U.S. DEPARTMENT OF THE INTERIOR
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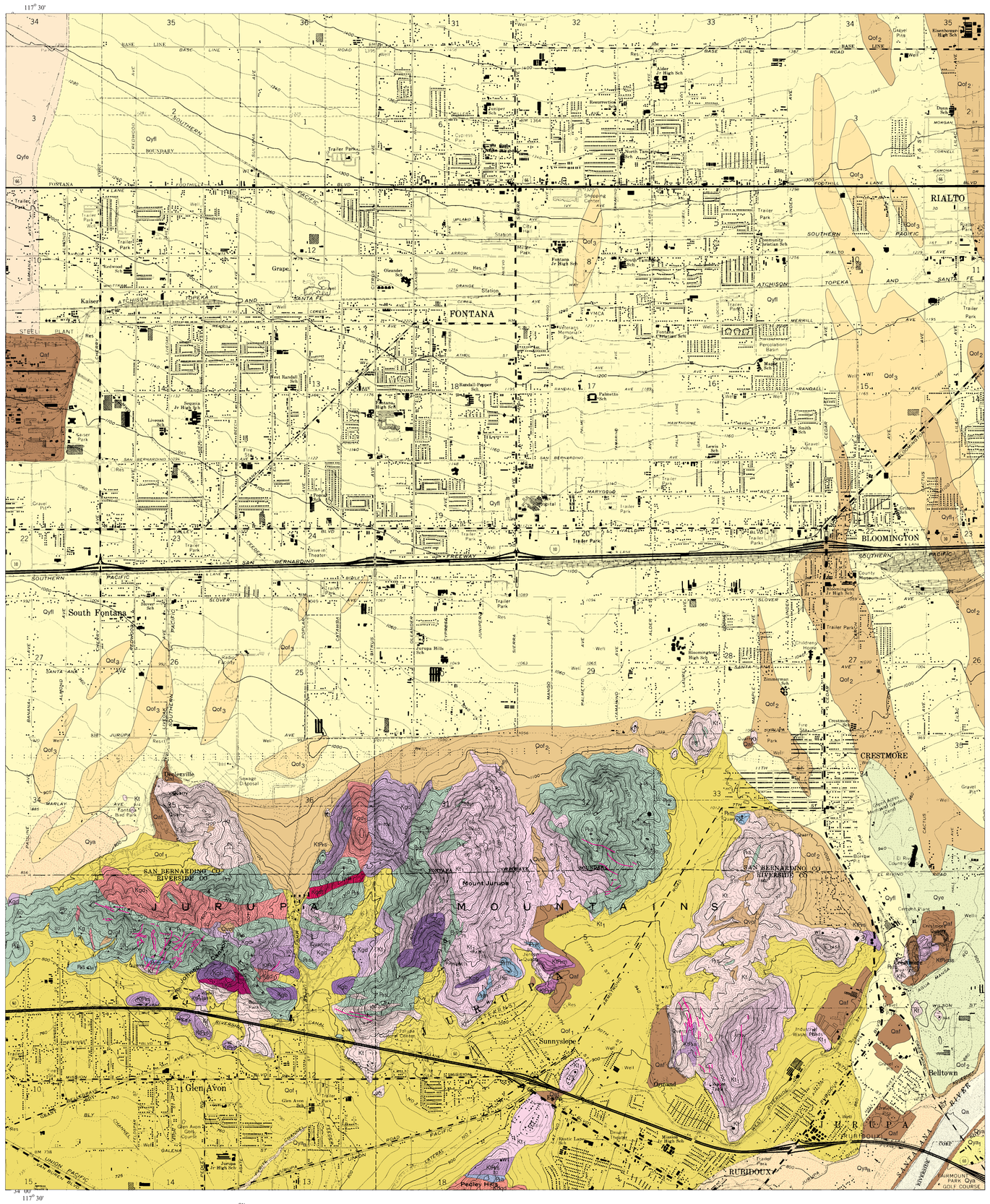
OPEN-FILE REPORT 03-418



Base from U.S. Geological Survey
7.5' Fontana quadrangle, 1973
Polyconic projection

Geology mapped by D.M. Morton; 1977-78, 1990-99.

