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Sierra Madre fault zone, Sierra Madre B section (Class A) No. 105c

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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 B by Wesnousky (1986 #5305); section extends from Big Tujunga Canyon to Chiquita 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	Poor Compiled at 1:750,000 scale. *Comments:* Location of fault taken from 1:750,000 map of Jennings (1994 #2878).
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 16 km of a total fault length of 128 km.
Average strike	N70°W (for section) versus N86°W (for whole fault)
Sense of movement	Reverse *Comments:* Described as reverse by Ziony and Yerkes (1985 #5931).
Dip	45° NE. *Comments:* Shallow near surface to shallowly south-dipping as thrust rolls over into a landslide; local dips up to 85° (Crook and others, 1987 #5956); Ziony and Yerkes (1985 #5931) cite dips of 15–50° NE.
Paleoseismology	Site 105-7, Dunsmore Canyon: trenches across one of two scarps

studies	found evidence of Holocene displacement (Crook and others, 1987 #5956). Site 105-8, Jet Propulsion Laboratory: trenches and borings helped define near-surface geometry of fault and documented offset of unit 3 alluvium (11–200 ka, unpublished studies discussed in Crook and others, 1987 #5956). Site 105-10, Loma Alta Park: trench across one strand of fault zone found evidence of two earthquakes in past 15 k.y., with reverse displacement of more than 4 m/event; (Rubin and others, 1998 #6101).
Geomorphic expression	Scarps, truncated ridges, hanging drainages, abrupt mountain front.
Age of faulted surficial deposits	Fault strands displace Quaternary units 2–4 of Crook and others (1987 #5956). Unit 2 is 1–11 ka, unit 3 is 11–200 ka, unit 4 is older than 200 ka.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Timing of most recent event is based on trenching studies described by Crook and others (1987 #5956, p. 62—trenches 18AB&C) and Rubin and others (1998 #6101).
Recurrence interval	500–7,500 yr *Comments:* Based on 2 events in past 15 k.y. (Rubin and others, 1998 #6101); 500 years (calculated from assumed slip per event and slip rate Dolan and others, 1995 #5965); >5 k.y. (Crook and others, 1987 #5956).
Slip-rate category	Between 1.0 and 5.0 mm/yr *Comments:* 4.0±2.0 mm/yr extrapolated by Working Group on California Earthquake Probabilities (1995 #4945) from the Cucamonga fault [105h]; 0.5 +0.7/-0.1 mm/yr vertical separation rate based on faulted late-Pleistocene fluvial terraces (Walls, 2001 #6109). Slip rate assigned 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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