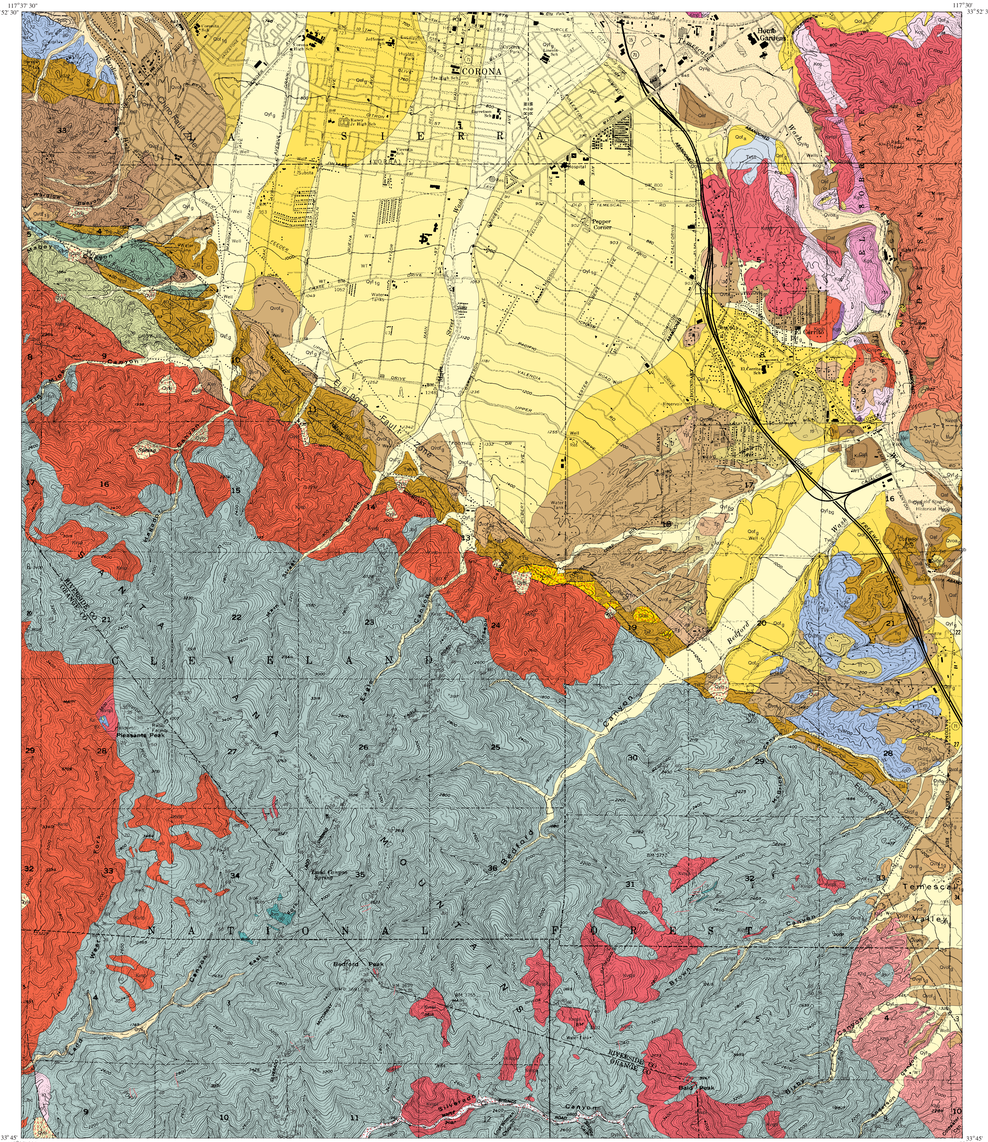
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
CALIFORNIA DIVISION OF MINES AND GEOLOGY

OPEN-FILE REPORT 02-21



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

GN
MN
13.5°

SCALE 1:24,000

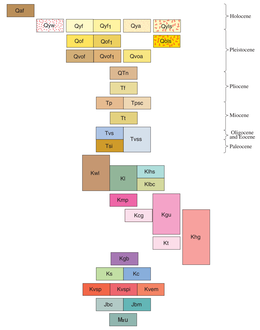
1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET

Geology mapped by C.H. Gray, Jr., 1961, D.M. Morton, 1995-1997, and F.H. Weber, 1976

CORRELATION OF MAP UNITS



On some SCAMP geologic map plots, including the Corona South 7.5' quadrangle, characteristic grain size information is displayed using subscripted alpha characters (e.g. Qyf_{cg}, Qwa_{ls}) when the character conform to the following definitions:

a – armaceous (very coarse sand through very fine sand)
b – boulder gravel (>25mm)
g – gravel (cobble through granule gravel)
s – silty
c – clayey
m- marl
p – peat

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

Contact—Generally located within ±15 meters

Fault—High angle. Strike-slip component on all faults is right-lateral; dip-slip component is unknown, but probably reflects valley-highland relation. Solid where located within ±15 m; dashed where located within ±30 m; dotted where concealed; queried where existence questionable.

