U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

Geologic Map of the Devore 7.5-minute Quadrangle, San Bernardino County, California

by

D.M. Morton[1] and J.C. Matti[2]

U.S. Geological Survey

Open-file Report 90-695

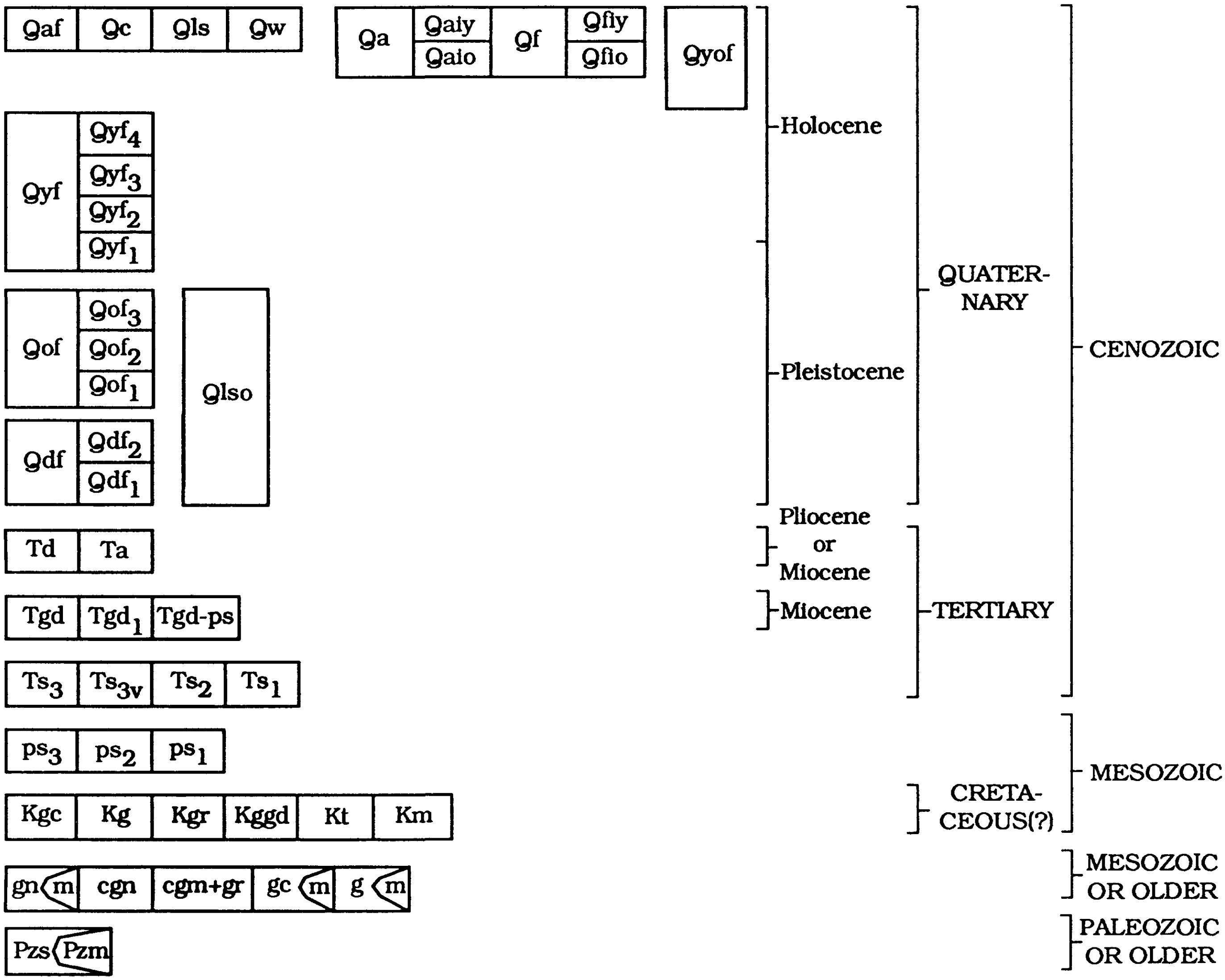
Prepared in cooperation with The State of California, Division of Mines and Geology

