U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

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CALIFORNIA DIVISION OF MINES AND GEOLOGY
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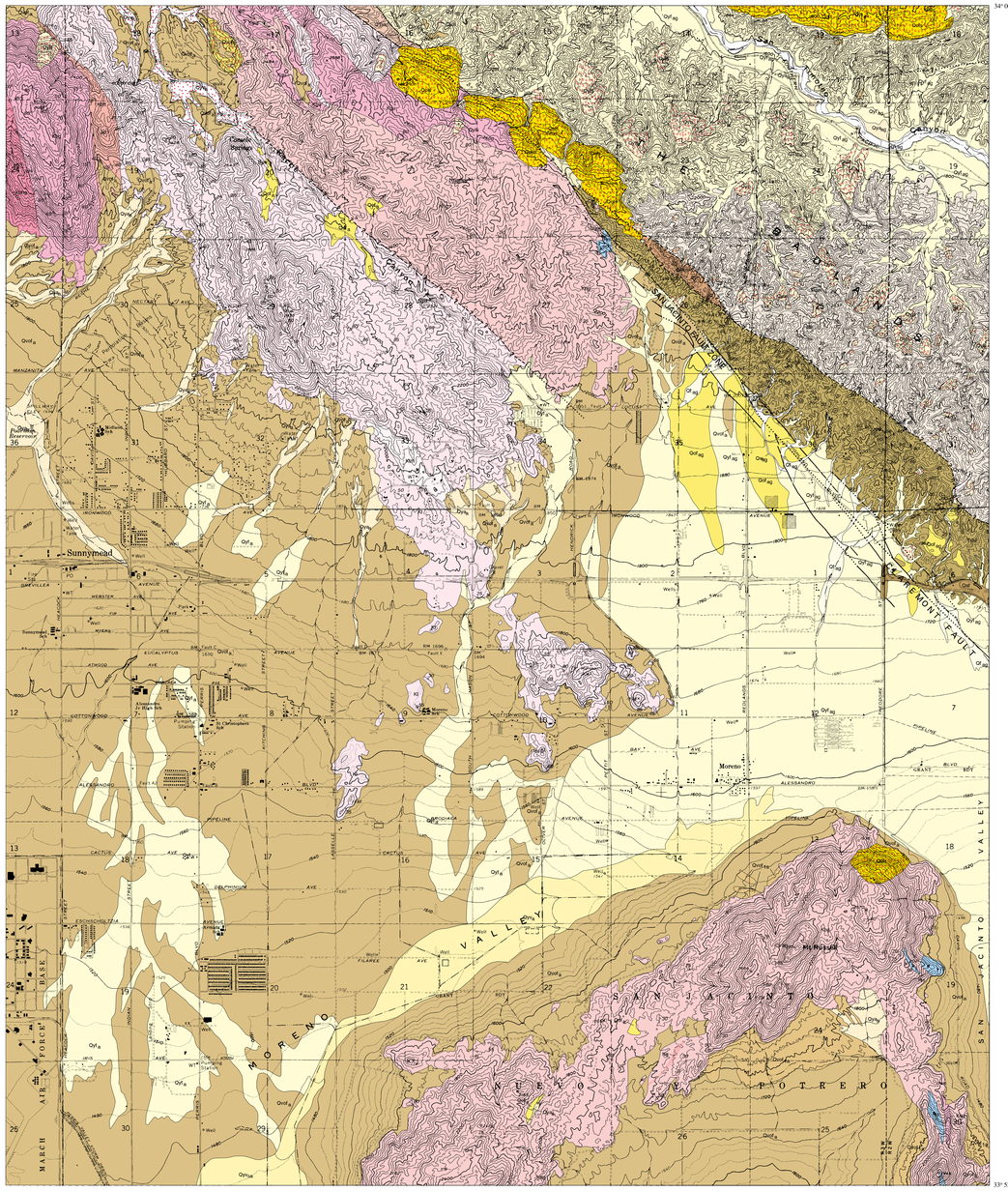
OPEN-FILE REPORT 01-450



