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Sierra Madre fault zone, Sierra Madre C section (Class A) No. 105d

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Synopsis	**General:** In general the Sierra Madre-Cucamonga fault zone marks the southern margin of uplift of the San Gabriel Mountains, although the Santa Susana fault extends the zone of south-vergent uplift west of these mountains. Only local portions of the fault zone have had detailed paleoseismic investigations, and those have had fairly limited results. Published slip rates vary widely along the fault zone. The best-understood part of the fault is the easternmost section, the Cucamonga fault zone, with excellent geomorphic expression, several trenches, and age control from radiocarbon and soil stratigraphic studies. These studies have demonstrated multiple Holocene events on several strands of the Cucamonga fault and a minimum slip rate of 4.5 mm/yr. Two studies on the central and eastern portions of the Sierra Madre fault zone have indicated that recurrence intervals between large events (M greater than or equal to 7) seem to be long (perhaps 7–

	8 k.y. or longer). The slip rate on the Sierra Madre fault appears to be considerably less than the Cucamonga fault, perhaps as low as 1 mm/yr or less. Studies on the San Fernando fault zone indicate a somewhat shorter recurrence interval of perhaps as much as 4,000 yr. The Santa Susana fault is less well understood, but has been inferred to have a slip rate greater than 5 mm/yr. **Sections:** This fault has 8 sections. The Santa Susana, San Fernando, Sierra Madre and Cucamonga fault zones are four basic units of this fault zone. Santa Susana, itself, has been divided structurally into three parts (Yeats, 1987 #6113; Yeats and others, 1994 #6114, see discussion of section 105a) but is treated here as one section. The Sierra Madre fault zone, along with the San Fernando fault zone, has been divided into three to seven elements. Segmentation of the Sierra Madre fault has been proposed based on the identification of several, convex-to-the-south, "salients" (Proctor and others, 1972 #6100; Ehlig, 1975 #6088; Wesnousky, 1986 #5305; Petersen and Wesnousky, 1994 #5962). However, it has not been demonstrated that rupture would be restricted to an individual segment in an earthquake. Sierra Madre segment A (Wesnousky, 1986 #5305) is not considered by Crook and others (1987 #5956) as part of the Sierra Madre fault zone, but rather is called the Vasquez Creek fault (after Miller, 1928 #5961), a southern branch of the San Gabriel fault. Segments B through E of Wesnousky (1986 #5305) after Proctor and others (1972 #6100) and Ehlig (1975 #6088) are retained in this compilation as sections. Morton and Matti (1987 #6099) discuss possible segmentation of the Cucamonga fault zone (but it is treated here as one section). Walls and others (1997 #6110) suggest at least two and possibly three segments for the San Fernando-Sierra Madre-Cucamonga fault zone (San Fernando, Sierra Madre and Cucamonga) based on differing uplift rates. In support of a lesser number of segments, Tucker and Dolan (2001 #6107) suggest that the entire Sierra Madre section, from Altadena to San Dimas, may rupture in single events.
Name comments	**General:** **Section:** Originally distinguished as segment C by Wesnousky (1986 #5305); section extends from Chiquita Canyon to Santa Anita Canyon. **Fault ID:** Refers to numbers 344 (Santa Susana fault), 355 (unnamed faults), 356 (San Fernando fault), 357 (Sierra Madre fault), 385 (Clamshell and Sawpit Canyon faults), 395 (Duarte

	fault), and 399 (Cucamonga fault) of Jennings (1994 #2878). Also refers to numbers 68 (Santa Susana fault), 69 (San Fernando fault), 83 (Sierra Madre fault), 84 (Duarte fault), 85 (Clamshell-Sawpit fault zone), and 86 (Cucamonga fault) of Ziony and Yerkes (1985 #5931).
County(s) and State(s)	LOS ANGELES COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Compiled at 1:24,000 scale. *Comments:* Location of fault based on 1:24,000-scale mapping of Crook and others (1987 #5956).
Geologic setting	Sierra Madre fault zone, within the eastern part of the Transverse Ranges, refers to the entire 125-km-long complex zone of mechanically related thrust and reverse faults that grossly demarcate the base of the San Gabriel Mountains from San Fernando Pass on the west to Cajon Pass on the east, and also includes the Santa Susana fault to the west (Ehlig, 1975 #6088; Crook and others, 1987 #5956; Morton and Matti, 1987 #6099; Yeats, 1987 #6113). Reverse slip on this fault zone has contributed to the 2–3 km elevation of the mountain range (Walls, 2001 #6109).
Length (km)	This section is 23 km of a total fault length of 128 km.
Average strike	N68°W (for section) versus N86°W (for whole fault)
Sense of movement	Thrust *Comments:* Reverse sense of movement documented by Ziony and Yerkes (1985 #5931).
Dip	80° NE. *Comments:* Southerly traces are thrusts with dips up to 40°; northerly traces within bedrock are higher angle, with mapped dips commonly to 80° (Crook and others, 1987 #5956). Ziony and Yerkes (1985 #5931) cite dips of 15–50° NE.
Paleoseismology	

studies	
Geomorphic expression	Scarps along lower thrusts; aligned notches mark higher angle faults; abrupt mountain front.
Age of faulted surficial deposits	Fault strands displace Quaternary units 3 and 4. Unit 3 is 11–200 ka, unit 4 is older than 200 ka (Crook and others, 1987 #5956).
Historic earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:* Timing of the most recent event is poorly constrained, but likely occurred between 11 and 200 ka.
Recurrence interval	*Comments:* There is considerable variation in suggested and stated recurrence intervals. Crook and others (1987 #5956) indicate that the last event occurred more than 5 k.y. ago. However, Dolan and others (1995 #5965) suggest that recurrence intervals are on the order of 500 yr calculated from assumed slip per event and slip rate.
Slip-rate category	Between 1.0 and 5.0 mm/yr *Comments:* The slip rate for this part of the fault is unknown. However, Working Group on California Earthquake Probabilities (1995 #4945) extrapolate the slip rate of 4.0±2.0 mm/yr from the Cucamonga fault [105h]. Slip rate assigned to the entire fault by Petersen and others (1996 #4860) for probabilistic seismic hazard assessment for the State of California was 3.0 mm/yr (with minimum and maximum assigned slip rates of 2.0 mm/yr and 4.0 mm/yr, respectively).
Date and Compiler(s)	2000 Jerome A. Treiman, California Geological Survey
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