[1] Riverside, California

[2] Tucson, Arizona

1991

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qaf **Artificial fill (Holocene)** -- Uncompacted fill resulting from mining and tunnel excavations; flood control levee fill; compacted engineered road and highway fill

Qc **Colluvium (Holocene)** -- Unconsolidated deposits of soil and angular rock debris occuring along the base of slopes. Consists of material ranging from almost wholly rock fragments to soil and humus-rich material

Qls **Landslides (Holocene)** -- Landslides mostly consist of a crown area and landslide deposit. Most landslide deposits are composed of massive unconsolidated rock debris. The direction of principal landslide movement shown by arrows. Areas or deposits of questionable landslide origin are querried

Qw **Alluvium of most recently active channels and washes (Holocene)** -- Unconsolidated coarse-grained sand to bouldery alluvium of active channels and washes flooring drainage bottoms within mountains and on alluvial fans along the bases of the mountains. Most alluvium is, or recently was, subject to active stream flow. Contains some low-lying terrace deposits along alluviated canyon floors and areas underlain by colluvium along base of some slopes

Qa **Alluvium of modern Cajon Wash (Holocene)** -- Unconsolidated deposits of coarse-grained sand to boulder alluvium of modern alluvual stream deposits with undissected surface. Locally includes:

Qai_y Relatively younger deposits intermittently subject to inundation and reworking by high-water stream flows

Qai_o Relatively older deposits that have been recently been abandoned by active stream flows or deposits subject to inundation and reworking only by the highest flood waters

Qf **Alluvium of modern alluvium fans (Holocene)** -- Unconsolidated deposits of coarse-grained sand to bouldery alluvium of modern alluvial fans with undissected surfaces. Locally includes:

Qfi_y Relatively younger deposits intermittently subject to inundation and reworking by high-water steram flows

Qfi_o Relatively older deposits that have recently been abandoned by active stream flows or deposits subject to inundation and reworking by only the highest flood waters

Qyof **Deposits of younger alluvial fans (Holocene)** -- Unconsolidated deposits of coarse-grained sand to bouldery alluvium of younger alluvial fans. Fans posses slightly dissected surfaces. Fans abandoned by active stream flow

Deposits of younger alluvial fans (Holocene and Pleistocene) -- Unconsolidated to moderately consolidated coarse-grained sand to bouldery alluvium fan deposits with slightly to moderately dissected surfaces. Locally includes:

Qyf5 — Alluvial fan deposits with slightly dissected surfaces and stage S7 soils (Holocene); slightly younger than Qfy4 based on geomorpholgy; located in the northeast part of the quadrangle between East Kimbark and Ames Canyons

Qyf4 — Alluvial fan deposits with slightly dissected surfaces and stage S7 soils (Holocene)

Qyf3 — Alluvial fan deposits with slightly dissected surfaces and stage S6 or incipiently developed stage S5 soils (Holocene)

Qyf2 — Alluvial fan deposits with moderately dissected surfaces and well developed stage S5 soils (Holocene)

Qyf1 — Alluvial fan deposits with moderately dissected surfaces and well developed stage S5 soils (Holocene and latest Pleistocene)

Qlso — **Older landslide deposits (Pleistocene)** -- Dissected older landslide deposits consisting of unsorted, unconsolidated to moderately consolidated, massive to crudely stratified angular rock debris. Areas or deposits of inferred or questionable landslide origin are querried

Deposits of older alluvial fans (Pleistocene) -- Unconsolidated to well consolidated deposits of coarse-grained sand to bouldery alluvium of older alluvial fans with moderately to well dissected surfaces. Locally includes:

Qof3 — Alluvial fan deposits with moderately well dissected surfaces and stage S4 soils (late Pleistocene)

Qof2 — Alluvial fan deposits with well dissected surfaces and stage S4 to stage S3 soils (late and middle Pleistocene)

Qof1 — Alluvial fan deposits with well dissected surfaces and stage S3 soils (middle Pleistocene)

Deposits of older dissected alluvial fans (Pleistocene) -- Unconsolidated to well consolidated deposits of coarse-grained sand to bouldery aluvium of older alluvial fans with extremely dissectee surfaces. Locally divided into:

Qdf2 — Alluvial fan deposits with extremely dissected surfaces and stage S2 soils (middle Pleistocene)