Base from U.S. Geological Survey
7.5' Sunnymead quadrangle, 1967
Polyconic projection

GN
MN
14.5°

SCALE 1:24,000

1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET
SUPPLEMENTAL CONTOURS 10 FEET

Geology mapped by D.M. Morton, 1978 and 1996-7; and J.C. Matti, 1996-7

GEOLOGIC MAP OF THE SUNNYMEAD 7.5' QUADRANGLE, RIVERSIDE COUNTY, CALIFORNIA

Version 1.0

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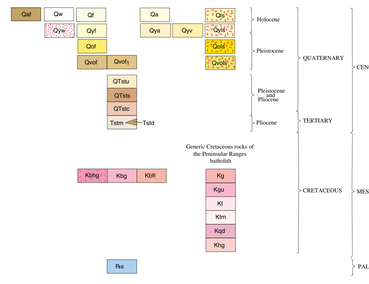
CORRELATION OF MAP UNITS



On some SCAMP geologic map plots, including the Sunnymead 7.5' quadrangle, characteristic grain size information is displayed using subscripted alpha characters (e.g. Qyf_{gc}, Qvw_{ab}), where the characters conform to the following definitions:

a - arenaceous (very coarse sand through very fine sand)
b - boulder gravel (>256mm)
g - gravel (cobble through granule gravel)
s - silty
c - clayey
m- marl
p - peat

Contact—Generally located within ±15 meters

Fault—High angle. Strike-slip component on all faults is right-lateral; dip-slip component is unknown, but north sides valley highland relations. Dashed where located within ±30 meters; dotted where concealed; queried where existence questionable. Arrow and number indicate measured dip of fault plane

Kg—Granite Dikes.

Strike and dip of beds

70 **Inclined**

Horizontal

Strike and dip of igneous foliation

70 **Inclined**

Vertical

Strike and dip of igneous joint

70 **Inclined**

Strike and dip of metamorphic foliation

70 **Inclined**

Vertical

Bearing and plunge of linear features

70 **Inclined**

DESCRIPTION OF MAP UNITS

YOUNG SURFICIAL DEPOSITS—Sediment recently transported and deposited in channels and washes, on surfaces of alluvial fans and alluvial plains, and on hillslopes. Soil-profile development is non-existant. Includes:

Qaf **Artificial fill (late Holocene)**—Deposits of fill resulting from human construction or mining activities; restricted to east edge of quadrangle, specifically to off-ramp construction along US Highway 60 Freeway

Qw **Very young alluvial wash deposits (late Holocene)**—Deposits of active alluvium; confined to ephemeral stream channel in San Timoteo Canyon. Consists mostly of unconsolidated sand and gravel. Sediment subject to localized reworking mainly during winter months

Qf **Very young alluvial fan deposits (late Holocene)**—Chiefly unconsolidated pebbly and gravelly sand. Restricted to drainages of several small, unnamed canyons eminating from south side of San Timoteo Badlands in eastern part of quadrangle. Cobbly alluvium especially abundant in headwater parts of fans

Qa **Very young axial channel deposits (late Holocene)**—Active and recently active fluvial deposits along canyon floors. Restricted to single occurrance on north side of San Timoteo Badlands in northeastern part of quadrangle. Consists of unconsolidated sandy, silty, or clay-bearing alluvium. Does not include alluvial fan deposits at distal end of channel

Qyls **Very young landslide deposits (late Holocene)**—Chiefly unconsolidated, unsorted rubble and debris of slides developed in Quaternary and Tertiary units of San Timoteo Badlands. Restricted to two small slides on north side of San Timoteo Canyon

YOUNG SURFICIAL DEPOSITS—Sedimentary units that are slightly consolidated to cemented and slightly to moderately dissected. Alluvial fan deposits (**Qyf** series) typically have high coarse:fine clast ratios. Younger surficial units have upper surfaces that are capped by slight to moderately developed pedogenic-soil profiles (A/C to A/AC/$B_{cambric}C_{ox}$ profiles). Includes:

Qyᵥ **Young alluvial wash deposits (Holocene and late Pleistocene)**—Sand and gravelly sand deposits; unconsolidated. Confined to ephemeral stream channel in Reche Canyon

Qyf **Young alluvial fan deposits (Holocene and late Pleistocene)**—Gray-hued sand and cobble- and gravel-sand deposits derived from lithicly diverse sedimentary units. Extensively developed in eastern Moreno Valley and in San Timoteo Canyon and its tributary canyons, where unit is mostly sand and gravel-sand. In most other parts of quadrangle, unit is mainly sand

Qya **Young axial channel deposits (Holocene and late Pleistocene)**—Gray, unconsolidated alluvium consisting of fine-grained sand and silt. Found in linear channels eminating from mountains on north side of Moreno Valley

Qyy **Young alluvial valley deposits (Holocene and late Pleistocene)**—Silty to sandy alluvium on valley floors; gray, unconsolidated. Restricted to axial part of Moreno Valley

Qyls **Young landslide deposits (Holocene and late Pleistocene)**—Chiefly unconsolidated, unsorted rubble ranging in size from very large blocks to silt; typically only 1 to 3 m thick

OLD SURFICIAL DEPOSITS—Sedimentary units that are moderately consolidated and slightly to moderately dissected. Older surficial deposits have upper surfaces that are capped by moderately to well-developed pedogenic soils (A/AB/BC_{ox} profiles and Bt horizons as much as 1 to 2 m thick and maximum hues in the range of 10YR 5/4 and 6/4 through 7.5YR 6/4 to 4/4 and mature Bt horizons reaching 5YR 5/6). Includes:

Qof **Old alluvial fan deposits (late to middle Pleistocene)**—Indurated, sandy and gravely alluvial fan deposits, found on south side of San Timoteo Badlands and in Reche Canyon. Slightly to moderately dissected; reddish-brown. Some deposits include thin, discontinuous surface layer of Holocene alluvial fan material

Qols **Old landslide deposits (late to middle Pleistocene)**—Rock debris; most is fragmented, unconsolidated to consolidated. Extensively developed adjacent to San Jacinto Fault zone. Large landslide in northeast corner of quadrangle is bedding plane failure

VERY OLD SURFICIAL DEPOSITS—Sediments that are slightly to well consolidated to indurated, and moderately to well dissected. Upper surfaces are capped by moderate to well developed pedogenic soils (A/AB/B/C_{ox} profiles having Bt horizons as much as 2 to 3 m thick and maximum hues in the range 7.5YR 6/4 and 4/4 to 2.5YR 5/6)

Qvof **Very old alluvial fan deposits (early Pleistocene)**—Mostly well-dissected, well-indurated, reddish-brown sand deposits, containing minor gravel. Commonly contains duripans and locally silcretes. Forms widespread deposits north and south of Moreno Valley, flanking bedrock areas. Deposits on older erosion surfaces lack diagnostic features, and may or may not be alluvial fan deposits

$Qvofₗ$ **Very old alluvial fan deposits, Unit 1 (early Pleistocene)**—Mostly well-dissected, well-indurated, reddish-brown sand deposits near Mt Russell. Commonly contains duripans and locally silcretes. Deposits on older erosion surfaces lack diagnostic features, and may or may not be alluvial fan deposits. Old part of unit Qvof

Qvols **Very old landslide deposits (middle to early Pleistocene)**—Rock debris; moderately well- to well-consolidated. Almost no primary landslide morphology preserved. Restricted to single slide near north edge of quadrangle, on east side of Reche Canyon