Kvspt—Dikes of Santiago Peak Volcanics

Strike and dip of beds

- **Horizontal**
- 30 **Inclined**
- **Vertical**
- 50 **Overturned**

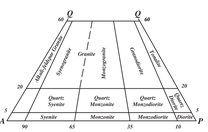
Strike and dip of igneous joint

- 70 **Inclined**
- **Vertical**

Strike and dip igneous foliation

- 60 **Inclined**

SURROUNDING 7.5' QUADRANGLES



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

DESCRIPTION OF MAP UNITS

Qaf — **MODERN 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:

Artificial fill (late Holocene)—Deposits of fill resulting from human construction or mining activities; includes numerous noncontiguous areas related to sand and gravel operations and flood control in and adjacent to Temescal Wash and to road grade and ramps along Corona Freeway segment of Interstate 15

YOUNG SURFICIAL DEPOSITS—Sedimentary units that are slightly consolidated and dissected 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/BC/Ca_k profiles). Includes:

Qyw — **Young wash deposits (Holocene and late Pleistocene)**—Sand, gravel and boulder deposits. Restricted to Silverado Canyon in southern part of quadrangle

Qyf — **Young alluvial fan deposits (Holocene and late Pleistocene)**—Gray-hued gravel and boulder deposits derived largely from volcanic and sedimentary units of Santa Ana Mountains. Fans consisting mainly of gravel emanate and coalesce from Tin Mine, Hagador, Main Street, and Eagle Canyons.. Fan emanating from Bedford Canyon is coarser grained, containing a large component of boulders. All fans coarsen toward mountains. Locally, young alluvial fan deposits are divided into subunits based on sequential terrace development and other factors; one such unit is found in quadrangle:

Qyf1 — **Young alluvial fan deposits, Unit 1 (Holocene and late Pleistocene)**—Consists of pale-gray, unconsolidated, cobble- to granule- sized gravel. Restricted to single fan bisected by younger Qyf fan emanating from Main Street and Eagle Canyons. Forms older part of Qyf unit. Precise distance this unit may have been displaced from its source area by young faults terminating upper part of fan is unknown, but estimated to be small

Qya — **Young alluvial channel deposits (Holocene and late Pleistocene)**—Gray, unconsolidated alluvium. Found chiefly in Temescal Wash and its tributaries, where it consists of medium- to fine-grained sand in lower reaches and coarsens to gravel and cobbles up stream. Also found in Wardlaw Canyon and its tributaries, and in Ladd Canyon in southwestern part of quadrangle

Qyls — **Young landslide deposits (Holocene and late Pleistocene)**—Rock debris and rubble, unsorted. All or parts of many Qyls landslides subject to renewed movement; primary landslide morphology typically preserved. Found mainly on lower part of northeastern slope of Santa Ana Mountains

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/B/Ca_k 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 argillic horizons reaching 5YR 5/6). Includes:

Qof — **Old alluvial fan deposits (late to middle Pleistocene)**—Moderately indurated, gravel and cobble alluvial fan deposits. Flanks Qyf and emanating from Bedford Canyon and Qyf1 unit emanating from main Street and Eagle Canyons. Most of unit is slightly to moderately dissected and reddish-brown. Some Qof includes thin, discontinuous surface layer of Holocene alluvial fan material. Includes:

Qofs — **Old alluvial fan deposits, Unit 1 (middle Pleistocene)**—Indurated, gravely alluvial fan deposits. Most are slightly to moderately dissected; reddish-brown. Some deposits include thin, discontinuous surface layer of Holocene alluvial fan material. In quadrangle, restricted to single occurrence flanking Qyf fan west of Corona

Qofl — **Old landslide deposits (late to middle Pleistocene)**—Mostly fragmented rock debris. Landslide morphology moderately to greatly modified. Restricted to fault-bounded deposits at foot of Santa Ana Mountains between Eagle and Bedford Canyons

