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Monte Vista-Shannon fault zone (Class A) No. 56

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Compiled in cooperation with the California Geological Survey

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Synopsis	Late Quaternary active and possibly Holocene active, reverse to reverse-dextral oblique slip fault that forms a part of what McLaughlin and others (1996 #5434) refer to as the Southwestern Santa Clara Valley thrust belt, which is located generally along the foothills of the northeastern Santa Cruz Mountains. The Monte Vista-Shannon fault zone commonly is associated with the Berrocal fault zone [57]. The Monte Vista-Shannon fault zone offsets sediment of the Pliocene-Pleistocene Santa Clara Formation; locally colluvial deposits are thrust over fluvial gravel of Permanente Creek, indicating late Pleistocene and possible

	Holocene displacement (W. McCormick, 1992, personal commun., in Hitchcock and others, 1994 #5450). Significant parts of the fault zone are concealed by Holocene alluvium. Hitchcock and others (1994 #5450) reported that fluvial terraces are deformed and locally displaced by traces of the Monte Vista fault zone. Hitchcock and Kelson (1999 #5451) estimated a late Pleistocene displacement rate of 0.12±0.06 mm/yr for the Monte Vista fault. Assuming a 45° dip, they calculated a late Pleistocene dip-slip rate of 0.17 mm/yr for the Monte Vista fault. Minor distributed coseismic contractional deformation in the urbanized areas along the northeastern flank of the Santa Cruz Mountains associated with the 1989 Loma Prieta earthquake locally was coincident with the general trend and locations of the Monte Vista-Shannon and Berrocal [57] fault zones (Haugerud and Ellen, 1990 #5448; Hitchcock and others, 1994 #5450; Langenheim and others, 1997 #5453; Hitchcock and Kelson, 1999 #5451).
Name comments	The Shannon fault was first named and mapped in detail by Bailey and Eberhart (1964 #5443). The Monte Vista fault was first mapped in detail and named by Sorg and McLaughlin (1975 #5442), who considered it to be the northern extension of the Shannon fault. The combined name Monte Vista-Shannon fault zone is used herein. **Fault ID:** Refers to numbers 190 (Monte Vista fault) and 216 (Shannon fault) of Jennings (1994 #2878) and number L07 (Monte Vista-Shannon fault) of Working Group on Northern California Earthquake Potential (1996 #1216).
County(s) and State(s)	SAN MATEO COUNTY, CALIFORNIA SANTA CLARA COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Good Compiled at 1:250,000 scale. *Comments:* Locations are based on digital revisions to Jennings (1994 #2878) using original mapping by Pampeyan (1993 #5462), Sorg and McLaughlin (1975 #5442), Rogers and Armstrong (1971 #5457), Wesling and Helley (1989 #5459), Bailey and Everhart (1964 #5443), McLaughlin and others (1991 #5433), Dibblee and Brabb (1978 #4844) at 1:24,000 scale; additional

	mapping by Dibblee (1966 #5463), Rogers and Williams (1974 #5461), and Brabb and Olson (1986 #5464) is at 1:62,000 scale.
Geologic setting	The Monte Vista-Shannon fault zone is located in a complex contractional system of generally northeast-vergent thrust and reverse faults that bound the northeastern side of the Santa Cruz Mountains (Schwartz and others, 1990 #5441; McLaughlin, 1990 #5454; McLaughlin and others, 1997 #5435). This thrust system has been described by McLaughlin and others (1997 #5435) as an eastward-propagating half-flower structure that roots toward the San Andreas fault zone [1]. The Monte Vista-Shannon fault zone is a predominantly a southwest-dipping reverse to reverse-dextral oblique slip fault that extends along the northeastern margin of the Santa Cruz Mountains from the vicinity of Los Trancos Creek southeast to the Alamitos Creek area, near Calero Reservoir. The Monte Vista-Shannon fault zone is closely associated with the Berrocal fault zone [57]. McLaughlin and others (1996 #5434) have referred to these faults as a complexly interwoven system of generally southwest-dipping reverse faults that collectively can be considered as one belt of faulting they termed the Southeastern Santa Clara Valley thrust belt. The relations between the Monte Vista-Shannon fault zone and the Berrocal fault zone [57] are complex. South of Cupertino, the Monte Vista fault may join the Berrocal fault along the range front near Saratoga (McLaughlin, 1974 #5431; Sorg and McLaughlin, 1975 #5442). However, subsurface data suggests that the Monte Vista fault may extend southeastward and join the Shannon fault south of Vasona Reservoir as mapped by Bailey and Everhart (1964 #5443). Cumulative displacement along the Monte Vista-Shannon fault is not well constrained. McLaughlin and others (1996 #5434) estimated that about 3 km of uplift, 3 km of shortening, and 4 km of reverse slip has occurred between the San Andreas fault [1] and the Southwestern Santa Clara Valley thrust system in the past 3 m.y. Minor distributed coseismic contractional deformation in the urbanized areas along the northeastern flank of the Santa Cruz Mountains associated with the 1989 Loma Prieta earthquake locally was coincident with the general trend and locations of the Monte Vista-Shannon [56] and Berrocal [57] fault zones (Haugerud and Ellen, 1990 #5448; Hitchcock and others, 1994 #5450; Langenheim and others, 1997 #5453; Hitchcock and Kelson, 1999 #5451).
Length (km)	46 km.

