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Quaternary Fault and Fold Database of the United States

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Malibu Coast fault (Class A) No. 99

Last Review Date: 2000-05-01

citation for this record: **Treiman, J.A., compiler, 2000, Fault number 99, Malibu Coast fault, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2020 03:11 PM.**

Synopsis	Fault zone is moderately well located from 1:24,000-scale mapping, but youthful and active hillslope processes make determination of recency of surface faulting difficult. Only two published studies provide control on recency along secondary traces (based on soil stratigraphic relations). Consulting studies have found evidence that main trace has not ruptured in Holocene, but most strands have had late-Quaternary activity. Fault is not well defined offshore.
Name comments	Recognition of a fault zone in this vicinity was first published by Lawson and others (1908 #5925); part of "Santa Monica fault" of Wood (1916 #5929); "Malibu Coast fault" first used by Soper (1938 #5948); other named faults associated with, and south of, Malibu Coast fault include Escondido thrust, Latigo fault, Malibu Bowl fault, Paradise Cove fault, Point Dume fault, Puerco fault and Solstice fault.

	Fault ID: Refers to number 389 (Malibu Coast fault) of Jennings (1994 #2878) and number 79 (Malibu Coast fault) of Ziony and Yerkes (1985 #5931).
County(s) and State(s)	VENTURA COUNTY, CALIFORNIA LOS ANGELES COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Good Compiled at 1:24,000 and 1:100,000 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 Campbell and others (1997), 1:100,000-scale map by Yerkes and Campbell (2005), and Treiman (1994) and Fischer and others (2005) mapped at unspecified scale.
Geologic setting	The Malibu Coast fault is high-angle sinistral-oblique reverse fault that has accommodated 80° of clockwise rotation of the western Transverse Ranges and perhaps as much as 60 km of sinistral slip (with other elements of the east-west frontal fault system) since early Miocene (Hornafius and others, 1986 #5922); more recently compression has been dominant (Campbell, 1990 #5942) and strike-slip has diminished to a very low rate in the Holocene (Treiman, 1994 #5949). Fault is suggested to be a western branch of the Santa Monica fault [101] (Junger and Wagner, 1977 #5945; McGill, 1980 #5946; Campbell, 1990 #5942); however Wright (1991 #5950) concludes that data are inadequate to demonstrate this.
Length (km)	62 km.
Average strike	N87°W
Sense of movement	Reverse *Comments:* Fault zone is currently dominated by compression along fault splays south of main trace, with perhaps minor component of sinistral strike-slip movement (Treiman, 1994 #5949).
Dip	30–80°

	Comments: Main trace dips 45–80° N. (Yerkes and Wentworth, 1965 #5952); other faults south of main trace have variable dips from horizontal to high-angle.
Paleoseismology studies	Site 99-1, Solstice fault: Trenching study found evidence of repeated late-Quaternary and Holocene displacement on Solstice fault based on soil development (Drumm, 1992 #5944). Site 99-2, Winter Mesa: Trenching study identified several bedding-parallel faults with possible Holocene displacement based on soil development and reconstructed geomorphic history. These faults lie between the Malibu Coast fault [99] and the Puerco Canyon fault (Rzonca and others, 1991 #5947).
Geomorphic expression	Features are principally an erosional fault-line expression (such as aligned benches, saddles and linear drainages), but significant sinistral deflection of older (late-Pleistocene) incised drainages may be indication of past sinistral displacement; near-shore part locally marked by kelp suggestive of linear substrate contrasts (Treiman, 1994 #5949).
Age of faulted surficial deposits	Holocene soils and colluvium at limited localities south of main trace (Rzonca and others, 1991 #5947; Drumm, 1992 #5944), late-Pleistocene terrace deposits (Yerkes and Wentworth, 1965 #5952). Other documentation of late-Quaternary offset can be found in various consulting reports referenced in Treiman (1994 #5949) and on file with State of California, California Geological Survey, Alquist-Priolo program. Tertiary marine and volcanic rocks (mostly Miocene) are faulted along much of the fault zone (Yerkes and Campbell, 1980 #5951; Campbell and others, 1996 #5943).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Timing of most recent paleoevent is poorly constrained. Treiman (1994 #5949) did not observe evidence of Holocene displacement along most of the Malibu Coast fault, although probable Holocene displacement is indicated at one and possibly two localities on secondary traces (sites 99-1 and 99-2) (Rzonca and others, 1991 #5947; Drumm, 1992 #5944); Campbell (1990 #5942) and Treiman (1994 #5949) suggest that

	Holocene displacement onshore may be a secondary response to primary displacement on the offshore Anacapa-Dume [100] or Santa Monica [101] faults.
Recurrence interval	
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* 0.03–0.09 mm/yr vertical displacement rate estimated by Clark and others (1984 #2876); Treiman (1994 #5949) suggests diminishing lateral displacement rate of 1–2 mm/yr (Quaternary) to 0.5 mm/yr (late-Quaternary) to near zero (Holocene); Petersen and Wesnousky (1996 #4860) report 3–5 mm/yr late-Pleistocene/Holocene slip rate based on unpublished work by Molnar (1991 report to Southern California Earthquake Center), but the estimates by Molnar are poorly constrained and included data for the Hollywood [101] fault. Slip rate assigned to the Malibu Coast fault by Petersen and others (1996 #4860) for probabilistic seismic hazard assessment for the State of California was 0.3±0.2 mm/yr.
Date and Compiler(s)	2000 Jerome A. Treiman, California Geological Survey
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