San Timoteo beds of Frick (1921) (Pleistocene and Pliocene)—Lithologically diverse sandstone, conglomeratic sandstone, and conglomerate; nearly all sandstone is arkosic and much is lithic. Named by Frick (1921) for upper Pliocene, vertebrate-bearing, nonmarine strata in San Timoteo Canyon. Upper part of San Timoteo beds contain vertebrate fauna of earliest Pleistocene Irvingtonian I age (Repenning, 1987): Eckis (1934) had earlier suggested a Pliocene age for upper part of section. Albright (1997) shows vertebrate fossils are throughout most of upper part of unit. Lower parts of San Timoteo beds of Frick (1921) are Pliocene. Clasts within unit appear to be entirely derived from Transverse Range sources similar in composition to rocks presently exposed in eastern San Gabriel Mountains, central San Bernardino Mountains, and in San Bernardino-Yucaipa area (Matti and Morton, 1993). In past, contact between San Timoteo beds of Frick (1921) and underlying Mount Eden Formation of Fraser (1931) inconsistently placed at various stratigraphic positions. In this report, contact is placed at boundary between older fluvial-lacustrine deposits (Mount Eden Formation of Fraser (1931)) and younger fluvial-alluvial fan deposits (San Timoteo beds of Frick (1921)). Age of this boundary is about 4.3 Ma (B. Albright, per. commun., 1998).

In quadrangle, includes two informal members, and two subdivisions of member:

QTstu **Upper member (Pleistocene and Pliocene)**—Gray, coarse-grained, moderately indurated sandstone and conglomerate. Contains early Pleistocene Irvingtonian I, Shutt Ranch and El Casco local faunas, about 1.8 Ma (Repenning, 1987). Erodes to form sharp-ridged badlands topography. Subdivided into:

QTsts **Conglomeratic sandstone beds**—Locally derived conglomeratic sandstone. Appears to be completely fault-bounded in quadrangle

QTstc **Quartzite-bearing conglomerate beds**—Conglomerate, quartzite-bearing, well-indurated. Appears to be completely fault-bounded in quadrangle

Tstrs, Tstrm **Middle member (Pliocene)**—Dominant lithology is light-gray, pebbly to cobbly, moderately to well-indurated, medium- to coarse-grained sandstone containing conglomerate beds up to 9 m in thickness. Pale brown- to light-gray fine-grained sandstone; pebbly sandstone is subordinate. Overall, member consists of about 70 percent sandstone and 30 percent conglomerate; conglomerate more abundant in upper part. Includes numerous reddish-brown stratigraphic intervals consisting of oxidized sandstone, which are not paleosols, and reddish-brown clay-rich intervals, which may be paleosols. Erodes to form sharp-ridged badlands topography. In eastern part of quadrangle, forms hogbacks on south side of San Timoteo Canyon. Included within Tstm is highly deformed, fault-bounded sandstone, pebbly sandstone, and conglomerate (**Tstd**) located along western part of badlands adjacent to Claremont Fault. Its stratigraphic position within Tstm is not known

Box Springs plutonic complex (Cretaceous)—Box Springs plutonic complex is an elliptical, horizontally-floored basin-shaped granitic complex centered on Box Spring Mountains; apparently lower part of granitic diapir. Most of complex lies west of quadrangle, and consists of essentially massive to indistinctly layered biotite tonalite core, surrounded by layer of foliated biotite granodiorite to tonalite. Further outward in complex is discontinuous layer of foliated, heterogeneous, porphyritic granodiorite, succeeded by uniform porphyritic granodiorite. Other compositionally and texturally diverse granitic rocks also occur within complex, but in relatively small amounts. All rocks of complex were included in Perris quartz diorite by Dudley (1935) and in Bonsall tonalite by Larsen (1948). Informal name, Box Springs plutonic complex, applied by Morton (1999). Except for dike rocks, units are described in general order from core outward. Includes:

Kbhg **Heterogeneous porphyritic granodiorite**—Heterogeneous porphyritic granodiorite and subordinate tonalite. Medium- to coarse-grained, light gray, foliated, and porphyritic. Quartz ranges from 25 to 35 percent; mafic minerals, biotite and subordinate hornblende, from 10 to 15 percent. Uneven distribution of mafic minerals imparts heterogeneous appearance to rock. Subhedral potassium feldspar crystals are up to 2.5 cm in length. Unit contains widespread discoidal mesocratic inclusions oriented parallel to foliation. Cut by numerous dikes of leucocratic granite and pegmatite