SCALE 1:24,000

1 0 1 MILE

1 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET

PRELIMINARY GEOLOGIC MAP OF THE FONTANA 7.5' QUADRANGLE, SAN BERNARDINO AND RIVERSIDE COUNTIES, CALIFORNIA

Version 1.0

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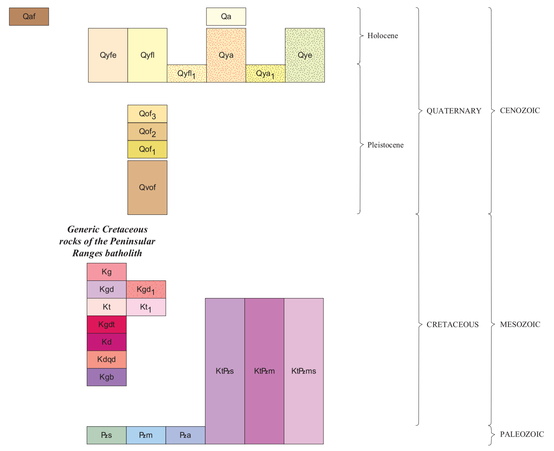
CORRELATION OF MAP UNITS



On some SCAMP geologic map plots, including the Fontana 7.5' quadrangle, characteristic grain size information is displayed using subscripted alpha characters (e.g., Qyf_g, Qvo_{sa}, after the unit label), where the characters conform to the following definitions:

a - arenaceous; sand or sand bearing (very coarse sand through very fine sand)
b - boulders or containing boulders (>25mm)
g - gravel or containing gravel (cobble through granule gravel)
s - silt or silty
c - clay or clay bearing
m- marl
p - peat

Where a unit label has more than one subscripted character, in all cases, the first character modifies the second (e.g., Qyf_{ag} indicates arenaceous gravel).

In the **Description of Map Units**, the Ma following U/Pb ages has an attached subscript; Ma_{id} for isotope dilution analyses, and Ma_{ip} for ion probe analyses.

Contact—Solid where located within ±15 meters; dashed where located within ±30 meters

Kg—Granitic dikes

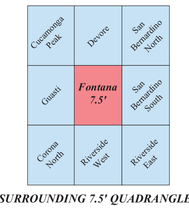
Strike and dip of igneous foliation
70 **Inclined**
Vertical

Strike and dip of metamorphic foliation
70 **Inclined**
Vertical

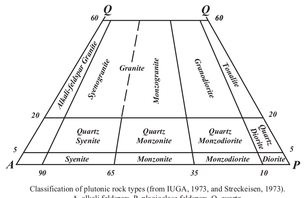
Strike and dip of secondary foliation in igneous rocks
50 **Inclined**
Vertical

Bearing and plunge of igneous lineations
20 **Inclined**

Bearing and plunge of metamorphic lineations
55 **Inclined**



SURROUNDING 7.5' QUADRANGLES



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

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.

This map was printed on an electronic plotter directly from digital files. Dimensional calibration may vary between electronic plotters and between X and Y directions on the same plotter, and paper may change size due to atmospheric conditions; therefore, scale and proportions may not be true on plots of this map.

Digital files available on World Wide Web at http://geopubs.wr.usgs.gov/open-file/of03-418/

DESCRIPTION OF MAP UNITS

VERY 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-existent. Includes:

Qaf **Artificial fill (late Holocene)**—Uncompacted fill from mining operations and solid-waste disposal. South of Sunnyslope includes area of cut-and-fill. Includes levees along the Santa Ana River. At the Crestmore quarry area includes mix of Qaf and unconsolidated talus deposits

Qa **Active alluvial-channel deposits (late Holocene)**—Unconsolidated grayish sandy alluvium along Santa Ana River. Subject to reworking by stream flow

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/BcambricCox profiles). Includes:

Qyfe **Young alluvial-fan deposits of Etiwanda Creek (Holocene and late Pleistocene)**—Unconsolidated grayish cobbly alluvium of East Etiwanda Creek fan. Restricted to eastern part of the East Etiwanda Creek fan, 1 km east of Bloomington

