Jump to Navigation

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Mission Ridge fault system, Mission Ridge section (Class A) No. 88b

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Synopsis	**General:** East-striking system of generally moderately to steeply south-dipping reverse to reverse sinistral oblique faults and associated folds. Fault system reported to be mostly blind at the western end (Keller and Gurrola, 2000), but is mostly a surface fault along the eastern extent. Mission Ridge fault system is characterized by late Pleistocene, and locally Holocene displacement (Minor and others 2009; Gurrola, 2006; Keller and Gurrola, 2000; Weber and others, 1975; Chauvel, 1958; Kahle, 1985 #7940; Rockwell and others, 1984). Mission Ridge fault system divided into 4 sections in this compilation, generally following the segmentation first proposed by Keller and Gurrola (2000). The Ellwood Mesa site (88-1) exposed evidence of three events, the most recent occurring after 36 ka. The penultimate event occurred about 37 ka and the pre-penultimate event occurred between 37 ka and 47 ka (Keller and Gurrola, 2000;

	Gurrola, 2006). Gurrola (2006) calculated a minimum dip slip rate of 0.4 mm/yr at the Ellwood Mesa site, based on a vertically offset 47 ka wave cut platform. The Santa Barbara Mission scarp site (88-2) exposed evidence of two events that offset latest Pleistocene to Holocene stream channel and floodplain deposits (Gurrola, 2006). Gurrola and Keller (2003) reported a vertical uplift rate of 0.75 mm/yr at the Sheffield Reservoir site (88-3), based on 90 m uplift of a 125 ka alluvial fan deposit. Assuming a 45° dip for the Mission Ridge section, a dip-slip rate of about 1 mm/yr is indicated. Gurrola and Keller (2003) reported progressive deformation of young fluvial deposits indicating multiple events across the northern limb of the Mission Ridge anticline at the Sheffield Reservoir site (88-3), but no dates or event horizons were determined. **Sections:** This fault has 4 sections. There is insufficient data to delineate seismogenic segments. Keller and Gurrola (2000) defined three segments that define their Mission Ridge fault system based on differences in geometric, geomorphic, and structural style. From west to east they defined the More Ranch segment, Mission Ridge segment and Arroyo Parida segment. The Arroyo Parida segment included the Santa Ana fault. The segments defined by Keller and Gurrola are adopted in this compilation, although they are considered sections and the Santa Ana fault is separated into a forth section.
Name comments	**General:** Mission Ridge fault system first introduced by Gurrola and Keller (1999) and Keller and Gurrola (2000) for the zone of surface faults and near surface blind faults consisting of (from west to east) the More Ranch, Mission Ridge, Arroyo Parida, and Santa Ana faults (referred to by Gurrola and Keller as fault segments). The More Ranch fault was first mapped and named by Hill (1932). The Mission Ridge fault, named for the low, north-facing scarps along the north side of Mission Ridge, was first inferred to be a fault and was named by Dibblee (1966). Arnold (1907) first described the Arroyo Parida fault. Putnam (1942) may have been the first to map the Santa Ana fault. **Section:** The Mission Ridge section is adopted from the Mission Ridge segment described by Keller and Gurrola (2000). The Mission Ridge section extends eastward from its complex junction with the More Ranch section [88a] in the eastern Goleta basin, through the Santa Barbara area just north of Santa Barbara Mission, to a left-stepping connection with the Arroyo Parida section near the large dextral deflection of Picay Creek north of

	Summerland. **Fault ID:** Refers to numbers 322 (More Ranch fault), 327 (Mission Ridge fault and Arroyo Parida fault) and 329 (Santa Ana fault) of Jennings (1994) and numbers 46 (Mission Ridge–Arroyo Parida fault zone), 47 (More Ranch fault), and 56 (Santa Ana fault) of Ziony and Yerkes (1985).
County(s) and State(s)	SANTA BARBARA COUNTY, CALIFORNIA VENTURA COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Location of fault from Qt_flt_ver_3-0_Final_WGS84_polyline.shp (Bryant, W.A., written communication to K.Haller, August 15, 2017) attributed to by Dibblee (1986 #7928, 1986 #7929, 1987 #7930), Minor and others (2009), and Gurrola (2006).
Geologic setting	Mission Ridge fault system is a generally east-striking zone of faults and associated folds that extend on land for about 68 km from the Ellwood Mesa area west of Isla Vista east to the San Cayetano fault [95]. Keller and Gurrola (2000) stated that the Mission Ridge fault system extends offshore west of Ellwood Mesa. Mission Ridge fault system is considered by Keller and Gurrola (2000) to be a major structure of the Santa Barbara Fold Belt, which is located on the south side of the Santa Ynez anticlinorium. Keller and Gurrola characterized the Santa Barbara Fold Belt as a linear zone of active folds located along the southern flank of the western Transverse Ranges. They reported that the Mission Ridge fault system is comprised of shallow subsurface folding developed on the hanging-walls of blind reverse and thrust faults, although generally north-vergent reverse faults locally extend to the surface or very near surface. Farther east the Mission Ridge fault system is expressed by surface faults and folds that offset or deform late Pleistocene alluvium and terrace deposits. Maximum displacement is not well-constrained for the Mission Ridge fault system. Chauvel (1958) postulated that the Arroyo Parida section [88c] may have up to 825 m of dip separation and between 0.8 to 1.2 km of sinistral displacement, based on an offset contact between Eocene Coldwater Formation

