R. 24 E. Bedrock samples from the major geologic units throughout the study area were found by chemical analysis to contain the typical geochemical abundances for the rock types represented except in the vicinity of the detachment faults or in the vicinity of mineralized areas. Minerals identified in the panned concentrates included abundant barite and lesser monazite, wulfenite, powellite, sphene, scheelite, and (in the southeastern part of the study area) thorite. All these minerals are relatable to heavy minerals in the felsic rocks, particularly the granite and granite gneiss, and are easily concentrated by panning. Overall, their abundance in the panned concentrates is too small and sporadic to suggest mineralization of possible importance. Samples collected near intrusive contacts were generally not mineralized, nor were the abundant dikes.

The only geochemical anomalies that appear to be related to mineralization are those in samples collected in the immediate vicinity of prospects. The prospects are characterized by veins that are generally narrow, and at many prospects, copper and silver are the metals of greatest enrichment. Barite is common in veins, and quartz is present in some veins; metallic minerals were generally not observed. Generally the veins may be described as Ba-Cu-Ag veins that may also include Pb, Zn, Au, and minor amounts of Bi and Mo. Ag is associated with nearly all the base-metal mineralization and in samples from one prospect averaged 70 ppm. Gold was detected in mineralized samples from one prospect in amounts as high as 50 ppm, and in small amounts in some other prospects.

Rock samples from possible thermal-spring deposits in the southeast corner of the study area yield no anomalous concentrations of Au, Ag, As, or Sb, which typically are associated with hot-spring gold deposits. Ba is in the normal range, and one sample contained slightly elevated concentrations of B and Mo. Hg is elevated in most samples.

Remote sensing

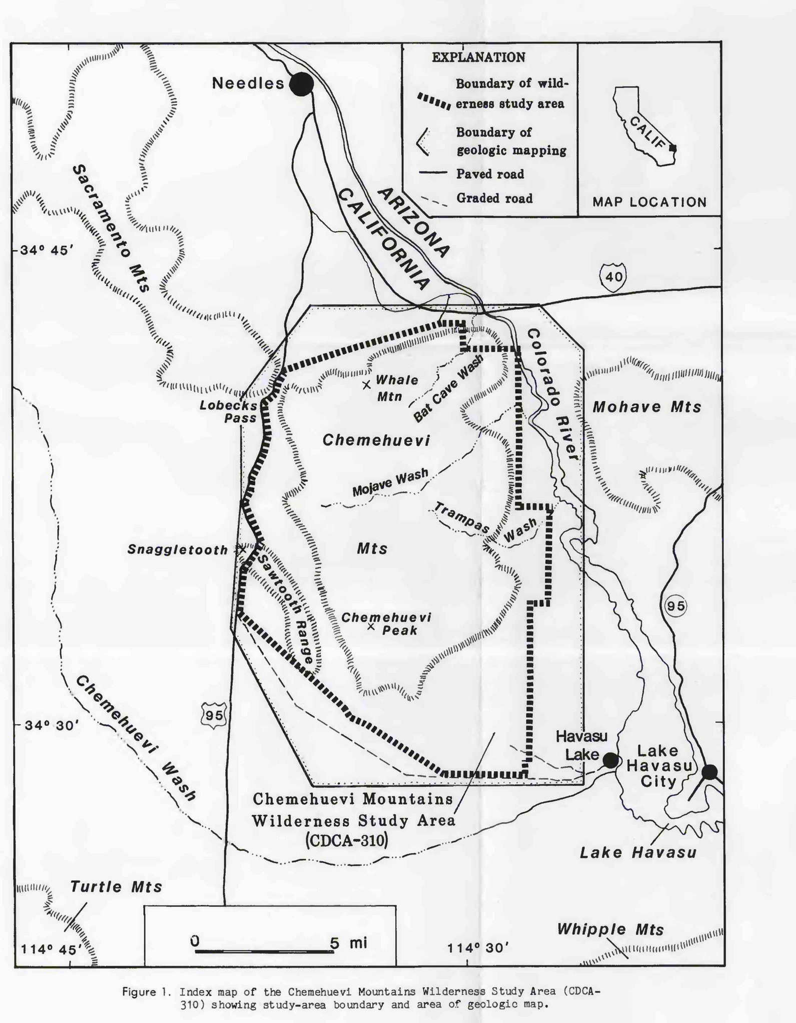

Figure 1. Index map of the Chemehuevi Mountains Wilderness Study Area (CDCA-310) showing study-area boundary and area of geologic map.

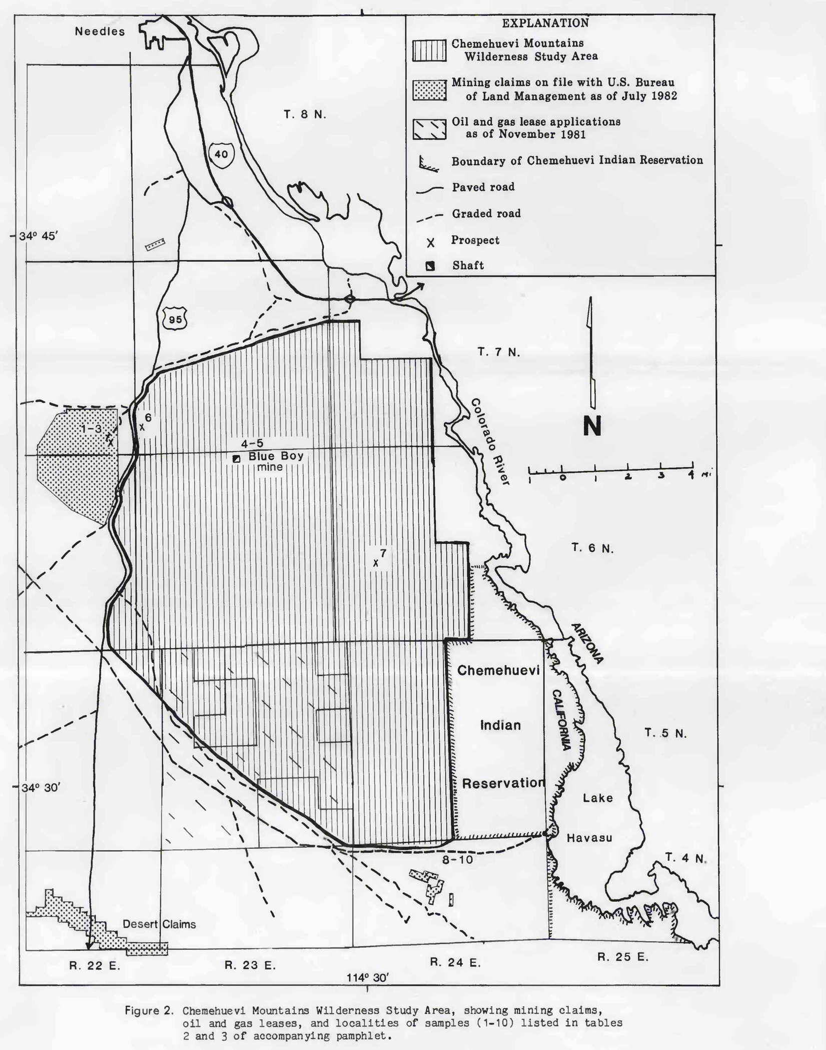

Figure 2. Chemehuevi Mountains Wilderness Study Area, showing mining claims, oil and gas leases, and localities of samples (1-10) listed in tables 2 and 3 of accompanying pamphlet.

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