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/Ca_k 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)

Qwf — **Very old alluvial fan deposits (early Pleistocene)**—Mostly well-dissected, well-indurated, reddish-brown cobble and gravel deposits. Commonly contains dariguns and locally silcretes. Found scattered along foot of Santa Ana Mountains and extending out from foot for 1 km. Most are fault-bounded and probably displaced laterally, as they commonly do not head at major canyons. Includes:

Qwfo — **Very old alluvial fan deposits, Unit 1 (early Pleistocene)**—Mostly well-dissected, well indurated, reddish-brown alluvial fan deposits. Grain size chiefly cobbles and gravel. Represents old part of Qwf. Found as fault slices and noncontiguous deposits resting on Paleocene Silverado Formation and on Cretaceous heterogeneous granitic rock in Temescal Valley

Qwa — **Very old alluvial channel deposits (early Pleistocene)**—Gravel, sand, and silt; reddish-brown, well-indurated, surfaces well-dissected. Underlies large area between Santa Ana River and Temescal Wash

QTn — **Late Cenozoic sedimentary rocks in Norco area (early Pleistocene to late Pliocene?)**—Moderately indurated sandstone, conglomeratic sandstone, and conglomerate. In Norco area, unit includes locally derived clasts as well as clasts derived from San Bernardino Mountains.

Tf — **Fernando Formation (Pliocene)**—Siltstone, sandstone, pebbly sandstone, and conglomerate. Name introduced by Eldridge and Arnold (1907) for deposits on northwest side of San Fernando Valley. Formalized by Kew (1923) for similar-appearing rocks in Ventura basin. Durham and Yerkes (1964) defined current usage in area around Santa Ana Mountains. In Puente Hills, Fernando Formation is about 1825 m thick (Yerkes, 1972). Lower part equivalent to Repetto Formation (Woodring, 1938). In other areas it has been subdivided into two members separated by regional erosional unconformity

Tp — **Puente Formation (early Pliocene and Miocene)**—Marine sandstone, siltstone, conglomerate, and shale. Named by Eldrige and Arnold (1907) for exposures in Puente Hills. English (1926) extended distribution of Puente Formation to area south of Puente Hills, subdividing three units, from youngest to oldest, (1) shale, sandstone, and conglomerate (2) sandstone, and (3) shale. Daviess and Woodford (1949) subdivided Puente Formation in northwestern Puente Hills into four members, from youngest to oldest, (1) Sycamore Canyon Member, (2) upper siltstone ember, (3) sandstone member, and (4) lower siltstone member. Schoellhamer and others (1954) later designated formalized member names that are in current usage. Only Sycamore Canyon Member is subdivided in quadrangle. Mapped as undivided Puente in vicinity of El Cerrito; elsewhere subdivided into:

Tpsc — **Sycamore Canyon Member (early Pliocene and Miocene)**—Predominantly sandstone and pebble conglomerate. Sycamore Canyon Member is laterally variable, composed of varying amounts of pale gray, thick-bedded to massive, medium- to coarse-grained, friable sandstone; pale gray, thin-bedded, siliceous siltstone; pale gray, poorly bedded siltstone, and brownish-gray, massive conglomerate. Contains bathyal depth foraminiferal fauna (Yerkes, 1972). Restricted to small area in northwestern part of quadrangle

Tt — **Topanga Formation (middle Miocene)**—Marine sandstone, siltstone, and shale. Named by Kew (1923) for predominantly sandstone unit in Santa Monica Mountains; further subdivided by Vedder (1957). Kew (1923) recognized similar rocks in Puente Hills, Santa Ana Mountains, and San Joaquin Hills. At type locality, Topanga Canyon, unit contains middle Miocene fauna characterized by *Turritella ocoyana*

Tvs — **Vaqueros and Sespe Formations, undifferentiated (early Miocene, Oligocene, and late Eocene)**—Interbedded marine and nonmarine sandstone and conglomerate assigned to the Sespe and Vaqueros Formations. Occurs in northwestern corner of quadrangle and as fault and alluvium bounded blocks south of El Cerrito. Locally, marine fossil-bearing strata of Vaqueros Formation are bed-by-bed interlayered with nonmarine rocks of Sespe Formation to degree that formations cannot be mapped as separate units. Undifferentiated unit locally includes boulder conglomerate (Woodford and others, 1973)

Tvss — **Vaqueros, Sespe, Santiago and Silverado Formations, undifferentiated (early Miocene, Oligocene, late Eocene, and Paleocene)**—Marine and nonmarine sandstone and conglomerate of Sespe, Vaqueros, and Silverado Formations. Found only on small hill between Home Gardens and El Cerrito.

