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.

Lavic Lake fault (Class A) No. 351

Last Review Date: 2003-09-01

Compiled in cooperation with the California Geological Survey

citation for this record: **Treiman, J.A., compiler, 2003, Fault number 351, Lavic Lake fault, 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 02:51 PM.**

Synopsis	The Lavic Lake fault is a 32-km-long, northwest-trending fault that is part of a complex of similarly oriented dextral faults within the Eastern California (or Mojave) Shear Zone (ECSZ) (Dokka and Travis, 1990 #3188). It was not well known and only partially mapped (Kupfer and Bassett, 1962 #6697; Dibblee, 1966 #1346; 1967 #6657) until its extent and significance were revealed in the M_W7.1 1999 Hector Mine earthquake, of which it was the causative fault (Treiman and others, 2002 #6692). Based on location and geometry, it is associated with the Pisgah-Bullion fault zone [122], and/or perhaps the Bullion Mountain fault zone [122b] with which it is on trend. The location of Pisgah crater, to the north, was probably controlled by this fault. Maximum dextral strike-slip displacement in the recent event was 5.5 m, with an

	average displacement about 2.5 m. Observations at one locality within the Bullion Mountains suggest that displacement may be on the order of 4.5 m (Treiman and others, 2002 #6692). Two detailed study sites exposed evidence of prior surface-rupturing events on the Lavic lake fault. Rymer and others (2002 #6707) reported evidence of an earlier event that occurred sometime within the past 1,800 years at site 351-2; although, it was not determined if this was an independent rupture on the Lavic Lake fault or triggered slip caused by movement along nearby faults. Trenches at site 351-3 did not expose evidence of the penultimate event in deposits as old as about B.C. 4950 (Rymer and others, 2002 #6707). Lindvall and others (2000 #6698; 2001 #6706) observed evidence of prior events, but pending results of dating, could only estimate that these events are likely on the order of tens of thousands of years old.
Name comments	Parts of the Lavic Lake fault were first partially mapped (but not named) by Kupfer and Bassett (1962 #6697) within a group of northerly splays off the Bullion fault [122b] in the northwestern Bullion Mountains. Dibblee (1966 #1346; 1967 #6657) mapped the same portion of the fault with a little more continuity, but the fault was revealed to have greater extent and was named following the 1999 Hector Mine earthquake (Hector Mine Earthquake Geologic Working Group, 1999 #6705; Treiman and others, 2002 #6692). **Fault ID:** Fault was previously shown, in part, by Jennings (1994 #2878) but not numbered.
County(s) and State(s)	SAN BERNARDINO COUNTY, CALIFORNIA
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Fault trace is simplified from detailed mapping of historic surface rupture, which defined the entire known trace; mapping was at 1:10,000 and 1:3,000 scale post-earthquake aerial photography, with additional small-scale rupture located utilizing GPS and compiled at 1:24,000 (Treiman, 2002 #6701).
Geologic setting	Holocene active dextral strike-slip fault located within the Eastern

	California Shear Zone (ECSZ), within the Mojave Desert (Dokka and Travis, 1990 #3188). The Lavic Lake fault is principally a northwest-striking fault within the northern Bullion Mountains and Lavic Lake (dry) basin. Maximum dextral displacement is not known. It is parallel to the adjacent Bullion and Pisgah faults [122], and largely on trend with the left-stepping faults of the Bullion Mountain fault zone [350]. Although not clearly defined northward, the fault may be related to an unnamed fault less than 4 km to the northwest (north of Pisgah crater) and was a likely zone of weakness for the intervening eruption of the Pisgah crater cinder cone and associated basalt. Ground rupture in 1999 veered southward from the principal northwest trend within the Bullion Mountains, and followed a moderately well defined pre-existing trace to join the Bullion fault [122]. Like other faults in the ECSZ, the Lavic Lake fault appears to join with other sub-parallel northwest-trending faults to accommodate a more northerly-oriented principal shear direction (Treiman and others, 2002 #6692).
Length (km)	40 km.
Average strike	N12°W
Sense of movement	Right lateral *Comments:* Treiman and others (2002 #6692)
Dip Direction	V *Comments:* Vertical dip is inferred from relatively linear outcrop pattern (Treiman and others, 2002 #6692) and seismicity (Hauksson and others, 2002 #6696).
Paleoseismology studies	Site 351-1 by Lindvall and others (2000 #6698; 2001 #6706) included several trenches at the Drainage Divide site across the historic rupture on a branch of the southern end of this fault. Evidence of prior ruptures was present, but faulted strata have not yet been dated. Authors estimate prior event may have occurred tens of thousands of years ago on this strand. Other data suggest that the penultimate event may have bypassed this strand (Treiman and others, 2002 #6692). Sites 351-2 and 351-3 by Rymer and others (2002 #6707) involved excavation of three trenches (A-C) across the 1999 rupture trace and one trench (D) across an older vegetation