Qdf1 — Alluvial fan deposits with extrremely dissected surfaces and stage S1 soils (middle and early Pleistocene)

Td — **Olivine diabase and gabbro (Pliocene or Miocene)** -- Texturally-zoned small pluton consisting of aphanitic- to fine-grained olivine diabase near the margins grading to coarse-grained olivine gabbro near its center; includes Miocene granodiorite between Cajon and Lytle Creeks. Contains late-crystallizing, non-discrete pegmatitic clots characterized by large amounts of ilmenite and amphobile, and thin dikes of white granophyre

Ta — **Andesitic dike rocks (Pliocene or Miocene)** -- Andesitic rocks constituting thin, mostly under one meter thick, dikes mainly on central part of Lower Lytle Creek Ridge. Consists of fine- to medium-grained, equigranular- to porphyritic-textured hypabyssal andesite

Tgd

Granodiorite to granite (Miocene) -- Medium- to coarse-grained, mostly massive hypidiomorphic-granular, white-weathering biotite granodiorite to granite. Mostly thoroughly fractured; deeply weathered along ridge tops. Intrusive into Pelona Schist on Lower Lytle Creek Ridge. Biotite from this body yielded ages of about 14Ma (Miller and Morton, 1977). Locally includes:

Tgd_1

Dikes and irregular shaped bodies composed of rocks transitional between granodiorite and granite and biotite dacite. These rocks are probably shallow intrusions of the granodiorite to granite. The hypabyssal dacitic rock is porphyritic with phenocrysts of quartz, feldspar, and, most characteristicly, well-oriented biotite, which imparts a foliated texture to the rock

$Tgd\text{-}ps_2$

Desination for some areas of Lower Lytle Creek Ridge underlain by nearly equal amounts of dacitic-granodioritic rock mixed with Pelona Schist

Ts_3

Conglomerate (Tertiary) -- Moderately indurated, gray, massive appearing to moderately well-bedded, non-marine boulder conglomerate. Contains some interbeds of coarse-grained, moderately indurated sandstone. Occurs along the San Gabriel Mountain front where the conglomerate is unconformably underlain by units of Qof_2 and Qdf_2 and is in fault contact with overlying granulitic gneiss. Locally includes:

Ts_{3v}

Conglomerate containing sparse clasts of argillic-altered, silicic volcanic rocks

Ts_2

Arkosic Sandstone (Tertiary) -- Well indurated, indistinctly bedded, pebbly, tan arkosic non-marine sandstone occurring within the San Andreas fault zone. Contains common, four to eight inch-in-diameter clasts of thoroughly fractured granitic rocks and subangular, olive brown volcanic rocks. Most of this unit appars to have been thoroughly deformed, but it retains a massive appearance

Ts_1

Sandstone and mudstone (Tertiary) -- Well indurated, brown to maroon, interbedded non-marine arkosic sandstone, mudstone, nad uncommon conglomerate within the an Andreas fault zone. Mudstone weathers to friable material. Most of the feldspar in this rock has decomposed to clay

Pelona Schist (Mesozoic) -- Divided into:

ps_3

Muscovite schist -- Spotted muscovite-albite-quartz schist located between the San Andreas and Glen Helen fault zones. Mostly uniform appearing, regularly layered, very fissile, dark gray schist with local quartz-rich layers and very sparse masses of talc and/or dark tremolite rock. Spotted appearance is due to small porphyroblasts of dark gray albite

ps_2

Siliceous schist -- Siliceous, tan to gray muscovite schist, quartzite, spotted albite schist, greenstone, and biotite-bearing schist with rare masses of carbonate-tremolite and talc-rich rock. Spotted and biotite-bearing schists are fissile. Quartzite occurs inter-layered within siliceous schist. Most of this unit is thoroughly fractured and landslide prone

ps_1

Greenstone -- Dark greenish colored, foliated, and indistinctly layered chlorite-epidote-albite greenstone. Locally hornblende-bearing, especially adjacent to intrusive contacts with granodiorite. Greenstone is relatively landslide prone

Kgc

Mylonitic leucogranite (Cretaceous?) -- White weathering mylonitic leucocratic granite located west and northwest of Sycamore Flat between Cajon and Lytle Creeks. Distinct mylonitic layering produced by deformed quartz and feldspar. Most rocks are thoroughly fractured and decomposed

