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Elsinore fault zone, Whittier section (Class A) No. 126a

Last Review Date: 1998-12-01

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Synopsis	**General:** A major dextral strike-slip fault zone that is part of the San Andreas fault system. Research studies have been done to assess faulting on most of the sections, and have documented Holocene activity for the length of the fault zone with a slip rate around 4–5 mm/yr. Multiple events have only been dated on the Whittier fault and Glen Ivy North fault strand, so interaction between faults and adjacent sections is not well-known. Multiple strands within several sections mean that the studies are not always fully representative of the whole section. Numerous consulting reports (not summarized herein) that have addressed location and recency of faulting are on file with the State of California, California Geological Survey, as part of the records of their Alquist-Priolo Earthquake Fault Zoning Program. **Sections:** This fault has 7 sections. Sections are selected

	following the segmentation from Working Group on California Earthquake Probabilities (1995 #4945) from north to south: Whittier section [126a], Chino section [126b], Glen Ivy section [126c], Temecula section [126d], Julian section [126e], Coyote Mountain section [126f], with addition of Laguna Salada section [126g] as used by Petersen and others (1996 #4860) and Chino fault (paired with the Whittier fault by Rockwell and others, 1992 #6431).Anderson and others (1989 #6372) also identified same segments, with addition of Chupamiertos and Sierra Mayor segments in Baja California (not included in this summary); Wesnousky (1986 #5305) defined four segments, combining the Whittier, Chino and Glen Ivy into his segment A, Temecula into segment B, Julian into segment C, and the Coyote Mountain and Laguna Salada sections into segment D.
Name comments	**General:** **Section:** This is fault #444 of Jennings (1994 #2878); shown by Lawson (1908 #4969). The Whittier fault was named by English (1926 #6411); it is generally considered to extend along the west side of the Puente Hills, from Whittier in the northwest to the Santa Ana River on the southeast. **Fault ID:** Refers to numbers 431 (Chino fault), 444 (Whittier fault), 446 (Fresno, Tin Mine and Main Street faults), 460 (Wildomar fault), 461 (Glen Ivy North fault), 462 (Glen Ivy South fault), 467 (Willard fault), 469 (Wolf Valley fault), 470 (unnamed faults flanking Agua Tibia Mountain), 482 (Earthquake Valley), 483 & 496 (Elsinore fault), and 511 (Laguna Salada fault) of Jennings (1994 #2878); and numbers 10 (Chino fault), 12 (Whittier fault), 13 (Main Street fault), 14 (Fresno-Eagle fault), 15 (Tin Mine fault), 16 (Glen Ivy North fault), 17 (Glen Ivy South fault), 18 (Wildomar fault), 19 (Willard fault), 20 (Wolf Valley fault) of Ziony and Yerkes (1985 #5931).
County(s) and State(s)	ORANGE COUNTY, CALIFORNIA LOS ANGELES COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Fault trace is taken from Treiman (1991 #6442), Tan, Miller and Evans (1984 #6437).

Geologic setting	The Elsinore fault zone is a major dextral shear system, parallel to the southern San Andreas fault [1], that accommodates about 5 mm/yr of the Pacific-North American Plate boundary slip. The northern elements of the fault zone, the Chino and Whittier faults, bound the Puente Hills, an uplifted block of Tertiary sediments. The Glen Ivy section forms the northeast boundary of the Santa Ana Mountains, and, together with the Temecula section, forms the Elsinore trough. To the southeast the fault zone (Temecula, Julian, and Coyote Mountain sections) cuts diagonally across various Peninsular Range batholithic and pre-batholithic metamorphic terrain until it reaches the southwestern margin of the Salton Trough as the Laguna Salada fault. Total strike-slip is reported to be as much as 40 km but is more likely only 10–15 km, and total vertical separation is about 200 m (Hull and Nicholson, 1992 #6416).
Length (km)	This section is 36 km of a total fault length of 306 km.
Average strike	N70°W (for section) versus N51°W (for whole fault)
Sense of movement	Right lateral *Comments:* 40:1 ratio (D:R) indicated by Rockwell, Gath and Gonzalez (1992 #6431).
Dip	northeast dip at low-angle to 90° *Comments:* Dip varies from vertical to low angle in near surface merging to 70° NE. at depth (Gath and others, 1992 #6413; Rockwell and others, 1992 #6431). Durham and Yerkes (1964 #6408) describe dips of 37–80°.
Paleoseismology studies	Site 126-1, Bee Canyon: trenching documented Holocene (14C-dated) displacement at southern end of Whittier fault (Hannan and others, 1979 #6414). Site 126-7, Olinda Oil Field: three-dimensional trenching defined timing and magnitude of recent events across one of four strands, providing minimum slip-rate and time since last event (Gath and others, 1992 #6413; Patterson and Rockwell, 1993 #6427). Site 126-8, Yorba Linda: offset of 14C-dated stream channel established Holocene slip rate and older stream offsets in fluvial terrace established similar late Quaternary slip rate. Both sets of

	data showed dominance of dextral component (Rockwell and others, 1992 #6431).
Geomorphic expression	Large dextral stream deflections (>1 km) document Quaternary displacement; smaller stream offsets, sidehill benches, linear drainages express Holocene activity.
Age of faulted surficial deposits	Holocene channel deposits, late Quaternary fluvial deposits and adjacent fans (Rockwell and others, 1992 #6431; Patterson and Rockwell, 1993 #6427).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Last event occurred between 1400 and 2200 yr BP with a minimum of 1.9 m of dextral offset (Patterson and Rockwell, 1993 #6427; Working Group on California Earthquake Probabilities, 1995 #4945).
Recurrence interval	 *Comments:* Patterson and Rockwell (1993 #6427 as cited by Working Group on California Earthquake Probabilities, 1995 #4945) dated prior events at 1800±400 yr BP and 3050±50 yr BP. Minimum recurrence interval calculated for probabilistic seismic hazard assessment for the State of California was 760 (+640,-274) yr (Working Group on California Earthquake Probabilities, 1995 #4945), but much longer recurrence intervals are suggested by the geologic data.
Slip-rate category	Between 1.0 and 5.0 mm/yr *Comments:* At Olinda Oil field: 1-1.5 mm/yr on one of four strands inferred to indicate 2.5±1 mm/yr for entire zone (considering relative geomorphic expression of the four strands) during past 14 k.y. (Gath and others, 1992 #6413; Rockwell and others, 1992 #6431; Patterson and Rockwell, 1993 #6427). At Yorba Linda slip rates of 2.5-3.0 mm/yr (Holocene) and 2.85 mm/yr (<140 ka) are indicated (Rockwell and others, 1992 #6431). Slip rate assigned to the this part of the Elsinore fault zone by Petersen and others (1996 #4860) for probabilistic seismic hazard assessment for the State of California was 2.5 mm/yr (with minimum and maximum assigned slip rates of 1.5

	mm/yr and 3.5 mm/yr, respectively.
Date and Compiler(s)	1998 Jerome A. Treiman, California Geological Survey Matthew Lundberg, California Geological Survey
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#4945 Working Group on California Earthquake Probabilities, 1995, Seismic hazards in southern California—Probable earthquakes, 1994 to 2024: Bulletin of the Seismological Society of America, v. 85, no. 2, p. 379-439.

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