Qyfl **Young alluvial-fan deposits of Lytle Creek (Holocene and late Pleistocene)**—Unconsolidated, gray, cobbly and bouldery alluvium of Lytle Creek fan. Relatively fine-grained (pebbly and cobbly) in southern extent; becomes coarser grained (cobbly and bouldery) northward. Forms broad channels west and north of Crestmore. Includes:

Qyf_{l1} **Young alluvial-fan deposits of Lytle Creek, Unit 1 (early Holocene and late Pleistocene)**—Unconsolidated alluvial-fan deposits. Consists of gravel, sand, and silt

Qya **Young alluvial-channel deposits (Holocene and late Pleistocene)**—Unconsolidated, gray, sandy alluvium along Santa Ana River, and headward part of broad channel along northwestern Jurupa Mountains. Includes:

Qya_1 **Young alluvial-channel deposits, Unit 1 (early Holocene and late Pleistocene)**—Unconsolidated, gray, sandy alluvium. Older fluvial deposit of Santa Ana River; older and slightly elevated above Qya

Qye **Eolian deposits (Holocene and late Pleistocene)**—Unconsolidated, gray to tan, massive, fine-grained sand forming stabilized dunes. May include some deposits of Pleistocene age

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/BCox 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_3 **Old alluvial-fan deposits (late to middle Pleistocene)**—Reddish brown, gravel and sand alluvial-fan deposits; indurated, commonly slightly dissected. In places includes thin alluvial-fan deposits of Holocene age. Includes:

Qof_2 **Old alluvial-fan deposits, Unit 3 (late to middle Pleistocene)**—Unconsolidated, tan, cobbly and bouldery alluvium. Occurs as slightly raised deposits through younger Lytle Creek fan (Qyf). May include some deposits of Holocene age

Qof_1 **Old alluvial-fan deposits, Unit 2 (late to middle Pleistocene)**—Unconsolidated, tan, cobbly and bouldery alluvium of Lytle Creek fan. Slightly older than Qof_3

Old alluvial-fan deposits, Unit 1 (late to middle Pleistocene)—Mainly indurated, tan to brown, sandy to pebbly and cobbly, clay-bearing older alluvium. Forms extensive deposits on south side of Jurupa Mountains. Near Jurupa Mountains includes consolidated conglomeratic deposits. Locally underlain by unconsolidated gray cobbly alluvium

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/BCox 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 (middle to early Pleistocene)**—Patches of well-indurated, brown, pebbly and cobbly, clay-bearing alluvium perched on and near summit areas of Jurupa Mountains, May be remnants of previously extensive deposit

Generic Cretaceous granitic rocks of the Peninsular Ranges batholith

Kg **Granitic dikes, undifferentiated (Cretaceous)**—Coarse-grained granite to pegmatitic-textured, off-white biotite granite dikes. Pegmatite dikes contain accessory muscovite, garnet and tourmaline. Fairly abundant north of Rubidoux and Glen Avon

Kgd **Granodiorite (Cretaceous)**—Medium- to coarse-grained, equigranular to porphyritic, heterogeneous biotite granodiorite and lesser amounts of monzogranite and tonalite. Contains locally abundant inclusions and schist septa. Includes:

Kgd_1 **Granodiorite, Unit 1 (Cretaceous)**—Medium- to coarse-grained, equigranular to porphyritic, heterogeneous granodiorite and lesser amounts of monzogranite and tonalite. Contains locally abundant inclusions and schist septa

Kt **Tonalite (Cretaceous)**—Relatively uniform, medium-to coarse-grained equigranular gray biotite-hornblende tonalite. Contains widespread and locally abundant dark inclusions

Kt_1 **Tonalite, Unit 1 (Cretaceous)**—Homogeneous biotite hornblende tonalite and hornblende quartz diorite and lesser amounts of hornblende diorite and granodiorite. Contains widespread and locally abundant dark inclusions

Kgdt **Tonalite and granodiorite, undifferentiated (Cretaceous)**—Undifferentiated intermixed biotite-hornblende tonalite and biotite granodiorite