Kg

Leucocratic muscovite granite (Cretaceous?) -- Medium- to coarse-grained, massive to semi-foliated, thoroughly fractured, mostly decomposed, white weathering muscovite granite exposed between faults south of Sycamore Flat

Kgr

Granite (Cretaceous?) -- Coarse-grained leucocratic granite grading from gneiss to gneissic granite exposed within the San Andreas fault zone. Sub-porphyritic with phenocrysts (porphyroblasts?) of pink potassium feldspar. Many fractures contain epidote. Thoroughly fractured, but relatively resistant to erosion, giving rise to smooth, rounded exposures

Kggd

Granite and granodiorite (Cretaceous?) -- Off-white weathering, medium-grained subporphyritic massive granite to granodiorite. Constitutes northeast striking dikes cutting tonalitic rock west of Lytle Creek. Phenocrysts are potassium feldspar and quartz

Kt

Tonalitic rocks (Cretaceous?) -- Foliated, gray, medium- to coarse-grained granitic rocks mostly of tonalitic composition exposed mainly west of Lytle Creek. Mostly equigranular, locally subporphyritic with phenocrysts of feldspar. Foliation produced by oriented biotite and hornblende; commonly as dark, plate-like inclusions parallel to foliation. Locally contains septa of gneiss and schist incorporated to various degrees within the tonalite; some rock contains scattered garnets with kelyphytic rims. Locally includes:

Km

Mylonitized tonalitic rocks -- Southern part of the tonalitic rock unit is thoroughly mylonitized giving rise to a uniform porphyroblastic textured mylonite constituting a zone 200 to 400 meters in width. Mylonite is gray, porphyroblastic, mainly of tonalite composition, but locally with diorite to granite composition. Mylonite is very fine-grained to aphanitic with porphyroclasts of plagioclase and quartz and very striking porphyroblasts(?) and porphyroclasts of hornblende as much as 3 cm in length. Most of the elongat porphyroblasts are preferentially oriented down dip. Contains dark gray to black aphanitic mylonite and ultramylonite layers (pseudotachylyte) approximately 3 cm thick

gn

Undivided gneiss east of the San Andeas fault zone (Mesozoic or older) -- Heterogeneous, irregularly layered and foliated amphibolite-grade, biotite and biotite-bearing gneiss. Includes some rocks which appear to be tonalite. Locally includes:

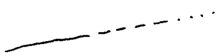
m

Pods and stringers of coarse-grained white marble

cgn

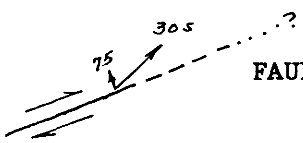
Cataclastic gneiss (Mesozoic or older) -- Cataclastic-mylonitic amphibolite grade biotite gneiss intruded by mylonitic granitic rocks in the Scotland area. Gneiss is layered and intensely folded. Contains some white marble pods; marble ranges from coarse-grained to very fine-grained with a mylonitic fabric. Locally includes:

cgn-gr	Some cataclastic gneiss contains large amounts of cataclastic textured chloritic granitic rocks
gc	**Granulitic gneiss, mylonite, and cataclastite (Mesozoic or older)** -- Prograde granulite gneiss now largely retrograde to amphibolite and greenschist grade mylonite and cataclastite. Gneiss includes quartz-feldspar gneiss, garnet-quartz-feldspar, amphibolite, garnet-pyroxene, and spinel-pyroxene rich rocks. Locally includes:
m	Scattered lenses of coarse-grained marble. Layers of coarse-grained marble occur in the layered gneiss. Mylonitic marble increases along the southern margin of the gneiss
g	Gneiss composed mostly of prograde minerals and texture. This rock consists of compositionally layered, not foliated, garnet-pyroxene-plagioclase granulitic rock. Contains small amounts of mylonitic rocks
Ps	**Schist and gneiss (Paleozoic or older)** -- Undivided, well-foliated schist and gneiss exposed on Penstock Ridge and areas west of Lytle Creek. Most of the gneiss and schist is of variable composition, but most is biotite bearing. Locally contains:
Pm	Quartz-feldspar rock, graphitic- and sulphide-rich rocks, calc-silicate rocks, and discontinuous masses of coarse-grained marble, some of which contain wollastonite
Pm-Kt	Admixed masses within tonalite

