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Quaternary Fault and Fold Database of the United States

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San Gabriel fault zone, Big Tujunga section (Class A) No. 89e

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Synopsis	**General:** Quaternary to late Quaternary active dextral normal fault zone that locally exhibits evidence of Holocene displacement. The fault zone extends for about 135 km from the Frazier Mountain area southeast to the Saugus/Castaic area where the fault's strike changes to an east-west trend through the southern San Gabriel Mountains. The fault apparently either dies out or is truncated by the San Antonio fault [328] in the eastern San Gabriel Mountains (Ehlig, 1973 #7867; Weber, 1982 #7881, 1986 #7882; Powell, 1993 #5753; Matti and Morton, 1993 #5737). **Sections:** This fault has 5 sections. There is insufficient data to delineate seismogenic segments. Weber (1982 #7881) described 5 segments that delineate the San Gabriel fault zone, and his nomenclature is adopted in this compilation, although section

	boundaries are slightly modified. From north to south they included the Palomas [89a], Honor Rancho [89b], Newhall [89c], San Gabriel River [89d], and Big Tujunga [89e] sections. Crowell (1982 #7857) suggested that dextral offset on the San Gabriel fault began in late Miocene (about 10 Ma) and mostly ceased by the end of Miocene time and concluded that dextral slip within the San Andreas transform system switched from the San Gabriel to the San Andreas fault [1] about 5 Ma. Weber (1982 #7881), however, questioned this interpretation, and noted that Pliocene Hungry Valley Formation is disrupted by the San Gabriel fault and that a few kilometers of dextral offset occurred after deposition of the Hungry Valley Formation. Weber (1982 #7881) presented geomorphic and stratigraphic evidence of late Quaternary dextral normal offset. Cotton (1986 #7848, 1987 #7854) documented evidence of Holocene strike-slip displacement along the Honor Rancho section [89b] of the San Gabriel fault at the Rye Canyon [89-1a] and Trench A [89-1b] paleoseismic sites. Alluvial package mismatches across faults exposed at the Rye Canyon site [89-1a] indicate significant strike-slip offset. Cotton (1986 #7848, 1987 #7854) reported a preliminary Holocene dextral slip rate of about 0.6 mm/yr, based on dextrally offset paleochannel and fold axis exposed at the Trench A site [89-1b]. Uncertainty values were not reported in Cotton (1987 #7854).
Name comments	**General:** Fault first mapped and named by Kew (1924 #6014) for northwest striking fault extending from Tujunga Canyon northwest to the vicinity of Holser Canyon. Kew (1924 #6014) named the fault based on exposures in the western San Gabriel Mountains. Additional named faults forming the San Gabriel fault zone include: Canton, Castaic Valley, Daisy, De Mille, Dillon, Gold Creek, Piru, Placerita, and Ybarra faults. The San Gabriel fault zone bifurcates near Big Tujunga Creek and strands here have been referred to as the Vasquez or Vasquez Creek fault (Miller, 1928 #5961; Jahns and Proctor, 1975 #6093, Crook and others, 1987 #5956), the Sierra Madre fault (Eckis, 1934 #6087; Ehlig, 1968 #7865), or the South Branch of the San Gabriel fault (Crowell, 1962 #7855, 1981 #7856; Ehlig, 1973 #7867, 1975 #7868, 1981 #7869, 1982 #7870; Weber, 1982 #7881). **Section:** Big Tujunga section is based on the Big Tujunga segment described by Weber (1982 #7881). The section extends from vicinity of Big Tujunga station southeast near the bottom of Big Tujunga Canyon, through Grizzly Flats and complexly joins the Sierra Madre fault zone [105] in the San Gabriel Mountains

