DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

TO ACCOMPANY MAP MF-1159-B

MINERAL RESOURCE POTENTIAL OF THE SAN JACINTO WILDERNESS, RIVERSIDE COUNTY, CALIFORNIA

SUMMARY REPORT

By

Brett F. Cox, Jonathan C. Matti, and Howard W. Oliver
U.S. Geological Survey

and

Martin D. Conyac
U.S. Bureau of Mines

STUDIES RELATED TO WILDERNESS

Under the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964) and the Joint Conference Report on Senate Bill 4, 88th Congress, 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 submitted to the President and the Congress. This report discusses the results of a mineral survey of the San Jacinto Wilderness, San Bernardino National Forest, Riverside County, California. The area was established as a wilderness by Public Law 88-577, September 3, 1964.

SUMMARY

Geologic, geochemical, and geophysical evidence, together with a review of historical prospecting and mining activities, suggests that the San Jacinto Wilderness has low potential for all types of mineral and energy resources—including precious and base metals, construction stone and aggregate, fossil fuels, radioactive minerals, and geothermal energy.

INTRODUCTION

The San Jacinto Wilderness is located in the San Jacinto Mountains of southern California, roughly 90 mi east of Los Angeles and 4 mi west of Palm Springs (fig. 1). The wilderness is part of the San Bernardino National Forest and includes two separate parcels lying north and south of Mt. San Jacinto State Park. The two parcels are roughly equal in size and together cover a total area of 21,950 acres. The north parcel occupies the steep northern side of 10,800-ft San Jacinto Peak; the south parcel occupies a plateau and adjoining slopes and ridges southeast of San Jacinto Peak. Streams originating in the north parcel drain northward to the San Gorgonio and Whitewater Rivers, whereas streams in the south parcel drain eastward to Palm Canyon and southwestward to the San Jacinto River.

All travel in the wilderness must be conducted on foot, as there are no roads or jeep trails. The south parcel is accessible from the west side by trails that start near the mountain village of Idyllwild, and from the north side by trails that begin at the upper terminus of an aerial tramway in San Jacinto State Park. The north parcel can be approached by roads that lead southward from San Gorgonio Pass, but lacks foot trails and is largely inaccessible due to precipitous terrain.

GEOLOGY

The San Jacinto Wilderness lies near the northern end of the Peninsular Ranges of southern California, a geologic province that is dominated by plutonic igneous rocks of Mesozoic age (Jahns, 1954). Principal geologic features near the wilderness have been summarized by Dibblee (1981, 1982). The wilderness is part of a large structural block that is bounded by several major faults. The San Jacinto fault, 7 mi southwest of the south parcel (Sharp, 1967), and the Banning fault, 5 mi north of the north parcel (Allen, 1957; Matti and Morton, 1982), show evidence of recent activity. An ancient north-trending zone of mylonitic shearing occupies Palm Canyon, east of the wilderness (Sharp, 1979). The geologic features of the wilderness and immediate vicinity, as mapped by Morton and others (1980), are shown in generalized form on figure 2. Crystalline bedrock is exposed in most parts of the two wilderness parcels except for a few small areas that are underlain by Quaternary gravel deposits. Roughly 85 percent of the bedrock consists of plutonic igneous rocks of Mesozoic age; the remaining 15 percent consists of metasedimentary rocks of Paleozoic and (or) Mesozoic age.

The six units of crystalline bedrock mapped by Morton and others (1980) form three parallel north-trending belts which are broadly concave toward the west (fig. 2). Sphene-bearing hornblende-biotite tonalite (termed quartz diorite by Morton and others, 1980) that is nearly uniform in composition and fabric is the predominant type of rock in the westernmost belt, which underlies the western three-fourths of the north wilderness parcel and the northwest corner of the south parcel (plutonic rock terminology of Streckeisen, 1973). Hill (1981) has conducted a detailed study of the distribution and petrology of this tonalite body. Two narrow bodies of quartz diorite with abundant mafic inclusions also are present within this belt.

East of the tonalite lies a belt of plutonic igneous rocks that show pronounced compositional and textural heterogeneity. This central belt occupies the eastern quarter of the north parcel and the central part of the south parcel. In the south parcel the heterogeneous assemblage consists predominantly of granodiorite, quartz monzonite, and monzogranite. In the north parcel the heterogeneous assemblage includes the three aforementioned lithologies, but locally contains significant amounts of mafic diorite and gabbro.

