Jump to Navigation

Quaternary Fault and Fold Database of the United States

As of January 12, 2017, the USGS maintains a limited number of metadata fields that characterize the Quaternary faults and folds of the United States. For the most up-to-date information, please refer to the interactive fault map.

Sargent fault zone, southeastern section (Class A) No. 58b

Last Review Date: 2000-08-10

Compiled in cooperation with the California Geological Survey

citation for this record: **Bryant, W.A., compiler, 2000, Fault number 58b, Sargent fault zone, southeastern section, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2020 03:04 PM.**

Synopsis	**General:** Holocene active reverse-oblique and dextral strike-slip fault zone in the Santa Cruz Mountains, located between the Calaveras [54] and San Andreas [1] fault zones. For this compilation the fault is zone divided into two sections based on the geometry and style of displacement. The northwestern section is characterized by late Quaternary contractional deformation with a dextral strike-slip component. Traces of the southeastern section of the Sargent fault are characterized by predominantly Holocene dextral strike-slip displacement and locally exhibit evidence of dextral fault creep at a rate of about 3 mm/yr

	(Prescott and Burford, 1976 #5437). Geomorphic evidence of Holocene dextral strike-slip displacement characterizes the Castro fault (included with the southeastern section) from the vicinity of Castro Valley southeast to the Pajaro River (Bryant, 1980 #5428); (Bryant and others, 1981 #4805). A paleoseismic study, conducted by Nolan and others (1995 #5436)resulted in a preliminary Holocene dextral displacement rate of 0.6 mm/yr based on apparent vertical separation of offset alluvium and assumptions of the ratio of horizontal to vertical components of displacement. Nolan and others (1995 #5436) acknowledged that the rate is less than the measured fault creep and speculated that slip is transferred to other faults between their trench site and the geodetic site, which is located about 13 km to the northwest. Nolan and others (1995 #5436) reported a preliminary recurrence interval of 1,200–1300 years for 0.7- to 0.8-m slip events. They interpreted four events in the past 5,940 yr, indicating an average recurrence interval of roughly 1,485 years. **Sections:** This fault has 2 sections. There is insufficient data to document seismogenic segments for the Sargent fault zone. Based on geometry and style of offset, the Sargent fault zone is divided into sections for this compilation. The northwestern section extends from the complex junction with the San Andreas fault zone [1] near Lake Elsman southeast to the vicinity of Hecker Pass (Highway 152). This section is characterized by predominantly southwest-dipping reverse faults with an unknown component of dextral strike-slip offset. The southeastern section of the Sargent fault zone extends from the Hecker Pass area southeast to near Hollister. This section is characterized by predominantly dextral strike-slip displacement as evidenced by geomorphic expression (Bryant, 1980 #5428; 1981 #4805), abundant microseismicity (*e.g.*, Bakun and McLaren, 1984 #5427), and geodetic evidence of 3 mm/yr dextral creep (Prescott and Burford, 1976 #5437). The southeastern section is comprised by the Sargent, Castro, Flint Hills East, and Flint Hills West faults.
Name comments	**General:** **Section:** Informal name proposed in this compilation for the section of the Sargent fault that extends from just north of Hecker Pass (Highway 152) southeast to a few kilometers north-northwest of Hollister. Traces of the southeastern section of the Sargent fault are delineated by geomorphic evidence of Holocene dextral strike-slip displacement and locally exhibit evidence of