	and Oligocene Sespe Formation. Dibblee (1966) reported that the Arroyo Parida section is characterized by up to 300 meters of up on south vertical displacement and a possible, though unknown, component of sinistral displacement. Jackson and Yeats (1982) argue that subsurface data do not support a large component of sinistral offset.
Length (km)	km.
Average strike	
Sense of movement	Reverse, Left lateral *Comments:* Keller and Gurrola (2000) stated displacement is predominately south-side-up reverse, but may have a small sinistral component.
Dip	45–55° S. *Comments:* Gurrola (2006) shows the Mission Ridge fault dipping from 45°-55° S. in cross section A-A'. Dibblee (1966) depicted a nearly vertical dip in cross sections F-F', G-G', and H-H'.
Paleoseismology studies	Santa Barbara Mission scarp site (88-2) by Gurrola (2006) involved the excavation of one trench at the base of a north-facing fold scarp. Trench exposed deformed and faulted Qf2 alluvial fan deposits interpreted to be 60-100 ka, based on relative soil profile development, 21Ne cosmogenic exposure dating, and stratigraphic position with respect to age-dated marine terraces. Sheffield Reservoir site (88-3) by Gurrola and Keller (2003) and Gurrola (2006) involved two trenches across the Mission Ridge fault. Trench exposed deformed alluvial fan deposits that document 90 m of vertical relief in the past 125 ka. The second trench excavated across the northern limb of the Mission Ridge anticline documented progressive deformation of Holocene deposits with depth.
Geomorphic expression	The Mission Ridge section is delineated by prominent topographically expressed anticlinal ridges such as Mission Ridge, a well-defined hanging wall anticline that deforms and uplifts late Pleistocene fanglomerate (60–70 ka, based on ^{21}Ne cosmogenic dating by Gurrola, 2006). Mission Ridge is associated with 2 wind gaps and associated defeated

	paleochannels of Mission Creek. Mission Ridge deflects Mission Creek in a dextral sense. Farther east the Mission Ridge section is delineated by the Montecito anticline, a 2 km long hanging-wall fold delineated by a fold scarp in late Quaternary fanglomerate. Deformed curbs, sidewalks, roads, and a tilted tennis count suggest that parts of the Mission Ridge section near the Montecito anticline may be actively creeping (Keller and Gurrola, 2000; Keller and others, 1999; Gurrola, 2006).
Age of faulted surficial deposits	Dibblee (1966, 1986 #7928, 1986 #7929) mapped late Pleistocene fanglomerate offset by the Mission Ridge fault. Gurrola and Keller (2003) identified deformed alluvial fan deposits dated between 100 ka to 139 ka, based on 14C and cosmogenic ^{21}Ne dating. Gurrola (2006) reported that Mission Ridge fault exposed in trench at the Sheffield Reservoir site (88-3) along N-facing Montecito fold scarp deforms latest Pleistocene to Holocene fluvial deposits and overlying A soil horizon. Minor and others (2009) mapped latest Pleistocene to Holocene alluvium (their Qac unit) as offset by a strand of thee Mission Ridge fault zone.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Gurrola and Keller (2003) and Gurrola (2006) identified a deformed peat horizon within fluvial deposits at the Sheffield Reservoir site (88-3) they dated between AD 1690 and AD 1730. They concluded that the deformed peat horizon indicated an earthquake on the Mission Ridge section that occurred between AD 1690 and AD 1782, the date of the arrival of Spanish settlers.
Recurrence interval	*Comments:* Gurrola (2006) interpreted two paleoevents at the Santa Barbara Mission scarp site (88-2). The faults offset stream channel and floodplain deposits thought to be latest Pleistocene to Holocene in age, although ages are not well constrained. Gurrola and Keller (2003) reported progressive deformation of young fluvial and alluvial deposits across the northern limb of the Mission Ridge anticline at the Sheffield Reservoir site [88-3] indicating multiple events, but no dates or event horizons were determined.

Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Gurrola and Keller (2003) and Gurrola (2006) reported a vertical uplift rate of about 0.75 mm/yr, based on 90 m uplift of a 125 ka alluvial fan deposits at the Sheffield Reservoir site (88-3). Sinistral component in not known.
Date and Compiler(s)	2017 William A. Bryant, California Geological Survey
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