The easternmost of the three belts consists of metasedimentary rocks of Paleozoic and (or) Mesozoic age that include biotite-rich gneiss and schist, micaceous quartzite, and minor amounts of marble and calc-silicate hornfels. These rocks are isoclinally folded and contain scattered quartz veins and abundant dikes and lenticular segregations of pegmatitic granite. Metasedimentary rocks in the eastern half of the south parcel have been mapped separately from a unit of complexly intermingled metasedimentary rocks and plutonic intrusive rocks that lies a short distance east of the north parcel.

GEOLOGY, GEOCHEMISTRY, AND GEOPHYSICS PERTAINING TO MINERAL RESOURCE ASSESSMENT

Geology

Much of the San Jacinto Wilderness lacks geologic environments that are favorable for the occurrence of mineral deposits. The north parcel and the western half of the south parcel are underlain by plutonic igneous rocks that lack mineralized veins, dikes, or any other features of potential interest. Potentially favorable geologic environments are limited to the belt of metasedimentary rocks that passes through the eastern half of the south parcel, particularly the parts of this belt that lie near intrusive contacts with plutonic igneous rocks. Elsewhere in the Peninsular Ranges, mineral deposits are locally developed where similar metasedimentary rocks have been intruded by Mesozoic plutons; however, during our field studies we observed no evidence of significant mineralization in any part of the San Jacinto Wilderness. Thus, field observations suggest that the San Jacinto Wilderness has low mineral resource potential.

Geochemistry

A reconnaissance geochemical survey of the San Jacinto Wilderness (Cox and Matti, 1983) was conducted for 33 major, minor, and trace elements in order to determine spatial variations in chemistry that might reflect local concentrations of ore minerals. Chemical analyses, which for most elements were determined by emission spectrography, were performed on 11 bedrock samples, on 23 stream-sediment samples, and on 23 heavy-mineral concentrates produced by panning down a split of each stream-sediment sample. Sample locations are shown on the accompanying mineral resource potential map. The bedrock samples were collected only where staining or alteration suggested potential mineralization. The stream-sediment samples and panned concentrates were collected at sites representing all the major streams that drain the wilderness.

The results of the geochemical survey provide no indication of significant mineralization within the San Jacinto Wilderness. The data indicate that both metasedimentary rocks and calc-silicate inclusions in granitic rocks in the eastern half of the south wilderness parcel are slightly enriched in boron and several metallic elements. No such enrichment was detected in the plutonic igneous rocks that underlie the remainder of the wilderness. Elements that are locally enriched in the metasedimentary rocks and in stream-sediment panned concentrates from watersheds underlain by metasedimentary rocks include boron, barium, chromium, copper, lanthanum, molybdenum, nickel, tin, tungsten, and zinc. However, the maximum concentrations of these elements are no higher than a few hundred parts per million and are low in comparison to values that have been reported in geochemical surveys of districts with known mineral deposits. The slight enrichment of metasedimentary rocks indicated by the geochemical survey probably reflects weak metasomatism of country rock during the intrusion of plutonic igneous rocks and probably has no significance. The results of the geochemical survey thus are compatible with the geologic evidence: the analytical data suggest low mineral resource potential for the San Jacinto Wilderness.

Geophysics

Geophysical surveys of the San Jacinto Wilderness included an aeromagnetic survey (U.S. Geological Survey, 1979) and a gravity profile (H. W. Oliver, unpub. data, 1982). Neither survey provides any indication of mineral deposits.

The aeromagnetic survey was flown over the south parcel of the wilderness; the north parcel was not included because the extreme topography on the north face of San Jacinto Peak (nearly 10,000 ft of relief) makes a low-terrain-clearance aerial survey unfeasible. Flight lines were spaced about 0.5 mi apart, at an altitude of 1000 ft above ground. Prior experience over similar crystalline terrane in central California indicates that these specifications are adequate to reveal significant deposits of magnetic iron-ore as well as buried masses of mafic igneous rock that might contain concentrations of chromium and nickel (Oliver, 1982; du Bray and others, 1982).

The aeromagnetic map compiled from the survey data is characterized by unusually low magnetic relief. The largest magnetic high is only about 20 gammas and is clearly associated with the metasedimentary rocks in the southeast corner of the south parcel. These rocks are apparently weakly magnetic, although the magnetism is probably attributed to magnetite rather uniformly distributed in amounts less than 0.1 percent. Magnetic variations over the plutonic igneous rocks are even smaller (± 10 gammas) and attest to the lack of any significant concentrations of magnetic iron-bearing minerals or buried mafic igneous rocks.