Ts — **Silverado Formation (Paleocene)**—Nonmarine and marine sandstone, siltstone, and conglomerate. Dickerson (1914) first recognized Paleocene rocks in Santa Ana Mountains, and based on faunal similarities, correlated strata with Martinez Formation of central California. Woodring and Popenoe (1945) described unit in detail and named it Silverado Formation. Formation was deposited on deeply weathered erosional surface. Rocks underlying Silverado are characteristically saprolitic. Silverado Formation consists of basal conglomerate, locally boulder-bearing, overlain by relatively thin sequence of sandstone and siltstone. Sandstone and siltstone sequence is overlain by thick sequence of sandstone, siltstone, and conglomerate which includes two distinctive clay beds of commercial importance. In addition to clay, upper part of section contains carbonaceous shale and lignite beds. Thicker lignite beds were locally mined for fuel. Upper part of unit also contains abundant marine mollusks. Some eastern exposures of formation contain distinctive and diagnostic Paleocene *Turritella pacheconsis*

Kwf — **Williams and Ladd Formations, undifferentiated (Upper Cretaceous)**—Sandstone, siltstone, conglomerate, and conglomeratic sandstone of Williams and Ladd Formations; all are feldspathic. Williams Formation typically conglomeratic throughout; Ladd Formation contains thick sequences of non-conglomeratic shale and siltstone. However, both formations contain rocks ranging from conglomerate to shale. Williams Formation typically resistant, cliff-forming, white to brownish-gray, massive-bedded, poorly sorted feldspathic sandstone, pebbly sandstone, and conglomeratic sandstone. Unconformity separates two formations

Kl — **Ladd Formation (Upper Cretaceous)**—Conglomerate, sandstone, siltstone, and shale. Named by Popenoe (1942) for exposures just west of mouth of Ladd Canyon, northern Santa Ana Mountains. Popenoe divided formation into older Baker Canyon Conglomerate Member and younger Holz Shale Member as follows:

Khs — **Holz Shale Member**—Interbedded marine shale, siltstone, sandstone, and localized conglomerate beds. Sandstone beds are mostly massive, but locally crossbedded. Unit contains 5 cm- to 1 m-wide calcite cemented concretions. Foraminifera are widespread and megafossils abundant in places. Except for resistant conglomerate beds, Holz Shale weathers to form smooth rounded slopes. Unit includes prominent zone of concentrated sandstone and conglomerate beds

Klbc — **Baker Canyon Conglomerate Member**—Marine and locally nonmarine(?) conglomerate. Lower part is gray conglomerate containing clasts up to 2 m across, derived mainly from granitic and volcanic rocks. Granitic clasts appear to be from Cretaceous Peninsular Ranges batholith and volcanic clasts from Cretaceous Santiago Peak Volcanics. Upper part of conglomerate is brown conglomeratic sandstone and pebble conglomerate. Sparse sandstone beds contain abundant mollusk shells. Conglomerate is similar to the Cretaceous Trabuco Formation and locally interfingers within the Trabuco Formation west of the quadrangle. Pelecypods indicate deposition in primarily shallow-water environment

Kmp — **Micropegmatite granite (Cretaceous)**—Fine-grained, pink-tinted, leucocratic granite having distinctive micropegmatitic texture. In quadrangle, restricted to hill 1 km northwest of Home Gardens. Most of unit is in Corona North quadrangle where it forms elongate band of outcrops between Corona and Norco

Kcg — **Monzogranite of Cajalco pluton of Morton (1999) (Cretaceous)**—Mostly biotite and biotite-hornblende monzogranite ranging to granodiorite. Exposed north and east of El Cerrito; very extensive in Lake Mathews 7.5' quadrangle to east. Medium grained equigranular to subporphyritic. Informally named for exposures in Cajalco area, Lake Mathews 7.5' quadrangle (Morton, 1999). Rocks of Cajalco pluton were included within Cajalco quartz monzonite by Dudley (1935) and within Woodson Mountain granodiorite by Larsen (1948). Body is composite, shallow-level pluton emplaced by magmatic stoping within largely volcanic and volcaniclastic rocks. It was tilted eastward and eroded to progressively greater depths from west to east. East of quadrangle, upper part of pluton contains very prominent halo of highly tourmalinized rock. Zircon ages are 109.5 Ma_{id} and 112.6 Ma_{ip}. Within quadrangle unit includes:

Kgu — **Granite, undifferentiated (Cretaceous)**—Equigranular, leucocratic fine-to coarse-grained massive granite and biotite monzogranite. Consists of quartz, alkali feldspars and sparse biotite. Forms elongate dike-like mass northeast of El Cerrito

Khg — **Heterogeneous granitic rocks (Cretaceous)**—Heterogeneous mixture of widely diverse granitic rocks types. Assemblage includes monzogranite, granodiorite, tonalite, and gabbro. Rocks of tonalite composition are most abundant. Mapped west of Temescal Valley in southeastern part of quadrangle

Kt — **Tonalite, undifferentiated (Cretaceous)**—Gray, medium-grained biotite-hornblende tonalite, typically foliated. Restricted to small, partially fault-bounded area south of Ladd Canyon in southwestern part of quadrangle

Kgb — **Gabbro (Cretaceous)**—Mainly hornblende gabbro. Includes Virginia quartz-norite and gabbro of Dudley (1935), and San Marcos gabbro of Larsen (1948). Typically brown-weathering, medium-to very coarse-grained hornblende gabbro; very large poikilitic hornblende crystals are common, and locally gabbro is pegmatitic. Much of unit is quite heterogeneous in composition and texture. Includes noritic and dioritic composition rocks. Exposed in two small areas east and southeast of El Cerrito

Ka — **Serpentinite (Cretaceous)**—Small body of highly deformed, slickensided, greenish-brown serpentine surrounded by calcite and forsterite bearing carbonate-silicate rocks (Rg) within intrusive rocks associated with Santiago Peak volcanics (Rvtga). Restricted to single occurrence just west of Pleasants Peak

Kc — **Carbonate-silicate rock (Cretaceous)**—Small body of reddish-brown carbonate-silicate rock spatially associated with serpentinite (Ka)

Kvsp — **Santiago Peak Volcanics (Cretaceous)**—Basaltic andesite, andesite, dacite, rhyolite, volcaniclastic breccia, welded tuff, and epiclastic rocks (Herzig, 1991). Originally named Black Mountain volcanics by Hanna (1926), but name was pre-empted. Larsen (1948) renamed unit Santiago Peak Volcanics for exposures in vicinity of Santiago Peak, northern Santa Ana Mountains. Rocks are very heterogeneous, discontinuous, and poorly exposed. Most of unit is hydrothermally altered; alteration was contemporaneous with volcanism. Zircon ages of Santiago Peak Volcanics range from 123 to 134 Ma (Anderson, 1991), making it coeval with older part of Peninsular Ranges batholith.

Kvspt — **Intrusive rocks associated with Santiago Peak Volcanics (Cretaceous)**—Porphyritic intrusive rocks principally of intermediate composition probably emplaced at shallow depths. Composed of plagioclase, clinopyroxene and altered orthopyroxene. Includes silicic porphyries composed of plagioclase, quartz, and altered pyroxene and biotite (Herzig, 1991).

Kwem — **Estelle Mountain volcanics of Herzig (1991) (Cretaceous)**—Heterogeneous mixture of rhyolite flows, shallow intrusive rocks, and volcaniclastic rocks. Distinguished from Santiago Peak Volcanics (Kvsp) by paucity of andesitic rocks. Underlies large area east of El Cerrito. Informally named by Herzig (1991) for exposures in vicinity of Estelle Mountain, Lake Mathews 7.5' quadrangle. These rocks were termed Temescal dacite-porphyry by Dudley (1935) and Temescal Wash quartz latite porphyry by Larsen (1948). Zircon age of rock from unit collected west of Lake Mathews, Lake Mathews 7.5' quadrangle, is 125.8 Ma (Anderson, 1991).