	fault creep. Geomorphic evidence of Holocene dextral strike-slip displacement is found along the Castro fault, rather than the Sargent fault, from the vicinity of Castro Valley southeast to the Pajaro River (Bryant, 1980 #5428; 1981 #4805). **Fault ID:** Refers to number 222 (Sargent fault) of Jennings (1994 #2878) and A6 (Sargent fault) of Working Group on Northern California Earthquake Potential (1996 #1216).
County(s) and State(s)	SANTA CLARA COUNTY, CALIFORNIA SAN BENITO COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Locations are based on digital revisions to Jennings (1994 #2878) using original mapping by Dibblee and Brabb (1978 #4844), Bryant (1980 #5428), Bryant and others (1981 #4805), and Rogers (1993 #5438) at 1:24,000 scale, and detailed mapping by McLaughlin (1971 #1318; 1973 #5430) and Armstrong (1980 #5425) at 1:12,000 scale.
Geologic setting	The Sargent fault zone is located in an extremely complex contractional system of generally northeast-vergent thrust and reverse faults bounding the eastern side of the Santa Cruz Mountains (Schwartz and others, 1990 #5441; McLaughlin and others, 1997 #5435). This thrust system has been described by McLaughlin and others (1997 #5435) as an eastward-propagating, half-flower structure which roots toward the larger San Andreas fault zone [1]. The Sargent fault zone extends from its complex junction with the San Andreas fault [1] near Lake Elsman southeast through the Santa Cruz Mountains, crosses the Pajaro River floodplain and extends near the northeastern front of the Lomerias Muertas and Flint Hills. The mapped surface traces ends a few kilometers east of Hollister and it is not known if the fault extends farther south-southeast to join the Calaveras fault zone [54]. The Sargent fault zone has been associated with the Berrocal fault zone [57] and has been referred to as the Sargent-Berrocal fault zone. The Sargent fault zone is divided herein into two sections based on style of displacement. Northwest of Hecker Pass, the fault exhibits primarily southwest-dipping reverse-oblique slip with an unknown component of dextral slip and

	southeast of Hecker Pass the fault zone has principally dextral strike slip. McLaughlin and others (1996 #5434) stated that prominent strike-slip displacement on steeply dipping strands of the fault zone are younger than the lower-angle thrust faults, which they truncate. Cumulative vertical offset along the Sargent fault zone is principally down-to-the-northeast reverse and may have as much as 3 km of vertical displacement, 2 km of horizontal shortening and 4 km of reverse-slip since Miocene time (<5 m.y.) (McLaughlin and others, 1997 #5435). The component of dextral slip is unknown, but McLaughlin and others (1997 #5435) speculated that the Sargent fault zone could account for as much as 26 km of dextral slip. Aydin and others (1992 #5426) reported evidence of dextral-reverse slip on the Sargent fault near Lake Elsman, the result of probable secondary surface-rupture associated with the 1989 Ms 7.1 Loma Prieta earthquake.
Length (km)	This section is 27 km of a total fault length of 54 km.
Average strike	N49°W
Sense of movement	Right lateral *Comments:* Reported as dextral to dextral-reverse by Bryant (1980 #5428), Bryant and others (1981 #4805). McLaughlin (1971 #1318; 1973 #5430; 1974 #5431), and Prescott and Burford (1976 #5437). Focal mechanisms associated with the Sargent fault zone exhibit dextral slip on NW-striking fault planes and oblique slip and reverse faulting on more west-striking fault planes (Bakun and McLaren, 1984 #5427). Dextral fault creep of 3 mm/yr is documented by Prescott and Burford (1976 #5437).
Dip Direction	V; NE; SW *Comments:* Locally branch faults have moderate to steep dips, but principal active traces of southeastern section to the northeast and the southwest, but principal active traces of southeastern section are near vertical (Allen, 1946 #5377; Bryant, 1980 #5428; 1981 #4805; Nolan and others, 1995 #5436).
Paleoseismology studies	Pajaro River floodplain (site 58-1). Studies by Nolan and others (1995 #5436) involved the excavation of one fault-parallel and four fault-normal trenches in the Pajaro River floodplain. Trenches exposed faulted middle to late Holocene alluvium, lacustrine deposits, and march deposits. AMS 14C dates from