Gravity measurements were made along a profile trending approximately north-south through the western part of the south parcel between Idyllwild and San Jacinto Peak. The survey was conducted across this broad area of plutonic rocks to search for possible buried masses of relatively dense metamorphic rocks that might contain contact-metasomatic ore deposits similar to those found locally in the Sierra Nevada (Oliver, 1977, fig. 5; du Bray and Oliver, 1981). After making corrections for differences in latitude, elevation, and terrain effects, gravity is nearly constant along the profile. This result confirms the nearly homogeneous nature of the plutonic rocks in this area, as was indicated by the magnetic data, and suggests that there are no large buried masses of high-density rock near the line of the gravity profile.

Specific-gravity measurements on about 100 plutonic rock samples from the San Jacinto Mountains also show that there is very little variation in the sample densities, which are generally confined to the range 2.67 g/cm^3 to 2.70 g/cm^3 (Baird and others, 1979, fig. 9 and Appendix fig.). This result is consistent with the gravity data, and both the gravity and density data provide no evidence for significant mineralization in the south parcel.

MINING DISTRICTS AND MINERALIZATION

The history of mineral exploration and the present status of claims and prospects in the San Jacinto Wilderness and vicinity were investigated by the U.S. Bureau of Mines. The wilderness is distinguished by a sparsity of prospecting activities and by a total lack of reported mineral production. This lack of historic mineral resource development is consistent with the geologic, geochemical, and geophysical evidence reviewed above, which suggests low mineral resource potential for the wilderness.

The San Jacinto Wilderness has no mining history. From about 1903 to 1938 six claims, or small blocks of claims, were located within or immediately adjacent to the wilderness (fig. 2, locs. 1-6). All of these claims are now inactive and none of them are patented. One was filed for lode gold (loc. 3); two others were designated "oil claim" and "oil placer" (locs. 5, 6), the locations of which presumably are erroneous; the rest of the claims were filed for placer gold (locs. 1, 2, 4). No workings were found on any of the claims, and samples collected on the claims lack evidence of metallic minerals. No claims have been filed for radioactive minerals, fossil fuels, or geothermal energy, and there is no evidence suggesting that any of these resources are present in the wilderness.

Potential construction materials are available in the wilderness, but have not been exploited. Granitic rock suitable for use as riprap or dimension stone is present throughout much of the north parcel and western half of the south parcel; a few small deposits of sand and gravel are present within stream canyons of both parcels. None of these deposits of rock, sand, or gravel are significant at the present time, for more accessible deposits of equal or better quality are located outside the wilderness closer to markets.

Known mineral resources in surrounding areas near the San Jacinto Wilderness are limited, consisting of marble, sand and gravel, and minor amounts of gold. Layers of marble reported to be 100 to 200 ft thick are exposed north of the wilderness at the southern side of San Gorgonio Pass. A small quantity of rock was quarried there in the early 1940's, and a 160-acre claim has been patented (Logan, 1947). Sand and gravel also have been exploited in neighboring areas of San Gorgonio Pass. Numerous claims have been staked for lode gold in granitic rocks approximately 7 mi southeast of the wilderness, but only a small amount of gold has been produced (Merrill, 1915; Unruh and Ruff, 1981). Finally, a patented 640-acre claim filed for tungsten is located about 2.5 mi east of the south parcel of the wilderness (Tucker and Sampson, 1945).

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Geologic, geochemical, and geophysical investigations, and a review of historical mining activities, all suggest that the San Jacinto Wilderness has low potential for all types of mineral resources. This conclusion is based on the following considerations: (1) no evidence of significant mineralization was observed in the wilderness; (2) maximum concentrations of metallic elements determined by a geochemical survey are low compared to values that have been reported in geochemical surveys of districts with proven mineral resources; (3) gravity and aeromagnetic surveys conducted within the south parcel of the wilderness did not reveal any masses of unusually dense or magnetic rock such as might be associated with hidden ore deposits; (4) there have been no mining activities in the wilderness; and (5) utilization of construction materials (granitic rock, sand, and gravel) is unlikely, because similar deposits outside the wilderness are of equal or better quality, more accessible, and closer to markets. Due to the foregoing reasons, we believe the San Jacinto Wilderness has low potential for metallic and radioactive minerals, construction materials, fossil fuels, and geothermal resources.