	lineament. Trenches A-C documented only the historic rupture. Trench D documented one prior rupture that occurred after 260 A.D., based on radiocarbon dating of two detrital charcoal samples.
Geomorphic expression	Prior to the 1999 Hector Mine earthquake, the Lavic Lake fault was primarily expressed within the northwestern Bullion Mountains by offset drainages, bedrock scarps, aligned notches and sidehill benches. Post-earthquake expression is typical of historic surface rupture, with scarps, offset topographic features and local extensional graben and compressional features (Treiman and others, 2002 #6692; Treiman, 2002 #6701).
Age of faulted surficial deposits	Fault offsets Tertiary volcanic rocks, Quaternary alluvial fans and Holocene fans, lake deposits and stream alluvium (Dibblee, 1966 #1346; 1967 #6657; Treiman and others, 2002 #6692).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Timing of most recent prehistoric event based on Rymer and others (2002 #6707) who found evidence of penultimate event <1800 yr ago and geomorphic expression (Treiman and others, 2002 #6692; Treiman, 2002 #6701).
Recurrence interval	*Comments:* Rymer and others (2002 #6707), site 351-2, identified a surface-rupturing event in trench D at the northern end of the fault that occurred about 260 A.D. Rymer and others (2002 #6707) stated that the extent of this event is not known and did not know if the surface rupturing event was triggered by movement along nearby faults. Surface rupture associated with the 1999 Hector Mine earthquake did not rupture at the trench D site. Trenches A–C, excavated across traces of the 1999 rupture, did not expose evidence of coseismic surface rupture corresponding to the 260 A.D. event; however, the exposures suggests that an earlier event, if present, occurred some time earlier than about B.C. 4950. Lindvall and others (2000 #6698; 2001 #6706) reported that trenches at the Drainage Divide site (351-1) have evidence for prior events that may be on the order of tens of thousands of years old, but ages of these events are

	pending.
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Geomorphic expression of the Lavic Lake fault is consistent with a dextral slip rate of about 0.2–1 mm/yr.
Date and Compiler(s)	2003 Jerome A. Treiman, California Geological Survey
References	#1346 Dibblee, T.W., Jr., 1966, Geologic map of the Lavic quadrangle San Bernardino County, California: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-472, 5 p. pamphlet, 1 sheet, scale 1:62,500. #6657 Dibblee, T.W., Jr., 1967, Geologic map of the Emerson Lake quadrangle, San Bernardino County, California: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-490, scale 1:62,500. #3188 Dokka, R.K., and Travis, C.J., 1990, Late Cenozoic strike-slip faulting in the Mojave Desert, California: Tectonics, v. 9, p. 311-340. #6696 Hauksson, E., Jones, L.M., and Hutton, K., 2002, The 1999 Mw7.1 Hector Mine, California earthquake sequence-Complex conjugate strike-slip faulting: Bulletin of the Seismological Society of America, v. 92, p. 1154-1170. #6705 Hector Mine Earthquake Geologic Working Group, 1999, Surface rupture, slip distribution, and other geologic observations associated with the M 7.1 Hector Mine earthquake of 16 October 1999 [abs.]: American Geophysical Union Fall Meeting Program, Dec. 13-17, 1999, 11 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. #6697 Kupfer, D.H., and Bassett, A.M., 1962, Geologic reconnaissance map of part of the southeastern Mojave desert, California: U.S. Geological Survey Mineral Investigations Field Studies Map MF-205, scale 1:125,000. #6698 Lindvall, S., Rockwell, T., and Rubin, C., 2000,

	Collaborative paleoseismic studies along the 1999 Hector Mine earthquake surface rupture and adjacent faults: Southern California Earthquake Center Annual Report, 6 p. #6706 Lindvall, S., Rockwell, T., Schwartz., D., Dawson, T., Helms, J., Madden, C., Yule, D., Stenner, H., Ragona, D., Kasman, G., Seim, M., Meltzner, A., and Caffee, M., 2001, Paleoseismic investigations of the 1999 M7.1 Hector Mine earthquake surface rupture and adjacent Bullion fault, Twentynine Palms Marine Corps base, California [abs.]: Geological Society of America Abstracts with Programs, v. 33, p. 79. #6707 Rymer, M.J., Seitz, G.G., Weaver, K.D., Orgil, A., Faneros, G., Hamiton, J.C., and Goetz, C., 2002, Geologic and paleoseismic study of the Lavic Lake fault at Lavic Lake playa, Mojave desert, southern California: Bulletin of the Seismological Society of America, v. 92, p. 1577-1591. #6701 Treiman, J.A., 2002, Lavic Lake, Bullion and related faults, San Bernardino County, California: California Geological Survey Fault Evaluation Report FER-246, 18 p., scale 1:24,000, website, [ftp://ftp.consrv.ca.gov/pub/dmg/pubs/fer/246/]. #6692 Treiman, J.A., Kendrick, K.J., Bryant, W.A., Rockwell, T.K., and McGill, S.F., 2002, Primary surface rupture associated with the Mw 7.1 16 October 1999 Hector Mine earthquake, San Bernardino County, California: Bulletin of the Seismological Society of America, v. 92, p. 1,171-1,191.