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Sierra Madre fault zone, Sierra Madre E section (Class A) No. 105g

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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 named segment E by Wesnousky (1986 #5305); section extends from Big Dalton Canyon to San Antonio 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)	SAN BERNARDINO COUNTY, CALIFORNIA LOS ANGELES COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Poor Compiled at 1:750,000 scale. *Comments:* Location 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 15 km of a total fault length of 128 km.
Average strike	N87°E (for section) versus N86°W (for whole fault)
Sense of movement	Thrust *Comments:* Fault is depicted as having dips shallower than 45? by Dibblee (2002 #6085). However, Ziony and Yerkes (1985 #5931) indicate reverse movement.
Dip	25° N *Comments:* 25° near surface dip from trench and borings (Tucker and Dolan, 1999 #6106).
Paleoseismology studies	Site 105-11, San Dimas: trench study, including 14C-dated alluvium, constrains latest rupture to before mid-Holocene and

	quantifies slip on one strand in latest Pleistocene/Holocene (Tucker and Dolan, 1999 #6106).
Geomorphic expression	Abrupt mountaint front with lobate thrust foreland; faceted spurs.
Age of faulted surficial deposits	Fault displaces late-Pleistocene/Holocene alluvium at one site (Tucker and Dolan, 1999 #6106); fault presumably uplifts late-Quaternary terrace and alluvial deposits and displaces earlier Tertiary and Cretaceous rocks (Streitz, 1964 #6104; Streitz, 1966 #6105; Crook and others, 1987 #5956).
Historic earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:* showed last event was probably before 7.3 ka, and 10 m cumulative reverse slip since 20 ka.
Recurrence interval	>7 ka *Comments:* Based on single trench study (Tucker and Dolan, 1999 #6106) the interval since the last event is more than 7 k.y. However, dolan and others (1995 #5965) calculate a return time of 520 yr based on assumed slip per event and slip rate.
Slip-rate category	Between 1.0 and 5.0 mm/yr *Comments:* Tucker and Dolan (1999 #6106) indicate that the preferred rate for frontal strand is 0.9 mm/yr. Working Group on California Earthquake Probabilities (1995 #4945) assume a rate of 4.0?2.0 mm/yr, which was extrapolated from the Cucamonga fault [105h]. 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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