REFERENCES CITED

Allen, C. R., 1957, San Andreas fault zone in San Gorgonio Pass, southern California: Geological Society of America Bulletin, v. 68, p. 315-350.

Baird, A. K., Baird, K. W., and Welday, E. E., 1979, Batholithic rocks of the northern Peninsular and Transverse Ranges, southern California: chemical composition and variation, in Abbott, P. L., and Todd, V. R., eds., Mesozoic crystalline rocks: Peninsular Ranges batholith and pegmatites, Point Sal ophiolite: San Diego, California, San Diego State University Department of Geological Sciences, p. 111-132.

Cox, B. F., and Matti, J. C., 1983, Geochemical map of the San Jacinto Wilderness, Riverside County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1159-C, scale 1:62,500 [in press].

Dibblee, T. W., Jr., 1981, Geology of the San Jacinto Mountains and adjacent areas, in Brown, A. R., and Ruff, R. W., eds., Geology of the San Jacinto Mountains: South Coast Geological Society (Santa Ana, California), Annual Fieldtrip Guidebook No. 9, p. 1-47.

_____, compiler, 1982, Geologic quadrangle maps of the San Jacinto Mountains and vicinity, California: South Coast Geological Society (Santa Ana, California), SCGS Maps 1-5.

du Bray, E. A., Dellinger, D. A., Oliver, H. W., Diggles, M. F., Johnson, F. L., Thurber, H. K., Morris, R. W., Peters, T. J., Lindsey, D. S., 1982, Mineral resource potential map of the John Muir Wilderness, Fresno, Inyo, Madera, and Mono Counties, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1185-C, scale 1:125,000.

du Bray, E. A., and Oliver, H. W., 1981, Gravity model and structural implications of the Goddard pendant, Sierra Nevada, California: Journal of Geophysical Research, v. 86, no. B10, p. 9279-9286.

Hill, R. I., 1981, Field, petrological and isotopic studies of the intrusive complex of San Jacinto Mountain, in Brown. A. R., and Ruff, R. W., eds., Geology of the San Jacinto Mountains: South Coast Geological Society (Santa Ana, California), Annual Fieldtrip Guidebook No. 9, p. 76-89.

Jahns, R. H., 1954, Geology of the Peninsular Range province, southern California and Baja California, in Jahns, R. H., ed., Geology of southern California: California Division of Mines Bulletin 170, Chapter II, p. 29-52.

Logan, C. A., 1947, Limestone in California: California Journal of Mines and Geology, v. 43, no. 3, p. 270-274.

Matti, J. C., and Morton, D. M., 1982, Geologic history of the Banning fault zone, southern California (abs.): Geological Society of America Cordilleran Section, Abstracts with Programs, v. 14, no. 4, p. 184.

Merrill, F. J. D., 1915, Fifteenth Report of the State Mineralogist: California State Mining Bureau, p. 535.

Morton, D. M., Matti, J. C., and Cox, B. F., 1980, Geologic map of the San Jacinto Wilderness, Riverside County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1159-A, scale 1:62,500.

Oliver, H. W., 1977, Gravity and magnetic investigations of the Sierra Nevada batholith, California: Geological Society of America Bulletin, v. 88, p. 445-461.

___, 1982, Geophysical studies of the Minarets Wilderness and adjacent areas, Madera and Mono Counties, California, in Mineral resources of the Minarets Wilderness and adjacent areas, Madera and Mono Counties, California: U.S. Geological Survey Bulletin 1516-B, p. 49-72.

Sharp, R. V., 1967, San Jacinto fault zone in the Peninsular Ranges of southern California: Geological Society of America Bulletin, v. 78, p. 705-730.

_____, 1979, Some characteristics of the eastern Peninsular Ranges mylonite zone, in Speed, Robert, and Sharp, Robert, eds., 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.

Tucker, W. B., and Sampson, R. J., 1945, Mineral resources of Riverside County: California State Division of Mines, 41st report of the State Mineralogist, p. 156.

Unruh, M. E., and Ruff, R. W., 1981, History of gold mining in the south San Jacinto Mountains, Riverside County, California, in Brown, A. R., and Ruff, R. W., eds., Geology of the San Jacinto Mountains: South Coast Geological Society (Santa Ana, California), Annual Fieldtrip Guidebook No. 9, p. 68-75.

U.S. Geological Survey, 1979, Aeromagnetic map of the San Jacinto area, California: U.S. Geological Survey Open-File Report 79-1447.