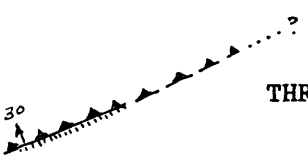


CONTACT - Dashed where approximately located; dotted where concealed

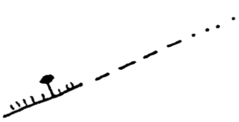
ALLUVIAL CONTACT - Showing younger alluvial unit incised into older alluvial unit; hachures at base of slope on younger unit



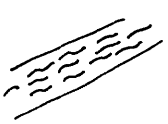
FAULT - Showing dip of fault surface, as well as bearing and plunge of slickenslides (s). Dashed where approximately located; dotted where concealed; queried where inferred; arrows indicate relative horizontal movement



THRUST FAULT - Showing dip. Dashed where approximately located; dotted where concealed; queried where inferred. Sawteeth on upper plate; hachures at base of slope on downthrown block of fault scarp

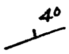


FAULT - Dashed where approximately located; dotted where concealed. Bar and ball on downthrown side; hachures on downthrown block where fault scarp present

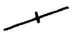


FAULT ZONE - Consists of crushed and brecciated rock

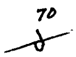
STRIKE AND DIP OF SEDIMENTARY BEDS



Inclined



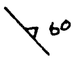
Vertical



Overturned

Horizontal

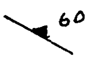
STRIKE AND DIP OF FOLIATION IN PLUTONIC ROCKS



Inclined

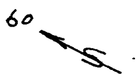
Vertical

STRIKE AND DIP OF FOLIATION AND (OR) LAYERING IN METAMORPHIC ROCKS

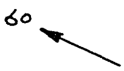


Inclined

Vertical



BEARING AND PLUNGE OF MINOR FOLD AXIS - In metamorphic and plutonic rocks



BEARING AND PLUNGE OF MINERAL LINEATION - In metamorphic rocks

LANDSLIDE - Arrows indicate direction of movement; hachures indicate headwall of crown area

GEOLOGIC SUMMARY

The Devore quadrangle straddles part of the boundary between two major physiographic provinces of California, the Transverse Ranges Province to the north and the Peninsular Ranges Province to the south. The north half of the Devore quadrangle is located in the eastern San Gabriel Mountains and includes a small area of the western San Bernardino Mountains. Both of these mountain ranges are part of the east central Transverse Ranges Province of southern California. The south half of the quadrangle is in the upper Santa Ana River valley at the northern end of the Peninsular Ranges Province.

A large number of active faults occur within the quadrangle. Right-lateral strike-slip faults of the San Andreas fault system dominate the younger structural elements of the quadrangle. The San Andreas fault zone separates the San Bernardino Mountains from the San Gabriel Mountains. Included within the San Gabriel Mountains part of the quadrangle are strands of what is commonly termed the San Jacinto fault zone. Also prominent are thrust faults of the Cucamonga fault zone. These faults are located along the south edge of the San Gabriel Mountains. The Cucamonga fault zone is the rejuvenated eastern end of a major old fault zone along the south side of the western and central Transverse Ranges (Morton and Matti, in press). Rejuvenation of the fault zone to produce the Cucamonga fault zone is apparently in response to compression in the eastern San Gabriel Mountains resulting from initiation of right lateral slip on the San Jacinto fault zone in the Peninsular Ranges.

The general structural grain within the San Gabriel Mountains is east striking. Basement rocks within the southeastern San Gabriel Mountains include a Paleozoic(?) metasedimentary sequence of schist, quartzite and marble. These rocks occur as discontinuous lenses and septa within Cretaceous granitic rocks, most of which are of tonalitic composition. Much of the granitic rocks are mylonitic. South of the granitic rocks is a complex metamorphic assemblage of Cretaceous or older rocks. This assemblage, at least in part metasedimentary, was first metamorphosed to upper amphibolite and lower granulite grade and subsequently remetamorphosed to a lower metamorphic grade. Most of the rocks have been intensely mylonitically deformed. This metamorphic complex has been intruded by charnockitic rocks of Cretaceous age (Walker and May, 1986). Mylonitic deformation produced rocks with an east-striking north-dipping foliation and a pronounced shallow east and west plunging lineation.