Kd **Diorite (Cretaceous)**—Mainly coarse-grained equigranular dark-gray hornblende diorite

Kdqd **Diorite and tonalite, undifferentiated (Cretaceous)**—Undifferentiated intermixed hornblende diorite and biotite-hornblende tonalite

Kgb **Gabbro (Cretaceous)**—Mainly coarse-grained to locally pegmatitic black hornblende gabbro

End rocks of Peninsular Ranges batholith

Pks **Schist (Paleozoic)**—Mainly interlayered biotite schist and quartzite. Layers typically one to several centimeters thick. Locally contains discontinuous calc-silicate-rich amphibolite layers

Pkm **Marble (Paleozoic)**—Mainly coarse-grained nearly white marble and included masses of calc-silicate rock

Pka **Amphibolite (Paleozoic)**—Coarse-grained, crudely foliated, black amphibolite

KPks **Intermixed heterogenous tonalite and schist (Cretaceous and Paleozoic)**—Intermixed biotite-hornblende tonalite and biotite-quartz schist. Restricted to north-central part of Jurupa Mountains

KPkm **Intermixed tonalite and marble (Cretaceous and Paleozoic)**—Marble intruded by heterogeneous biotite-hornblende tonalite. Restricted to east end of Jurupa Mountains (Jensen Quarry area)

KPkms **Intermixed tonalite, marble and schist (Cretaceous and Paleozoic)**—Intermixed biotite-hornblende tonalite and coarse grained marble containing lesser amounts of biotite-quartz schist. Restricted to Crestmore area

GEOLOGIC SUMMARY

The Fontana 7.5' quadrangle is located in the northern part of the Perris Block (English, 1926, Woodford, and others, 1971), a rectangular shaped and relatively tectonically stable structural block located between the San Jacinto and Elsinore Fault zones at the north end of the Peninsular Ranges Provinces (Jahns, 1954). Included in the southern part of the quadrangle are the Jurupa Mountains, that along with rocks exposed in the San Bernardino South 7.5' quadrangle to the east, are underlain by exposures of the northernmost Peninsular Ranges province basement rocks. The oldest rocks are a sequence of amphibolite grade metamorphic rocks consisting of predominantly biotite-quartz schist and lesser amounts of quartzite, marble, and amphibolite. The marble forms relatively thick layers, most of which have been quarried, mainly for manufacturing of cement. Pyroxene hornfels facies skarn occurs along contact zones between marble and intrusive granitic rocks. Major marble quarries include the Crestmore quarries at the eastern part of the quadrangle and the Jensen quarry at the eastern end of the Jurupa Mountains; smaller quarries are the Henshaw quarry located between the Crestmore quarries and the Jensen Quarry, and the Glen Avon Quarry located in the western part of the Jurupa Mountains. Much of the marble at the Crestmore quarries has a characteristic blue color. The Crestmore quarries are known worldwide for the large number of rare minerals found in the contact metamorphic rocks (about 150 mineral species, e.g., Murdoch and Webb, 1966). Most of the unusual minerals occur in a metasomatic zone between marble and a monzogranite intrusive in the Commercial Quarry (e.g., Burnham, 1959, Woodford and others, 1941). Based upon the abundance of marble in the section, these metasedimentary rocks are considered to be of Paleozoic age.

Intruding the metamorphic rocks are Cretaceous-age granitic rocks, the northern part of the Peninsular Ranges batholith. These batholithic rocks range in composition from gabbro to granitic pegmatite dikes. Biotite-hornblende tonalite is the most abundant granitic rock, but there is a large biotite granodiorite body located near the central part of the Jurupa Mountains. Emplacement age of the tonalite, based on U/Pb analyses of zircon, is 104 +/- 0.4 Ma (W.R. Premo, Written Com., 2003). Sr/Rb isochron whole rock age is 117.6 +/- 6 Ma (R.W. Kistler, Written Com., 2000). Granodiorite (Kgd) gave a zircon U/Pb age of 108 +/- 6 Ma (W.R. Premo, Written Com., 2003).