Kbg **Porphyritic granodiorite**—Coarse-grained, light gray, foliated, porphyritic biotite granodiorite and subordinate tonalite. In most places grades into heterogeneous porphyritic granodiorite unit (**Kbhg**). Groundmass is plagioclase, quartz (30 to 40 percent), and mafic minerals (5 to 10 percent). Mafic minerals are biotite and sparse hornblende, which are more evenly distributed than in heterogeneous granodiorite (**Kbhg**). Subhedral potassium feldspar phenocrysts are up to 2.5 cm in length. Discoidal mesocratic inclusions are oriented parallel to foliation

Kbft **Biotite-hornblende tonalite**—Light to medium gray, medium- to coarse-grained, foliated tonalite. Restricted to single area west of Reche Canyon. Contains 20 to 25 percent quartz and about 25 percent biotite and hornblende in subequal amounts. Hornblende and biotite occur as ragged crystals. Potassium feldspar present, but sparse. Anhedral, interstitial sphene is conspicuous accessory mineral. Contains abundant, fine-grained, mesocratic, ellipsoidal- to discoidal-shaped mafic inclusions aligned parallel to foliation

Generic Cretaceous rocks of the Peninsular Ranges batholith

Kg **Granitic dikes (Cretaceous)**—Includes texturally diverse group of leucocratic granitic dikes composed mainly of quartz and alkali feldspars. Restricted to Mt Russel area in southern part of quadrangle. Dikes range in thickness from few centimeters to over a meter and are up to several hundred meters in length. Most are tabular; some are texturally and compositionally unzoned, irregular-shaped bodies. Some dike rock has a foliated or gneissoid fabric. Textures are mostly coarse grained and equigranular granitic, but range from aplitic to pegmatitic. Accessory minerals include biotite, muscovite, and garnet

Kgu **Granite, undifferentiated (Cretaceous)**—Granite; leucocratic, fine- to coarse-grained, massive. Found as large and small dike-form bodies east of Reche Canyon

Kt **Tonalite, undifferentiated (Cretaceous)**—Mainly biotite-hornblende tonalite not associated with specific plutons. Underlies large area in central part of quadrangle. Gray, medium-grained, typically foliated. Forms large mass west of Reche Canyon

Kdm **Tonalite and mafic rocks, undifferentiated (Cretaceous)**—Mainly biotite-hornblende tonalite containing mixed mafic rocks and subequal amounts of mafic inclusions. Inclusion borders mostly gradational and ill-defined. Restricted to single occurance north of US Highway 60 Freeway, west of Hendrick Road

Kqd **Quartz diorite, undifferentiated (Cretaceous)**—Mainly biotite-hornblende quartz diorite; coarse-grained. Restricted to single occurrence in southeastern corner of quadrangle

Khg **Heterogeneous granitic rocks (Cretaceous)**—Includes heterogeneous, compositionally diverse granitic rocks mostly of tonalite and granodiorite composition, but includes some monzogranite and gabbro. Irregularly developed foliation. Underlies large areas in southern and northern parts of quadrangle

End rocks of the Peninsular Ranges batholith

Pzs **Biotite Schist (Paleozoic?)**—Medium-to dark-gray, fine-grained biotite schist and biotite-quartz-feldspar schist. Locally contains sillimanite and cordierite, and in places, abundant tourmaline. Commonly includes minor amounts of quartzite and calc-silicate hornfels. Limited exposures in Mt Russell area and 2 km west of Redlands Blvd