	foothills just north of Altadena. This part of the San Gabriel fault is transitional to the Sierra Madre fault zone. Traces delineating the Big Tujunga section variously have been referred to as the Vasquez or Vasquez Creek fault (Miller, 1928 #5961; Jahns and Proctor, 1975 #6093, Crook and others, 1987 #5956), the Sierra Madre fault (Eckis, 1934; Ehlig, 1968), or the South Branch of the San Gabriel fault (Crowell, 1962 #7855, 1981; Ehlig, 1973 #7867, 1975 #7868, 1981 #7869, 1982 #7870; Weber, 1982 #7881). In this compilation, faults composing the Big Tujunga section will be referred to as the South Branch San Gabriel fault (Vasquez Creek). **Fault ID:** Refers to numbers 316 (San Gabriel fault - Western Part) and 384 (San Gabriel fault – Eastern Part) of Jennings (1994 #2878), and number 63 (San Gabriel fault – Central part) of Ziony and Yerkes (1985 #5931).
County(s) and State(s)	LOS ANGELES COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Good Compiled at 1:24,000 and 1:12,000 scale. *Comments:* Location of fault from Qt_flt_ver_3-0_Final_WGS84_polyline.shp (Bryant, W.A., written communication to K.Haller, August 15, 2017) attributed to 1:24,000-scale map by Weber (1982 #7881) and 1:12,000-scale map by Smith (1986 #7880).
Geologic setting	San Gabrie fault zone is one of the principal structural elements of the Transverse Ranges. The San Gabriel fault zone consists of steeply dipping faults that extend for about 135 km from the eastern San Gabriel Mountains along a generally east-west strike, through the Saugus/Castaic area where the fault zone is characterized by a northwest strike. Near Big Tujunga Canyon the South Branch San Gabriel fault branches off southeast of the east-striking San Gabriel fault. The South Branch San Gabriel (Vasquez Creek) fault may have up to 5 km of cumulative dextral displacement as reported by Powell (1993 #5753), but other workers interpret 22–38 km of dextral offset (Matti and Morton, 1993 #5737; Ehlig, 1968 #7866). Beyer and others (2009#7849) suggested that as much as 12.2 km of post Miocene dextral

	separation. Farther southeast the South Branch San Gabriel fault dips to the northeast at a shallow angle and is characterized by an unknown amount of reverse or thrust displacement (Smith, 1986 #7880). Northwest of the Saugus area the fault zone forms the southwestern edge of the Ridge basin and terminates near Frazier Mountain (Yeats and others, 1994 #7883). Principal sense of displacement is dextral strike-slip, although there is a down-to-north component of normal stratigraphic separation (Yeats and others, 1994 #6114; Powell, 1993 #7883). Maximum cumulative dextral displacement is controversial—estimates range from 0–5 km (Weber, 1982 #7881, 1986 #7882), to a maximum of 70 km (Ehlert, 1982 #7864). Most estimates fall in the 30–45 km range. The reader is referred to Powell (1993 #5753) and Yeats and others (1994 #6114) for summaries of previous estimates of displacement along the San Gabriel fault zone.
Length (km)	km.
Average strike	
Sense of movement	Right lateral, Normal *Comments:* Powell (1993 #5753) reported that the Vasquez Creek (South Branch San Gabriel) fault may have up to 5 km of dextral displacement, but large lateral offsets are not supported by palinspastic reconstructions. Beyer and others (2009 #7849) suggested as much as 12±2 km of post Miocene dextral separation may characterize the Vasquez Creek-De Mille faults. Smith (1986 #7880) noted that the style of displacement along the South Branch San Gabriel fault has varied through time. The contrast in basement rocks across the fault indicates significant lateral offset, but the topographic expression of the fault suggests vertical (reverse, NE side up) displacement for the most recent (Pleistocene) style of offset. Farther to the northwest along the southern side of Big Tujunga Canyon the fault is characterized by up-to-south vertical displacement (Smith, 1986 #7880; Weber, 1982 #7881).
Dip	30–75° NE. *Comments:* Crook and others (1987 #5956) and Smith (1986 #7880).
Paleoseismology	

studies	
Geomorphic expression	Traces characterizing the Big Tujunga section are delineated by geomorphic features such as linear drainages, broad dissected escarpments in crystalline bedrock. Fault traces lack geomorphic evidence of latest Pleistocene to Holocene displacement.
Age of faulted surficial deposits	Fault offsets crystalline basement rocks of pre-Cambrian, Paleozoic, and Mesozoic age, and, locally, Pleistocene alluvium and landslide deposits (Crook and others, 1987; Smith, 1986; Weber, 1982 #7881). Alluvial deposits of latest Pleistocene and Holocene age are not offset (Smith, 1986 #7880).
Historic earthquake	
Most recent prehistoric deformation	undifferentiated Quaternary (<1.6 Ma) *Comments:* Timing of the most recent paleoevent is poorly constrained. Weber (1982 #7881) mapped offset Pleistocene alluvium and older landslide deposits near the northern end of the Big Tujunga section. Smith (1986 #7880) reported that fanglomerate deposits equivalent to his Pasadena geomorphic surface (late Pleistocene) are offset, but the younger Devil's Gate surface is not offset.
Recurrence interval	
Slip-rate category	Between 0.2 and 1.0 mm/yr
Date and Compiler(s)	2017 William A. Bryant, California Geological Survey
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