	detrital charcoal, leaves, and twigs in Holocene alluvium indicate 14C ages ranging from 2,940±50 yr BP to 5,940±80 yr BP. Faults exposed in the trenches are near vertical and have slickensides and striae consistent with dominantly strike-slip offset.
Geomorphic expression	Geomorphic expression Traces of the southeastern section of the Sargent fault zone are marked by geomorphic features indicative of Holocene dextral strike-slip offset including side-hill benches, linear troughs, dextrally deflected drainages and linear drainages, closed depressions, scarps vegetation contrasts on Holocene alluvium, aligned springs and seeps in alluvium, and dextrally deflected ridges (Bryant, 1980 #5428; 1981 #4805).
Age of faulted surficial deposits	Traces of the southeastern section offset Mesozoic to Pleistocene sedimentary rocks. Nolan and others (1995 #5436) reported that traces of the Sargent fault offset fluvial deposits younger than 2,940±50 yr BP in the Pajaro River floodplain.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Nolan and others (1995 #5436) reported that the most recent paleoevent along the southeastern section occurred after 2,940 yr BP.
Recurrence interval	350–1485 yr (<6 ka) *Comments:* Nolan and others (1995 #5436) reported a preliminary recurrence interval of 1200–1300 years for 0.7–0.8 m displacement events. They interpreted four events in the past 5,940 yr, indicating an average recurrence interval of about 1,485 yr. If the Sargent fault zone has a slip rate of 3 mm/yr and typically produces <1 m slip events, a recurrence interval on the order of about 350 years is possible.
Slip-rate category	Between 1.0 and 5.0 mm/yr *Comments:* Nolan and others (1995 #5436) reported a preliminary Holocene dextral rate of about 0.6 mm/yr. This slip rate is based on measured apparent vertical separation of displaced alluvial units and assumptions regarding the vertical to horizontal components of slip based on observed striae along fault planes exposed in trench excavations along the Pajaro River floodplain.

	Nolan and others (1995 #5436) acknowledged that this rate is considerably less than the 3 mm/yr creep rate reported by Prescott and Burford (1976 #5437) and speculated that additional slip must be transferred to another fault between their trench site and the alignment array located about 13 km to the northwest. Savage and others (1979 #5440), based on geodetic measurements between 1975 and 1978, reported that a slip rate of as much as 4 mm/yr on the Sargent fault best fits their dislocation modeling.
Date and Compiler(s)	2000 William A. Bryant, California Geological Survey
References	#5377 Allen, J.E., 1946, Geology of the San Juan Bautista quadrangle, California: California Division of Mines and Geology Bulletin 133, 57 p. #5425 Armstrong, C.F., 1980, Environmental geologic analysis of the Tar Creek south study area, Santa Clara County, California: California Division of Mines and Geology Open-File Report 80-11SF, scale 1:12,000. #5426 Aydin, A., Johnson, A.M., and Fleming, R.W., 1992, Right-lateral-reverse surface rupture along the San Andreas and Sargent faults associated with the October 17, 1989, Loma Prieta earthquake: Geology, v. 20, p. 1063-1067. #5427 Bakun, W.H., and McLaren, M., 1984, Microearthquakes and the nature of the creeping-to-locked transition of the San Andreas fault zone near San Juan Bautista, California: Bulletin of the Seismological Society of America, v. 74, no. 1, p. 235-254. #5428 Bryant, W.A., 1980, SE segments of Sargent and Castro faults: California Division of Mines and Geology Fault Evaluation Report FER-96, microfiche copy in Division of Mines and Geology Open-File Report 90-11, 19 p., scale 1:24,000. #4805 Bryant, W.A., Smith, D.P., and Hart, E.W., 1981, Sargent, San Andreas, and Calaveras fault zones—Evidence for recency in the Watsonville East, Chittenden, and San Felipe quadrangles, California: California Division of Mines and Geology Open-File Report OFR 81-7SF, scale 1:24,000. #4832 Dibblee, T.W., Jr., 1975, Geologic maps of the Pacheco Pass, Hollister, Quien Sabe, Ortigalita Peak, San Benito, Panoche Valley, and "Tumey Hills" quadrangles, San Benito, Santa Clara,

Merced, and Fresno Counties, California: U.S. Geological Survey Open-File Report 75-394, 7 sheets, scale 1:62,500.

