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Western Bear Lake fault (Class A) No. 622

Last Review Date: 2010-07-20

Compiled in cooperation with the Idaho Geological Survey

citation for this record: **Haller, K.M., and Lewis, R.S., compilers, 2010, Fault number 622, Western Bear 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 03:03 PM.**

Synopsis	High-angle, predominantly down-to-the-east normal fault along the subdued escarpment of the northeast flank of the Wasatch Range in Idaho. The central 20 km of the western Bear Lake fault is characterized by low (3- to 8-m-high) fault scarps that formed in the middle Holocene. No evidence of earlier faulting is known.
Name comments	The name "western Bear Lake fault" was first used by McCalpin (1990 #4419) for the fault that is subparallel to the eastern Bear Lake fault [2364]. Mansfield (1927 #4416) questioned the existence of faults along the west side of the Bear Lake Valley, but several are shown on 1:250,000-scale map of Oriel and Platt (1980 #4396). Armstrong and Cressman (1963 #4417) and Evans

	and others (2003 #7005) referred to this as the "West Bear Lake fault." Robertson (1978 #4418) refers to the fault as the "Bloomington scarp," named for a particularly well expressed scarp on part of the fault near Bloomington, which extends from near Bern south to near Fish Haven, Idaho. The fault has been depicted in various ways; it is shown in this report as depicted by Reheis and others (2005 #7008); however, McCalpin (1990 #4419) shows it as extending from Trail Creek (about 13 km southeast of Soda Springs, Idaho) southward to about 1 km northeast of Fish Haven, and he later suggests that the fault may only extend between Ovid and St. Charles, Idaho, where scarps are well expressed (McCalpin, 1993 #796). Witkind (1975 #320) shows it as extending more than 40 km farther to the north, to the east side of Reservoir Mountain. Evans (1991 #4425) suggests that the fault only extends from the central western shore of Bear Lake to near Montpelier, Idaho, or about half of the length shown here. **Fault ID:** Refers to fault number 25 ("fault west side Bear Lake [west side of graben]") in compilation by Witkind (1975 #320).
County(s) and State(s)	BEAR LAKE COUNTY, IDAHO
Physiographic province(s)	MIDDLE ROCKY MOUNTAINS
Reliability of location	Good Compiled at 1:50,000 scale. *Comments:* Fault location is based on 1:50,000-scale map of Reheis (2005 #7008). Reheis (2005 #7008) shows numerous synthetic and antithetic faults that are simplified in this compilation; location is further constrained by satellite imagery and topography at scale of 1:50,000. Reference satellite imagery is ESRI_Imagery_World_2D with a minimum viewing distance of 1 km (1,000 m).
Geologic setting	The western Bear Lake fault extends along the northeastern flank of the Wasatch Range. It is subparallel to the northern part of the eastern Bear Lake fault [2364], and thus the two faults bound the graben that coincides with the Bear Lake Valley. McCalpin (1990 #4419) describes it as a complexly faulted hinge related to formation of the Bear Lake graben. The fault may possibly extend into Utah, as it is on-trend with the Bear Lake (west side) fault

	[2531]. Evans (1991 #4425) suggests that the fault could sole into an underlying thrust fault as "reflectors at depths greater than 4 km do not appear to be offset on the western margin of the basin."
Length (km)	58 km.
Average strike	N9°W
Sense of movement	Normal *Comments:* Most agree that the predominant sense of movement is normal (Witkind, 1975 #320; McCalpin, 1990 #4419; 1993 #796). Based on interpretation of proprietary seismic-reflection data, Evans and others (2003 #7005) identify numerous small-displacement, steeply dipping normal faults in the hanging wall of the eastern Bear Lake fault. Colman (2006 #7012) concludes that faulting at depth results in largely flexural folding of the sediments at the surface.
Dip Direction	E *Comments:* Evans and others (2003 #7005) show the western Bear Lake faults as more steeply dipping normal faults than the nearby eastern Bear Lake fault.
Paleoseismology studies	McCalpin (1990 #4419) excavated two trenches approximately 400 m apart in September 1989. The southern trench is documented in this compilation; the northern one filled with water and little data could be salvaged from the excavation. Site 622-1. The trench and nearby auger holes suggest that 1.5-2.0 m, and possibly as much as 3.5 m, of net throw occurred between 5.9 and 6.5 ka.
Geomorphic expression	The 20-km-long "Bloomington scarp" is expressed by low scarps, generally "10 to 25 ft high" (3-8 m) (Robertson, 1978 #4418) on swamp deposits (McCalpin, 1993 #796). Armstrong and Cressman (1963 #4417) indicate that the "moderately straight lineaments, locally marked by scarps" roughly mark the topographic western edge of the Bear River Valley. Fault is located well to the east of the highly subdued mountain front escarpment along west side of Bear Lake Valley where the Wasatch Range eventually rises 1,000 m above valley floor. Local escarpment is 300-m high.