Jbc — **Bedford Canyon Formation (Jurassic)**—Slightly metamorphosed assemblage of interlayered argillite, slate, graywacke, impure quartzite, and small masses of limestone. As used here, Bedford Canyon Formation is areally limited to northern part of Santa Ana Mountains. Most of unit is poorly exposed; best exposures restricted to road cuts. Bedding and primary sedimentary structures are commonly preserved, although commonly distorted by tight folding. Very fine-grained fissile, black argillite and slate form beds 2 to 8 cm in thickness. Massively bedded, impure, fine-to medium-grained, pale gray to pale brown quartzite and graywacke beds are 4 to 30 cm thick; locally carbonaceous. Lenses of conglomerate occur sparsely through sequence. Incipiently developed transposed layering. S_{1p} is locally well-developed. Includes:

Jbm — **Marble (limestone)**—Small elongate to equant-shaped bodies of gray weathering, fine-grained marble (limestone), some fossiliferous. Ammonites occur at a few places (Imlay, 1963,1964, and 1980; Silberling, and others, 1961), and rhynchonellid brachiopod debris is locally abundant (Gray, 1961)

Mzu — **Mesozoic metasedimentary rocks, undifferentiated (Mesozoic)**—Wide variety of low-to high-metamorphic grade metamorphic rocks. Most occurrences include biotite schist

GEOLOGIC SUMMARY

The Corona South quadrangle is located near the northern end of the Peninsular Ranges Province. Diagonally crossing the quadrangle in the northern end of the Elsinore Fault zone, a major active right-lateral strike-slip fault zone of the San Andreas Fault system. East of the fault zone is the Perris block and west of it the Santa Ana Mountains block. Within the quadrangle basement rocks in the Perris block are almost entirely Cretaceous volcanic rocks and granitic rocks of the Cretaceous Peninsular Ranges batholith. Basement rocks of the Santa Ana Mountains block are dominated by the Bedford Canyon Formation, which includes fossiliferous limestone bodies containing a fauna indicating the limestone formed in a so-called black smoker environment.

Unconformably overlying and intruding the Bedford Canyon Formation is the Santiago Peak Volcanics of Cretaceous age. These volcanics consist of basaltic andesite, andesite, dacite, rhyolite, breccia and volcaniclastic rocks. Much of the unit has been hydrothermally altered; the alteration was contemporaneous with the volcanism. Minor serpentine and associated silica-carbonate rock occur in association with the volcanics.

Sedimentary rocks of late Cretaceous and Paleogene age and a few Neogene age rocks occur within the Elsinore Fault zone and between and within the Chino and Whittier Hills, where they extend from the Elsinore. Marine sandstone of the middle Miocene Topanga Formation occurs within the fault zone southeast of Corona. Underlying the Topanga Formation is the nonmarine undivided Sespe and Vaqueros Formation that are predominately sandstone. Sandstone, siltstone, and conglomerate of the marine and nonmarine Paleocene Silverado Formation extend essentially along the entire length of the fault zone in the quadrangle. Clay beds in the Silverado Formation have been an important source of clay. In the northwest corner of the quadrangle is a thick, faulted, sedimentary section that ranges in age from Cretaceous to early Pliocene-Miocene.

Emanating from the Santa Ana Mountains is an extensive alluvial fan complex that underlies Corona and surrounding valley areas. This fan complex includes both Pleistocene and Holocene deposits.

The Elsinore Fault zone at the base of the Santa Ana Mountains splays in the northwestern part of the quadrangle; beyond the quadrangle boundary the name Elsinore Fault is generally not used. The southern splay takes a more western trend and to the west of the quadrangle is termed the Whittier Fault, and like the Elsinore, is a major active fault. The northern splay continues on strike along the east side of the Chino (Puente) Hills north of the quadrangle where it is termed the Chino Fault. The Chino Fault appears to have very limited displacement.

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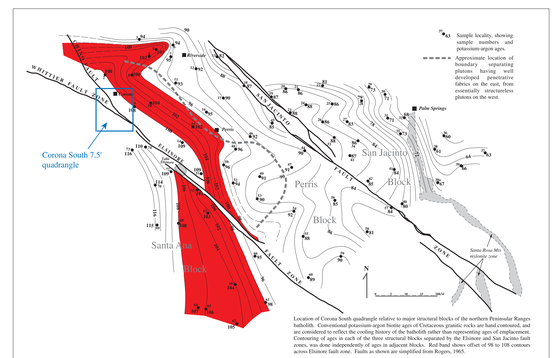

Location of Corona South quadrangle relative to major structural blocks of the northern Peninsular Ranges batholith. Conventional potassium-argon biotite ages of Cretaceous granitic rocks are hand contoured, and are considered to reflect the cooling history of the batholith rather than representing ages 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 hand shows offset of 98 to 108 contours across Elsinore fault zone. Faults as shown are simplified from Rogers, 1965.

GEOLOGIC MAP OF THE CORONA SOUTH 7.5' QUADRANGLE, RIVERSIDE AND ORANGE COUNTIES, CALIFORNIA

Version 1.0

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