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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.

Deep Springs fault (Class A) No. 50

Last Review Date: 2000-09-14

Compiled in cooperation with the California Geological Survey

citation for this record: **Bryant, W.A., compiler, 2000, Fault number 50, Deep Springs 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 03:09 PM.**

Synopsis	This Holocene active northwest-dipping normal fault is thought to transfer dextral slip between the Fish Lake Valley fault zone [49] and the Owens Valley fault zone [51] (Reheis and Sawyer, 1997 #2580; Lee and others, 2001 #5611). There is detailed reconnaissance-level geologic and geomorphic mapping at a scale of 1:62,500 for the entire fault zone (Nelson, 1966 #1590; 1966 #1591; McKee and Nelson, 1967 #1576; Bryant, 1988 #1455). Reheis and Sawyer (1997 #2580) reported a post-late Miocene (<5 Ma) slip rate of 0.2-0.5 mm/yr for the central part of the Deep Springs fault zone and 0.1-0.2 mm/yr for the northern part. They also estimated a late to middle Quaternary (post 0.76 Ma) slip rate of 0.3-0.5 mm/yr. Lee and others (2001 #5611) reported a late

	Pleistocene slip rate of about 0.9 mm/yr based on about 695 m of vertical offset of the 0.76 Ma Bishop ash (tuff), an estimated a recurrence interval of about 2-4 k.y., and the most recent event about 1,800 yrs BP.
Name comments	Deep Springs fault was first mapped and named by Miller (1928 #1580). The Deep Springs fault zone borders the southeastern side of Deep Springs Valley, a closed basin between the southern White Mountains and Northern Inyo Mountains. **Fault ID:** Refers to fault number 210 (Deep Springs fault) of Jennings (1994 #2878), fault DS of Piety (1995 #915), and fault numbers MA14 and G2 (Deep Springs fault) of dePolo (1998 #2845).
County(s) and State(s)	INYO COUNTY, CALIFORNIA
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:62,500 scale. *Comments:* Locations based on digital revisions to Jennings (1994 #2878). Original mapping by Nelson (1966 #1590; 1966 #1591), McKee and Nelson (1967 #1576), and Bryant (1988 #1455) is at 1:62,500 scale.
Geologic setting	The Deep Springs is a zone northwest-dipping normal faults that border the southeastern side of Deep Springs Valley, a closed basin between the southern White Mountains and Northern Inyo Mountains. Lee and others (1996 #5610; 2001 #5611) and Reheis and Sawyer (1997 #2580) consider the Deep Springs fault zone as a displacement-transfer structure between two dextral strike-slip faults, the Owens Valley fault zone [51] to the southwest and the Fish Lake Valley fault zone [49] to the northeast. Cumulative post late Miocene (<5 Ma) vertical displacement may be 1680-2000 m (Reheis and Sawyer, 1997 #2580).
Length (km)	23 km.
Average strike	N18°E
Sense of movement	Normal

	Comments: Fault zone exhibits geomorphic evidence of down-to-northwest normal displacement (Miller, 1928 #1580; Nelson, 1966 #1590; 1966 #1591; McKee and Nelson, 1967 #1576; Bryant, 1989 #1458; Reheis and Sawyer, 1997 #2580; Lee and others, 2001 #5611).
Dip	40°NW *Comments:* Wilson (1975 #1695) reported that the Deep Springs fault zone dips 40? NW in the subsurface, based on gravity and seismic-reflection data. Lee and others (1996 #5610; 2001 #5611) reported that dips of various strands of the Deep Springs fault zone range from 20? to 87?, based on surface outcrops. Dip direction from Wilson (1975 #1695), Lee and others (1996 #5610), Bryant (1989 #1458).
Paleoseismology studies	
Geomorphic expression	The Deep Springs fault zone is delineated by well defined geomorphic features indicative of Holocene normal faulting, such as prominent aligned faceted spurs, grabens on young alluvium, closed depressions, scarps on young alluvial fans, and vertically offset drainages (Bryant, 1988 #1455; 1989 #1458).
Age of faulted surficial deposits	The Deep Springs fault offsets Cretaceous crystalline basement rocks, 0.76 Ma Bishop ash (Reheis and Sawyer, 1997 #2580), late Pleistocene and Holocene alluvium (Bryant, 1989 #1458). The youngest offset materials are middle to late Holocene alluvial fans as young as 1.9 ka, as determined from 14C dating of detrital charcoal reported by Lee and others (2001 #5611).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Lee and others (1996 #5610; 2001 #5611) estimated that the most recent paleoevent occurred about 1,800 yr BP, based on fault scarp diffusion modeling and 14C dating of detrital charcoal. Lee and others (2001 #5611) concluded that the most recent paleoevent had an average vertical surface displacement of 2.7?0.9 m, based on topographic profiling of 16 fault scarps developed on Qf1 alluvium.