Average strike	N57°W
Sense of movement	Reverse *Comments:* Southwest-dipping reverse fault that may have an unproven component of dextral strike-slip (Sorg and McLaughlin, 1975 #5442; Hitchcock and others, 1994 #5450; McLaughlin and others, 1996 #5434).
Dip	45° SW. to 90° *Comments:* Sorg and McLaughlin (1975 #5442), McLaughlin and others (1991 #5433), Hitchcock and others (1994 #5450).
Paleoseismology studies	Site 56-1. Hitchcock and others (1994 #5450) reviewed and evaluated logs of trenches across traces of the Monte Vista-Shannon fault zone contained in consulting reports. In addition, Hitchcock and others mapped geomorphic features that probably mark traces of the Monte Vista, Shannon, Berrocal [57], and Cascade [232] faults. Hitchcock and others (1994 #5450) noted deformed late Pleistocene stream terraces, based on aerial photographic interpretation, field mapping, correlation of stream terraces, and longitudinal profiles of late Quaternary fluvial terraces along Saratoga, Stevens, and Los Gatos Creeks.
Geomorphic expression	The Monte Vista-Shannon fault zone is marked by moderately defined geomorphic features indicating latest Pleistocene and possible Holocene reverse displacement, such as benches, saddles, linear valleys, faceted spurs, scarps, linear range front, linear depressions, and vegetation contrasts (Bedrossian, 1980 #5465; Hitchcock and others, 1994 #5450).
Age of faulted surficial deposits	Jurassic and Cretaceous rocks of the Franciscan Complex are thrust over Pliocene and Pleistocene alluvial sediment of the Santa Clara Formation and younger Quaternary deposits (Sorg and McLaughlin, 1975 #5442; Wesling and Helley, 1989 #5459; McLaughlin and others, 1991 #5433; Hitchcock and others, 1994 #5450). Locally, colluvial deposits are thrust over fluvial gravel of Permanente Creek, indicating late Pleistocene and possible Holocene displacement (W. McCormick, 1992, personal commun., in Hitchcock and others, 1994 #5450).
Historic earthquake	

Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Timing for the most recent paleoevent is unknown. Hitchcock and others (1994 #5450) reported that colluvium is thrust over alluvial gravel at Permanente Creek, suggesting late Pleistocene to Holocene displacement.
Recurrence interval	*Comments:* Hitchcock and Kelson (1999 #5451) noted that coseismic deformation associated with the 1989 Loma Prieta earthquake locally was coincident with geomorphic features suggestive of recent faulting along the Monte Vista-Shannon fault zone (Haugerud and Ellen, 1990 #5448; Hitchcock and others, 1994 #5450; Langenheim and others, 1997 #5453). This could indicate that repeated localized contraction is in part coincident with the occurrence of Loma Prieta-type earthquakes. This would suggest a recurrence interval of about 400 years (Working Group on California Earthquake Probabilities, 1996 #1216). Alternatively, the recurrence interval would be much larger if the Monte Vista-Shannon fault zone ruptured independently of the San Andreas fault [1].
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Hitchcock and others (1994 #5450) reported a late Pleistocene displacement rate across the Monte Vista fault zone of 0.3±0.2 mm/yr. This is based on about 12 m of vertical separation of their Qt1 terrace across the Monte Vista fault at Stevens Creek. The age of the Qt1 terrace is poorly constrained, but estimates of 120 ka by E. Helley (cited in Sorg and McLaughlin, 1975 #5442) suggests an vertical displacement rate of about 0.1 mm/yr. Hitchcock and others (1994 #5450) argued that the age of the Qt1 terrace could be significantly younger: they suggested that the terrace may correlate with the alluvial-fan surface along Regnart Creek, which Sieh (1975 #5460) estimated to be about 23 ka (latest Pleistocene). This much younger age estimate would yield an vertical rate of 0.5 mm/yr. Because of the large uncertainty in estimated ages, they used a medial preferred displacement rate of 0.3±0.2 mm/yr. From this, Hitchcock and others (1994 #5450) calculated a late Pleistocene dip-slip rate of 0.4±0.3 mm/yr, based on a 45° fault dip. An unknown amount of dextral slip indicates this is a minimum net slip rate for the Monte Vista fault. Hitchcock and Kelson (1999 #5451) estimated the age of the Qt1

	surface at between 60 ka and 180 ka and noted that a smaller (2 m) amount of vertical separation of the Qf2 alluvial-fan surface of Regnart Creek indicates that the fan surface is younger and not correlative with the Qt1 terrace. Using a 12 m vertical separation and 120±60 ka for the Qt1 terrace, 2 m vertical separation, 23±12 ka age for the Qf2 alluvial fan surface at Regnart Creek, Hitchcock and Kelson (1999 #5451) estimated a late Pleistocene vertical displacement rate of 0.12±0.06 mm/yr for the Monte Vista fault. Assuming a 45° fault dip, they calculated a late Pleistocene dip-slip rate of 0.17 mm/yr for the Monte Vista fault. Slip rates for the Shannon and Cascade [232] faults are not known, although Hitchcock and Kelson (1999 #5451) determined a 0.2±0.05 mm/yr incision rate of Regnart Creek across the trace of the Cascade fault [232]. This is based on a 4.5 m height of a stream terrace correlated with the deformed Qf2 alluvial-fan surface above the active channel.
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