Tonalite and granodiorite commonly have two planar fabrics, a planar fabric oriented northwest that is typical Peninsular Range Batholith and one that is atypical striking east and northeast; both planar fabrics are produced by oriented hornblende and biotite and ellipsoidal to pancake-shaped mafic inclusions. East and northeast oriented inclusions are generally noticeably more attenuated than the northwest oriented inclusions. Commonly a single outcrop includes both fabric planes; where discernible the northwest striking fabric is older than the east and northeast oriented fabric.

The granitic rocks are some of the closest granitic rocks to the Los Angeles Metropolitan area that can be used for construction purposes. As such, the tonalite and granodiorite have been extensively quarried for the construction of breakwaters and a variety of other engineering projects. A major quarrying operation was located at the north central part of the Jurupa Mountains at Declerville where a rail line spur was constructed for transportation of tonalite. Another large quarry is located in the hills immediately east of the Jurupa Mountains. Currently the only active quarry is the Stringfellow quarries developed in granodiorite and located in the south central part of the Jurupa Mountains.

The northern half of the quadrangle is covered by unconsolidated boulder and cobble-bearing alluvium of the distal part of the Lytle Creek fan that emanates from the San Gabriel Mountains north of the quadrangle. An older alluvial-fan deposit derived from the eastern San Gabriel Mountains once covered the Jurupa Mountains; cobbles of eastern San Gabriel Mountains rocks, remnants of this now vanished fan, occur along ridge tops of the Jurupa Mountains and the hill to the east of the mountains (Morton and Matti, 1989).

Pleistocene alluvial-fan deposits flank the south side of the Jurupa Mountains. Most of these deposits are well indurated, brown, sandy deposits containing cobble deposits near the south side of the mountains; clasts are locally derived from the Jurupa Mountains. The active channel of the Santa Ana River is located in the southeast corner of the quadrangle.

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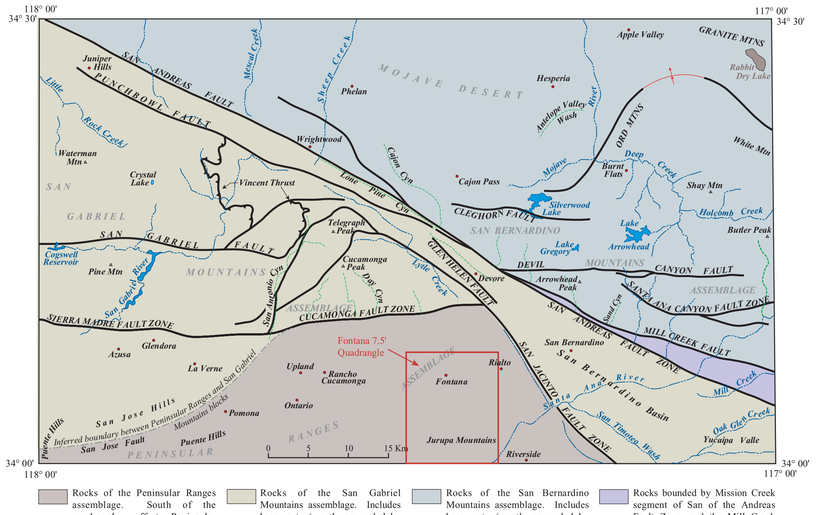

Rocks of the Peninsular Ranges assemblage. South of the quadrangle, offset Peninsular Ranges rocks occur east of the San

Rocks of the San Gabriel Mountains assemblage. Includes basement (mostly concealed by Quaternary deposits) that is offset by the San Jacinto Fault

Rocks of the San Bernardino Mountains assemblage. Includes basement (mostly concealed by Quaternary deposits) of the Mojave Desert, which is similar to San Bernardino Mountains basement

Rocks bounded by Mission Creek segment of San of the Andreas Fault Zone, and the Mill Creek Fault

Map of San Bernardino 30' X 60' quadrangle showing the location of the Fontana 7.5' quadrangle. Colored areas define structural assemblages. Approximate locations of most faults having large displacements or lengths are shown. Inferred boundary between Peninsular Ranges and San Gabriel Mountains assemblages is hidden beneath thick Quaternary deposits, and its location and character are highly speculative. • Town or geographic feature; ▲ Mountain Peak.