GEOLOGIC SUMMARY

The Sunnymead quadrangle is located in the northern part of the Peninsular Ranges Province and is underlain by Cretaceous basement rocks, which contain a few scattered pendants of Paleozoic? metamorphic rocks. This part of the Peninsular Ranges Province is divided into the Perris block, located west of the San Jacinto fault and the San Jacinto Mountains block to the east (See figure showing quadrangle location). The northeast quarter of the quadrangle is crossed diagonally by the San Jacinto fault zone, a seismicly active major fault of the San Andreas fault system. The San Jacinto fault zone consists of a main trace, which forms a relatively continuous, dissected, west-facing, fault scarp about 1,000 feet above the valley floor, in addition to multiple discontinuous breaks. A less well defined fault in granitic rocks west of, and parallel to the San Jacinto fault zone does not appear to cut Pleistocene alluvial deposits.

The area north of the San Jacinto fault zone is termed the San Timoteo Badlands. It is formed in a thick section of Pliocene and Pleistocene continental sedimentary rocks, which are informally referred to as the upper part of the San Timoteo beds of Frick (1921) (Morton, 1999). This unit consists chiefly of coarse-grained sandstone, conglomeratic sandstone, and conglomerate. All clasts within these beds were derived from Transverse Ranges basement rocks found north of the quadrangle. The San Timoteo beds have been deformed into a broad anticlinal structure produced by the sedimentary beds being compressed as they are translated around a restraining bend in the San Jacinto fault north of the El Casco quadrangle. A curving, diachronous fault produced by this compression is located in the western part of the badlands just east of the Jacinto fault zone.

The area west of the San Jacinto fault zone is underlain by plutonic rocks of the Cretaceous-age Peninsular Ranges batholith with a few small included pendants of schist and gneiss of probable Paleozoic age. Most of the plutonic rocks are biotite-hornblende tonalite, but locally include abundant granodiorite. In the northwestern part of the quadrangle is the eastern part of the Box Springs granitic complex, a basin-shaped complex that appears to be the distal part of a diapiric-shaped structure.

Most of the alluviated area west of the San Jacinto fault zone consists of Pleistocene age flavial deposits, which typically have a degraded upper surface that is preserved in some places near the contact with granitic rocks. The upper part of these deposits form the Paloma surface of Woodford and others(1971). Holocene age alluvial fans emanate from the San Timoteo Badlands.

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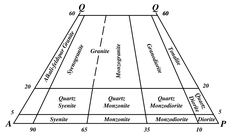
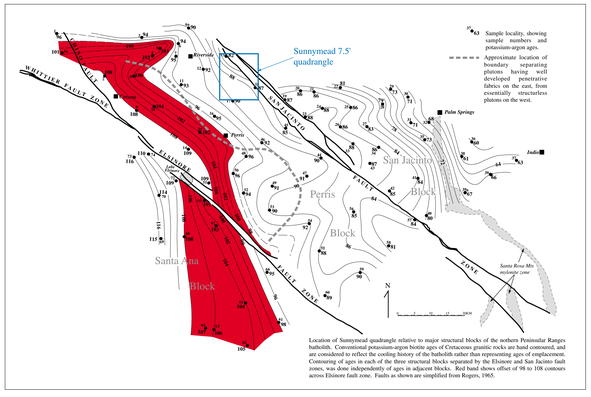
SURROUNDING 7.5' QUADRANGLES



Classification of plutonic rock types (from IUGA, 1973, and Streckeisen, 1973). A, alkali feldspar; P, plagioclase feldspar; Q, quartz.



Location of Sunnymead quadrangle relative to major structural blocks of the nothern Peninsular Ranges batholith. Conventional potassium-argon biotite ages of Cretaceous granitic rocks are hand contoured, and are considered to reflect the cooling history of the batholith rather than representing ages of emplacement. Contouring of ages in each of the three structural blocks separated by the Elsinore and San Jacinto fault zones, was done independently of ages in adjacent blocks. Red band shows offset of 98 to 108 contours across Elsinore fault zone. Faults as shown are simplified from Rogers, 1965.

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards or with the North American Stratigraphic Code. Any use of trade, firm, or product names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.

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