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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.

Hartley Springs fault zone (Class A) No. 43

Last Review Date: 1995-10-01

Compiled in cooperation with the California Geological Survey

citation for this record: **Sawyer, T.L., and Bryant, W.A., compilers, 1995, Fault number 43, Hartley Springs fault zone, 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	Although no detailed studies have been conducted along the Hartley Springs fault zone, the offset of several middle Pleistocene to latest Holocene deposits have been measured (e.g., Bailey and others, 1976 #5581; Clark and others, 1984 #2876; Bryant, 1984 #5578). Significant spatial and temporal variability in slip rates (Bryant, 1984 #5578), rate may have increased during middle Pleistocene (following Bishop tuff eruption) and decreased during late Pleistocene. Estimates of vertical slip-rate range from 0.15 mm/yr (Clark and others, 1984 #2876) to 0.4 mm/yr (based on data from Kistler, 1966 #5580; in Bryant, 1984 #5578).

Name comments	Fault, part of the Sierra Nevada fault system, was first depicted in general by Lawson (1908 #4969). Benioff and Gutenberg (1939 #5640) mapped a short southern splay they called the "earthquake fault." Huber and Reinhart (1965 #5639) and Kistler (1966 #5580) first mapped, but did not name, the fault at 1:62,500 scale. Bailey and others (1976 #5581) first named the fault Hartley Springs fault. Hartley Springs fault zone will be used in this compilation. **Fault ID:** Refers to number 201 (Hartley Springs fault) of Jennings (1994 #2878) and fault number MA3 (Hartley Springs fault zone) of dePolo (1998 #2845).
County(s) and State(s)	MONO COUNTY, CALIFORNIA
Physiographic province(s)	CASCADE-SIERRA MOUNTAINS
Reliability of location	Good Compiled at 1:62,500 scale. *Comments:* Location based on digital revisions to Jennings (1994 #2878) using original mapping by Huber and Reinhart (1965 #5639), Kistler (1966 #5580), and Bryant (1984 #5578) at 1:62,500.
Geologic setting	High-angle, down-to-east normal fault along eastern front of central Sierra Nevada, extending from Mono Craters ring-fracture system into Long Valley caldera. May 1980 earthquake sequence produced minor (possibly secondary) surface ruptures along fault within Long Valley caldera Taylor and Bryant (1980 #5586). Very young rhyolite (<1 k.y.) (Bailey and Koeppen, 1977 #3322) has been extruded locally along fault zone (Bryant, 1984 #5578). Pliocene volcanic rocks are vertically offset 450 m (Bailey and others, 1976 #5581); cumulative vertical displacement is significantly less within caldera relative to outside caldera (Bryant, 1984 #5578).
Length (km)	23 km.
Average strike	N5°W
Sense of movement	Normal
Dip Direction	E

Paleoseismology studies	
Geomorphic expression	Forms steep 600 m high escarpment along eastern front of Sierra Nevada (Bailey and others, 1976 #5581) forms linear troughs and closed depressions in Bishop tuff; in unconsolidated volcanic deposits and glacial till forms graben and moderate to high (7-17 m) scarps.
Age of faulted surficial deposits	Holocene air-fall pumice, phreatic, and terrace deposits (offsets of Holocene deposits are generally better defined within Long Valley caldera than to north); late Pleistocene glacial (Tioga-, Tenaya (?)-, and Tahoe-stage) deposits, andesite; middle Pleistocene Bishop tuff (0.76 Ma); Mesozoic granitic bedrock (Bryant, 1984 #5578).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Most recent paleoevent postdates 650 14C yr old phreatic deposit (Bailey and Koeppen, 1977 #3322).
Recurrence interval	
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Significant spatial and temporal variability in slip rates (Bryant, 1984 #5578), rate may have increased during middle Pleistocene (following Bishop tuff eruption) and decreased during late Pleistocene. Clark and others (1984 #2876) calculated a preferred late Pleistocene vertical slip-rate of 0.15 mm/yr for a branch fault north of Reversed Peak (Reversed Peak fault). This is a minimum vertical slip-rate because the fault zone at the June Lake area is about 4 km wide. A rate of 0.08-0.19 mm/yr is indicated from 15 m offset of trachyandesite (80-200 ka). A mid-Pleistocene slip rate of 0.4 mm/yr is calculated from 300 m vertical offset (Kistler, 1966 #5580) of the 0.76 Ma Bishop tuff. Pliocene volcanic rocks offset 450 m suggest a long-term rate of 0.14-0.17 mm/yr (Bryant, 1984 #5578).
Date and Compiler(s)	1995 Thomas L. Sawyer, Piedmont Geosciences, Inc. William A. Bryant, California Geological Survey

References	#3322 Bailey, R.A., and Koeppen, R.P., 1977, Preliminary geologic map of Long Valley caldera, Mono County, California: U.S. Geological Survey Open-File Report 77-468, 20 p. #5581 Bailey, R.A., Dalrymple, G.B., and Lanphere, M.A., 1976, Volcanism, structure, and geochronology of Long Valley caldera, Mono County, California: Journal of Geophysical Research, v. 81, no. 5, p. 725-744. #5640 Benioff, V.H., and Gutenberg, B., 1939, The Mammoth "earthquake fault" and related features: Bulletin of the Seismological Society of America, v. 29, no. 2, p. 333-340. #5578 Bryant, W.A., 1984, Hartley Springs fault zone, Mono County, California: California Division of Mines and Geology Fault Evaluation Report FER-157, microfiche copy in California Division of Mines and Geology Open-File Report 90-14, 7 p., scale 1:62,500. #2876 Clark, M.M., Harms, K.H., Lienkaemper, J.J., Harwood, D.S., Lajoie, K.R., Matti, J.C., Perkins, J.A., Rymer, M.J., Sarna-Wojcicki, A.M., Sharp, R.V., Sims, J.D., Tinsley, J.C., III, and Ziony, J.I., 1984, Preliminary slip rate table and map of late Quaternary faults of California: U.S. Geological Survey Open-File Report 84-106, 12 p., 5 plates, scale 1:1,000,000. #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. #5639 Huber, N.K., and Reinhart, C.D., 1965, Geologic map of the Devils Postpile quadrangle, Sierra Nevada, California: U.S. Geological Survey Geologic quadrangle Map GQ-437, scale 1:62,500. #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. #5580 Kistler, R.W., 1966, Geologic map of the Mono Craters quadrangle, Mono and Tuolumne Counties, California: U.S. Geological Survey Geologic quadrangle Map GQ-462, scale

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#4969 Lawson, A.C., chairman, 1908, The California earthquake of April 18, 1906—Report of the State Earthquake Investigation Commission: Washington, D.C., Carnegie Institution of Washington Publication 87.

#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.

#5586 Taylor, G.C., and Bryant, W.A., 1980, Surface rupture associated with Mammoth Lakes earthquakes of 25 and 27 May, 1980, *in* Sherburne, R.W., ed., Mammoth Lakes, California earthquakes of May 1980: California Division of Mines and Geology Special Report 150, p. 49–67.