East of Lytle Creek and west of the San Andreas fault, the predominate basement lithology is the Mesozoic Pelona Schist. The Pelona Schist consists mostly of metabasaltic and metagraywacke metamorphosed to greenschist grade. Intruding the Pelona Schist between Lytle Creek and Cajon Canyon is a granodioritic pluton of Miocene age (Miller and Morton, 1977).

Basement east of the San Andreas fault consists of amphibolite grade schist and gneiss with clots of pegmatite.

Exposures of Tertiary sandstone and conglomerate occur within the Cucamonga fault zone and in a zone 200 to 700 m wide between the San Andreas fault and thrust faults to the north. Most of the conglomerate within the Cucamonga fault zone is overturned forming the north limb of an overturned syncline. Clasts within this conglomerate are not derived from any of the basement rocks in the eastern San Gabriel Mountains. Clasts within the sandstone and conglomerate north of the San Andreas fault zone do not appear to be locally derived.

The south half of the quadrangle is dominated by the large symmetrical alluvial fan emanating from Lytle Creek.

The San Andreas fault forms a relatively narrow fault zone marked by a pronounced scarp especially well exposed near the east margin of the quadrangle. A zone of thrust faults north of the San Andreas fault consists of two, or more, poorly exposed north-dipping fault strands. The dip ranges from about 55° to near horizontal; the shallower dips probably result from the rotation of initially steeper fault surfaces under the influence of gravity. Between the San Andreas fault and the Glen Helen fault zone are several faults with north-facing scarps. The largest of these faults are the east striking Peters fault and the northwest striking Tokay Hill fault. Both of these faults have young appearing scarps with the south (valley) side up. The Tokay Hill fault is at least in part a reverse fault.

The Glen Helen fault is located along the west side of Cajon Canyon. From the area north of Interstate Highway 15 south through Glen Helen Regional Park this fault is well define by a pronounced scarp. An elongate sag pond is located within the park.

Between Lytle Creek and Cajon Canyon a major fault zone, usually labelled the "San Jacinto fault", enters the eastern San Gabriel Mountains at Sycamore Flat. This fault zone is probably the eastward extension of the San Gabriel fault zone that is deformed into a northwest orientation due to compression in the eastern San Gabriel Mountains (Morton and Matti, in press). At the south end of Sycamore Flat this fault zone consists of three discrete faults over a width of 300 m. At the north end of the flats, it consists of a 300 m wide shear zone. Three kilometers north of Sycamore Flat the fault zone bifricates into four strands. At the north west corner of the quadrangle these four faults are distributed over a width of nearly two kilometers. From the northern part of Sycamore Flat for a distance of nearly 5 km a northeast dipping reverse fault is located along the east side of the "San Jacinto" fault zone. This fault has locally thrust Miocene granodiorite over detritus derived from the granodiorite.

The Lytle Creek fault, which is commonly considered the western splay of the "San Jacinto" fault zone, is located on the west side of Lytle Creek. Lateral displacement on the Lytle Creek fault has offset part of an old Lytle Creek channel; this offset gravel-filled channel is best seen at Texas Hill, near the mouth of Lytle Creek, where the gravel was hydraulic mined for gold in the 1890s.

The Cucamonga fault zone consists of a one kilometer wide zone of northward dipping thrust faults. Most splays of this fault zone dip north 25° to 35° .

REFERENCES CITED

Miller, F. K., and Morton, D. M., 1977, Comparison of granitic intrusions in the Pelona and Orocopia Schists, southern California: U.S. Geological Survey Journal of Research, v. 5, no. 5, p. 63-69.

Morton, D.M., and Matti, J.C., IN PRESS, Extension and contraction within an evolving convergent strike-slip fault complex: the San Andreas and San Jacinto fault zones at their convergence in southern California: Geological Society of America Memoir.

Walker, N. W., and May, D. J., 1986, U-Pb Zircon ages from the SE San Gabriel Mts., CA: Evidence for Cretaceous metamorphism, plutonism, and mylonitic deformation predating the Vincent thrust: Geological Society of America Abstracts with Programs, v. 18, p. 195.