Recurrence interval	2-4 k.y. (0-760 ka) *Comments:* Lee and others (2001 #5611) estimated a recurrence interval of 2-4 k.y., based on assumed characteristic 2.7?0.9 m surface rupture and Quaternary vertical slip-rate of about 0.9 mm/yr.
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Reheis and Sawyer (1997 #2580) reported a post-late Miocene (<5 Ma) slip-rate of 0.2-0.5 mm/yr for the central part of the Deep Springs fault zone and 0.1-0.2 mm/yr for the northern part. These rates are based on the estimated total vertical slip of 1680-2000 m, which is the sum of the highest elevation of bedrock above Deep Springs Valley and depth to bedrock indicated by gravity data reported by Wilson (1975 #1695). Reheis and Sawyer (1997 #2580) also estimated a late to middle Quaternary (post 0.76 Ma) slip-rate of 0.3-0.5 mm/yr based on their observation that Bishop ash in an ancestral stream channel is located 200 m about the valley floor and the assumption that the maximum vertical offset is twice this value. Lee and others (2001 #5611) reported a Quaternary slip-rate of about 0.9 mm/yr based on about 695 m of vertical offset of the 760-ka Bishop ash.
Date and Compiler(s)	2000 William A. Bryant, California Geological Survey
References	#1455 Bryant, W.A., 1988, Deep Springs fault zone, northern Inyo County, California: California Division of Mines and Geology Fault Evaluation Report FER-202, 12 p., 1 pl., scale 1:62,500. #1458 Bryant, W.A., 1989, Deep Springs fault, Inyo County, California—An example of the use of relative-dating techniques: California Geology, v. 42, p. 243-255. #2845 dePolo, C.M., 1998, A reconnaissance technique for estimating the slip rate of normal-slip faults in the Great Basin, and application to faults in Nevada, U.S.A.: Reno, University of Nevada, unpublished Ph.D. dissertation, 199 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.

#5611 Lee, J., Rubin, C., and Calvert, A., 2001, Quaternary faulting history along the Deep Springs fault, California: Geological Society of America Bulletin, v. 113, no. 7, p. 855–869.

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#1576 McKee, E.H., and Nelson, C.A., 1967, Geologic map of the Soldier Pass quadrangle, California and Nevada: U.S. Geological Survey Geologic quadrangle Map GQ-654, 1 sheet, scale 1:62,500.

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#915 Piety, L.A., 1995, Compilation of known and suspected Quaternary faults within 100 km of Yucca Mountain, Nevada and California: U.S. Geological Survey Open-File Report 94-112, 404 p., 2 pls., scale 1:250,000.

#2580 Reheis, M.C., and Sawyer, T.L., 1997, Late Cenozoic history and slip rates of the Fish Lake Valley, Emigrant Peak, and Deep Springs fault zones, Nevada and California: Geological Society of America Bulletin, v. 109, no. 3, p. 280-299.

	#1695 Wilson, D.V., 1975, Geophysical investigation of the subsurface structure of Deep Springs Valley, California: Los Angeles, University of California, unpublished M.S. thesis, 65 p.