#4844 Dibblee, T.W., Jr., and Brabb, E.E., 1978, Preliminary geologic maps of the Chittenden, Los Gatos, and Watsonville East quadrangles, California: U.S. Geological Survey Open-File Report 78-453, 3 sheets, scale 1:24,000.

#5429 Hay, E.A., Cotton, W.R., and Hall, N.T., 1980, Shear couple tectonics and the Sargent-Berrocal fault system in northern California: California Division of Mines and Geology Special Report 140, 41-49 p.

#2878 Jennings, C.W., 1994, Fault activity map of California and adjacent areas, with locations of recent volcanic eruptions: California Division of Mines and Geology Geologic Data Map 6, 92 p., 2 pls., scale 1:750,000.

#1318 McLaughlin, R.J., 1971, Geologic map of the Sargent fault zone in the vicinity of Mount Madonna, Santa Clara County, California: U.S. Geological Survey Open-File Map (U.S. Department of the Interior and U.S. Department of Housing and Urban Development Basic Data Contribution 13), 2 sheets, scale 1:12,000.

#5430 McLaughlin, R.J., 1973, Geology of the Sargent fault zone in the vicinity of Mount Madonna, Santa Clara and Santa Cruz Counties: California State University, San Jose, unpublished M.S. thesis, 131 p., scale 1:12,000.

#5431 McLaughlin, R.J., 1974, The Sargent-Berrocal fault zone and its relation to the San Andreas fault system in the southern San Francisco Bay region and Santa Clara Valley, California: U.S. Geological Survey Journal of Research, v. 2, no. 5, p. 593-598.

#5435 McLaughlin, R.J., Langenheim, V.E., Jachens, R.C., Jayko, A.S., Stanley, R.G., and Valin, Z.C., 1997, Neogene transpressional range-front deformation, southwestern Silicon Valley, San Francisco Bay region, California [abs.]: EOS, Transactions of the American Geophysical Union, 1997 Annual Fall Meeting, v. 78, no. 46, p. F436.

#5434 McLaughlin, R.J., Sorg, D.H., and Helley, E.J., 1996, Constraints on slip histories of thrust faults of the southwestern

San Francisco Bay area from geologic mapping investigations: U.S. Geological Survey Open-File Report 96-267, 65-70 p.

#5436 Nolan, J.M., Zinn, E.N., and Weber, G.E., 1995, Paleoseismic study of the southern Sargent fault, Santa Clara and San Benito Counties, California: Unpublished U.S. Geological NEHRP Final Technical Report 1434-94-G-2466, 23 p.

#4860 Petersen, M.D., Bryant, W.A., Cramer, C.H., Cao, T., Reichle, M.S., Frankel, A.D., Lienkaemper, J.J., McCrory, P.A., and Schwartz, D.P., 1996, Probabilistic seismic hazard assessment for the State of California: California Department of Conservation, Division of Mines and Geology Open-File Report 96-08 (also U.S. Geological Open-File Report 96-706), 33 p.

#5437 Prescott, W.H., and Burford, R.O., 1976, Slip on the Sargent fault: Bulletin of the Seismological Society of America, v. 66, no. 3, p. 1013-1016.

#5438 Rogers, T.H., 1993, Geology of the Hollister and San Felipe quadrangles, San Benito, Santa Clara, and Monterey Counties, California: California Department of Conservation, Division of Mines and Geology Open-File Report 93-01, 26 p., scale 1:24,000.

#5440 Savage, J.C., Prescott, W.H., Lisowski, M., and King, N., 1979, Geodolite measurements of deformation near Hollister, California, 1971-1978: Journal of Geophysical Research, v. 84, no. B13, p. 7599-7615.

#5441 Schwartz, S.K., Orange, D.L., and Anderson, R.S., 1990, Complex fault interactions in a restraining bend on the San Andreas fault, Southern Santa Cruz Mountains, California: Geophysical Research Letters, v. 17, no. 8, p. 1207.