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Quaternary Fault and Fold Database of the United States

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Zayante-Vergeles fault zone (Class A) No. 59

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Compiled in cooperation with the California Geological Survey

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Synopsis	Major dextral reverse-oblique-slip fault with late Pleistocene and possible Holocene displacement (Coppersmith, 1979 #5384). Lots of detailed reconnaissance-level geologic and geomorphic mapping has been conducted for the fault zone, including Allen (1946 #5377), Brabb (1970 #5378; 1989 #5379; 1993 #5380), Brabb and Dibblee (1979 #4799), Clark and others (1989 #4811), Coppersmith (1979 #5384), Dibblee (1979 #4833; 1980 #4838), Dibblee and Brabb (1978 #4844), Dibblee and others (1978 #4843), Hall and others (1974 #5387), McLaughlin and others (1988 #5388), and Pampeyan (1979 #1245). Coppersmith (1979 #5384) identified latest Pleistocene and possible Holocene vertical displacement and estimated a vertical slip rate of 0.2

	mm/yr for the fault. This slip rate seems to have been relatively constant throughout Cenozoic time. Clark and others (1984 #2876) reported a late Quaternary net slip rate of between 0.03 mm/yr and 1.4 mm/yr based on data in Coppersmith (1979 #5384).
Name comments	Branner and others (1909 #5381) was the first to map and apply the name Zayante fault to part of this fault zone. Allen (1946 #5377) was the first to map and name the Vergeles fault. Clark and Rietman (1973 #5382) proposed that the Zayante and Vergeles faults are connected, based on gravity data; hence the compound name. Mooney and Colburn (1985 #5389) also suggested that the faults are connected, based on an abrupt 1.5 km deepening of basement just east of Watsonville. The current convention is to use the name Zayante-Vergeles for the entire fault zone (e.g., Coppersmith, 1978 #5383; 1979 #5384). **Fault ID:** Refers to numbers 220 (Zayante fault) and 228 (Vergeles fault) of Jennings (1994 #2878) and number L10 (Zayante-Vergeles fault) of Working Group on Northern California Earthquake Potential (1996 #1216).
County(s) and State(s)	SAN MATEO COUNTY, CALIFORNIA MONTEREY COUNTY, CALIFORNIA SAN BENITO COUNTY, CALIFORNIA SANTA CRUZ COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Poor Compiled at 1:750,000 scale. *Comments:* Locations are based on Jennings (1994 #2878). Original mapping by Allen (1946 #5377), Brabb (1970 #5378; 1989 #5379; 1993 #5380), and Hall and others (1974 #5387) is at 1:62,500 scale; mapping by Brabb and Dibblee (1979 #4799), Clark and others (1989 #4811), Coppersmith (1979 #5384), Dibblee (1979 #4833; 1980 #4838), Dibblee and Brabb (1978 #4844), Dibblee and others (1978 #4843) and McLaughlin and others (1988 #5388) is at 1:24,000 scale.
Geologic setting	The Zayante-Vergeles fault zone is a major northwest-striking structural element of the Santa Cruz Mountains restraining bend of the larger San Andreas fault zone [1]. Coppersmith (1990

	#5385) stated that the geometry of the Zayante-Vergeles fault zone relative to the San Andreas fault zone [1] and the reverse-oblique sense of slip both suggest that it is presently part of the accommodation of the restraining double bend in this part of the San Andreas fault zone [1]. The Zayante-Vergeles fault is marked by a zone (as much as 5 km wide) of en echelon, anastomosing and subparallel fault traces that extend from the vicinity of West Waddell Creek (about 4 km east of the San Gregorio fault zone [60]) southeast through the Santa Cruz Mountains, beneath Quaternary alluvium of the Pajaro River, and across the northern Gabilan Range, where it has a complex junction with the San Andreas fault zone [1] about 7 km southeast of Hollister. Post-Paleocene vertical displacement (up to the SW) may be as much as 3.5 km (Coppersmith, 1979 #5384). Cumulative dextral strike-slip displacement is not known.
Length (km)	87 km.
Average strike	N59°W
Sense of movement	Right lateral *Comments:* Allen (1946 #5377) and Clark and Rietman (1973 #5382) reported that the principal sense of displacement is vertical (up to SW) along the Zayante and Vergeles faults. Coppersmith (1990 #5385) reported post-Paleocene vertical displacements of as much as 3.5 km (up on west). Although vertical displacement has been the dominant sense of late Cenozoic offset, Coppersmith (1979 #5384) reported that most recent offsets are oblique-reverse with almost equal components of reverse and dextral strike-slip offset, based on multiple measurements of slickensides and striae on fault surfaces in early Pleistocene and Holocene deposits. Shaw and others (1994 #5390) concluded that the most recent sense of movement along the fault zone is primarily dextral strike-slip on the basis of the location of the Scotts Valley syncline in a restraining bend of the Zayante fault and the overall orientation of the Zayante-Vergeles fault zone with respect to the regional stress field.
Dip	60–80° SW. *Comments:* Based on cross sections in Allen (1946 #5377) and Coppersmith (1979 #5384). Allen (1946 #5377) observed dips of 60° to 80° SW. in outcrops of the Vergeles fault. Coppersmith (1979 #5384) inferred a generally steep to near vertical dip based