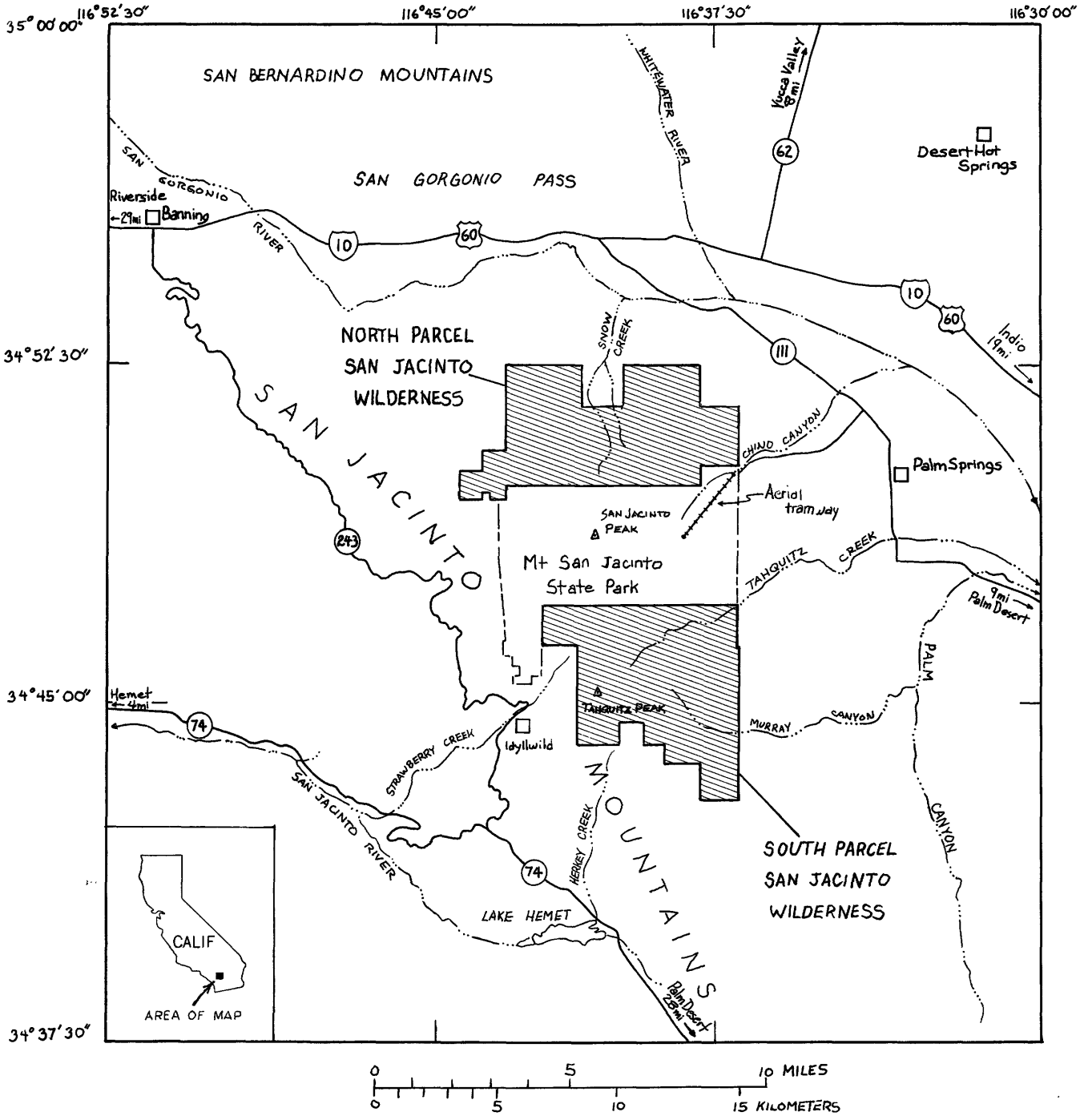
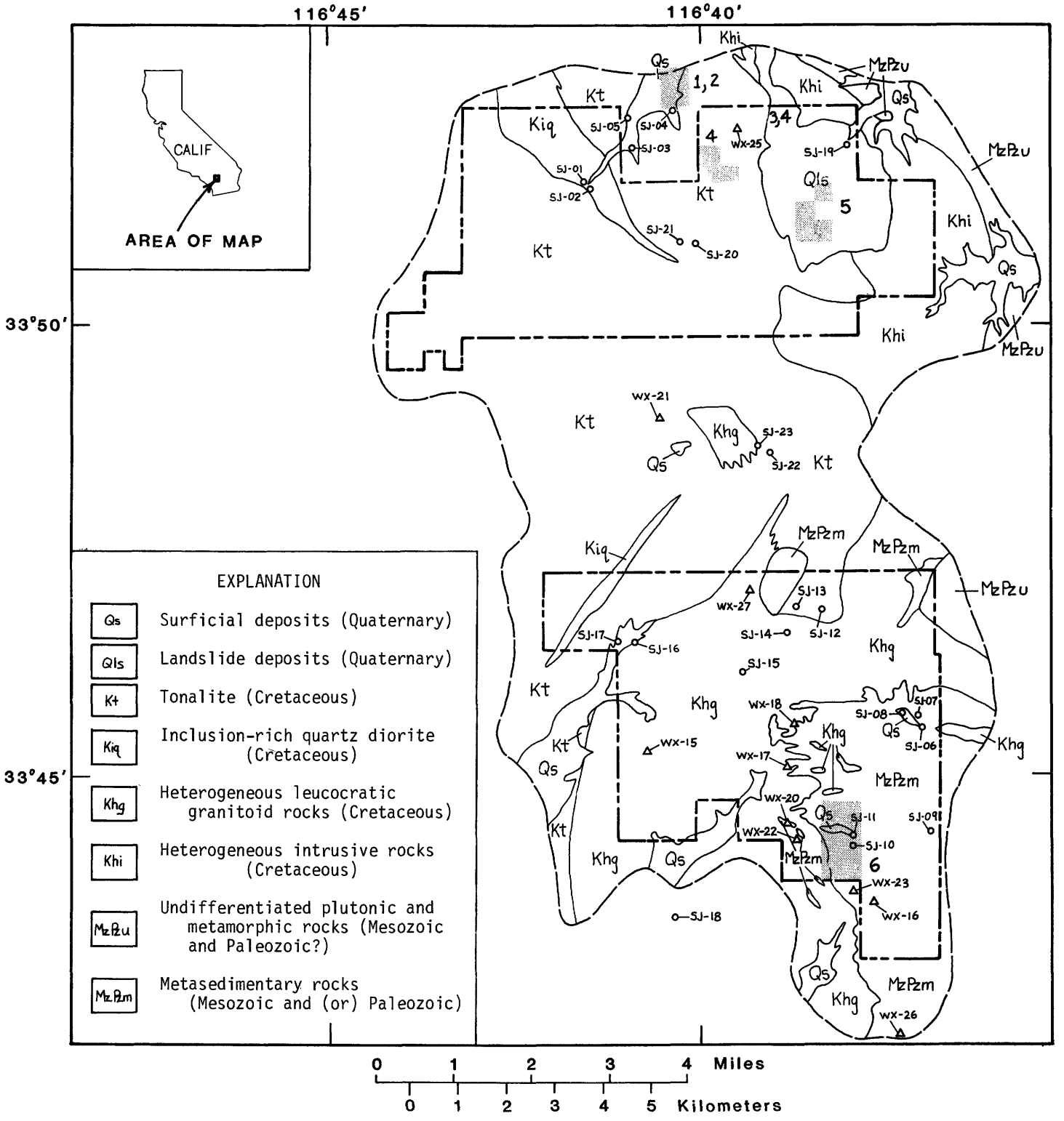


Figure 1.--Index map showing location of the San Jacinto Wilderness, Riverside County, California.



5 MINERAL CLAIM--Numbers refer to discussion in text; claim information provided below includes name, date, and commodity

1 Vanadate (1931): placer gold
2 Eureka Nos. 1-6 (1931): placer gold
3 Gold Hill Nos. 1-6 (1938): lode gold
4 Fall Creek (1931): placer gold
5 Railroad (1903): "oil claim"
6 White Marble Nos. 1 and 2 (1924): "oil placer"

△ WX-16 BEDROCK SAMPLE SITE

○ SJ-19 STREAM-SEDIMENT SAMPLE SITE

CONTACT

WILDERNESS BOUNDARY

BOUNDARY OF MAPPED AREA

Figure 2.-- San Jacinto Wilderness, showing simplified geology, geochemical sample sites, and location of mineral claims. Geology simplified from Morton and others (1980).