	on the generally linear geomorphic expression of the Zayante-Vergeles fault zone. Clark and others (1989 #4811) show the Zayante fault as a steeply SW dipping fault in cross sections and Shaw and others (1994 #5390) show it as nearly vertical.
Paleoseismology studies	The two sites studied by Coppersmith (1979 #5384) involved the excavation of six fault normal trenches, interpretation of magnetometer lines, and logging of road-cut exposures of strands of the Zayante-Vergeles fault zone in order to document recency, geometry, and rates of late Quaternary displacement. Fern Flat (site 59-1). This site is a road cut exposure at Fern Flat. Here a 58° southwest-dipping reverse fault zone offsets sedimentary rock of the Pliocene Purisima Formation and an overlying paleosol 1.3 m vertically. The most recent displacement is characterized by a significant horizontal component, based on striae and slickensides on fault surfaces that exhibit an average rake of 20°. Younger colluvium is draped across the fault but some fault planes extend into the colluvium, although displacements are not clear. Coppersmith (1979 #5384) concluded that the age of the overlying paleosol is early Holocene based on soil development. Bean Hill (site 59-2). A trench excavated across strands of the Zayante fault at the Bean Hill trench site exposed evidence of probable Holocene offset. The fault is expressed at the surface as a linear valley and closed depression. The trench exposed faulted sag-pond deposits that Coppersmith (1979 #5384) concluded are probably Holocene, based on lack of soil development and his observation that the trench was within a closed depression. Slickensides on sub-vertical shears show a range of rake angles of 23–51°, indicating a significant horizontal (dextral) slip component. The other five trenches excavated did not expose significant evidence of faulting.
Geomorphic expression	Fault zone is moderately defined by subtle geomorphic features suggestive of late Pleistocene and, locally, Holocene dextral reverse-oblique displacement such as linear valleys, closed depressions, notches, subtle scarps on latest Pleistocene to Holocene alluvium, warped late Pleistocene terrace surfaces, dextrally deflected and incised drainages, and linear vegetation contrasts on alluvium (Coppersmith, 1979 #5384; Bryant, 1981 #4802).

Age of faulted surficial deposits	The faults place Cretaceous crystalline rock against Tertiary sedimentary rock. Sediment of the Pliocene Purisima Formation is offset 200–400 m vertically whereas the middle Pleistocene Aromas Sands are offset about 50 m. Fluvial terraces vertically offset 10–17 m (Hall and others, 1974 #5387), defined as the Watsonville terrace surface by Dupre (1975 #5386), are about 100 ka, based on soil development and relative topographic position above sea level. The youngest faulted deposits include sag-pond deposits, a paleosol and overlying colluvium, which was estimated to be latest Pleistocene to Holocene by Coppersmith (1979 #5384).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* The time of the most recent paleoevent is not well constrained. Coppersmith (1978 #5383; 1979 #5384) reported evidence of possible Holocene displacement along the Zayante fault at the Fern Flat roadcut and the Bean Hill trench. A possible Holocene paleosol is vertically displaced 1.3 m and fault planes may extend into the overlying colluvial deposits at the Fern Flat site. Sag-pond deposits of probable Holocene age are offset at the Bean Hill trench site. Radiocarbon dates have not been reported for either of the sites and relative ages are based on assessments of degree of soil development and geomorphic expression by Coppersmith (1979 #5384).
Recurrence interval	 *Comments:* Wesnousky (1986 #5305) reported a recurrence interval of 3,130 years, which is calculated on the basis of an assumed size of event (M_W7.1) and slip rate of 0.1–1.3 mm/yr.
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Coppersmith (1979 #5384) calculated a late Cenozoic vertical slip rate of 0.2 mm/yr based on 1.3 m vertical offset of a paleosol exposed at the Fern Flat roadcut . Coppersmith (1979 #5384) noted that the vertical slip rate has remained relatively constant from Oligocene through late Pleistocene time. Clark and others (1984 #2876) calculated late Quaternary slip rates based on data from Coppersmith (1979 #5384). Vertical slip rates range from 0.04 mm/yr to 0.2 mm/yr, with preferred values of 0.06–0.1

	mm/yr. Net late Quaternary (<100 k.y.) slip rates were calculated by Clark and others (1984 #2876) using data from the Fern Flat site and Bean Hill trench site. At the Bean Hill site, a late Pleistocene net slip rate of 0.1–1.3 mm/yr was calculated by estimating the strike-slip component using rake angles of 23– 50° on fault surfaces and a vertical offset of about 1.3 m for a pebbly layer (Coppersmith, 1979 #5384). Age estimates of 5–15 ka were based on sag-pond filling rates and soil development. Clark and others (1984 #2876) calculated a preferred net slip rate of 0.2 mm/yr (0.03–1.4 mm/yr) based on a 1.3 m vertical offset of a paleosol estimated to be 8–30 ka (soil profile development) and rake angles of 8–58° on fault surfaces reported by Coppersmith (1979 #5384) at the Fern Flat site.
Date and Compiler(s)	2000 William A. Bryant, California Geological Survey
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