Age of faulted surficial deposits	Early Holocene alluvium and Quaternary loess are faulted, late Holocene alluvium is in fault contact with the older sediments (McCalpin, 1990 #4419, fig. 7).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Trenching by McCalpin (1990 #4419) documents Holocene faulting (5.9-6.5 ka). Fault is shown on map of Breckenridge and others (2003 #5878) in similar fashion as in this compilation.
Recurrence interval	*Comments:* McCalpin (1993 #796) states that during the interval of 11.2 ka to present only the Holocene event has occurred (5.9-6.5 ka) and thus can only provide an elapse time.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Data is insufficient to calculate a slip rate because evidence of only one faulting event exists. However, a low slip rate is suggested based on less than 2 m of net throw in the past 11.2 k.y.
Date and Compiler(s)	2010 Kathleen M. Haller, U.S. Geological Survey Reed S. Lewis, Idaho Geological Survey
References	#4417 Armstrong, F.C., and Cressman, E.R., 1963, The Bannock thrust zone southeastern Idaho: U.S. Geological Survey Professional Paper 374-J, 22 p., 4 pls. #5878 Breckenridge, R.M., Lewis, R.S., Adema, G.W., and Weisz, D.W., 2003, Miocene and younger faults in Idaho: Idaho Geological Survey Map 8, 1 sheet, scale 1:1,000,000. #7012 Colman, S.M., 2006, Acoustic stratigraphy of Bear Lake, Utah-ldahoLate Quaternary sedimentation patterns in a simple half-graben: Sedimentary Geology, v. 185, p. 113-125. #4425 Evans, J.P., 1991, Structural setting of seismicity in northern Utah: Utah Geological Survey Contract Report 91-15, 37 p.

#7005 Evans, J.P., Martindale, D.C., and Kendrick, R.D., 2003, Geologic setting of the 1884 Bear Lake, Idaho, earthquake; rupture in the hanging wall of a basin and range normal fault revealed by historical and geological analyses: Bulletin of the Seismological Society of America, v. 93, p. 1621-1632.

#4416 Mansfield, G.R., 192, Geography, geology, and mineral resources of part of southeastern Idaho: U.S. Geological Survey Professional Paper 152, 453 p., 12 pls.

#4419 McCalpin, J., 1990, Latest Quaternary faulting in the northern Wasatch to Teton corridor (NWTC): Technical report to U.S. Geological Survey, under Contract 14-08-001-G1396, October 1990, 42 p.

#796 McCalpin, J.P., 1993, Neotectonics of the northeastern Basin and Range margin, western USA: Zeitschrift fuer Geomorphologie N. Folge, v. 94, p. 137-157.

#4396 Oriel, S.S., and Platt, L.B., 1980, Geologic map of the Preston 1° x 2° quadrangle, southeastern Idaho and western Wyoming: U.S. Geological Survey Miscellaneous Investigations Map I-1127, 1 sheet, scale 1:250,000.

#7008 Reheis, M.C., 2005, Surficial geologic map of the upper Bear River and Bear Lake drainage basins, Idaho, Utah, and Wyoming: U.S. Geological Survey Scientific Investigations Map 2890.

#4418 Robertson, G.C., III, 1978, Surficial deposits and geologic history, northern Bear Lake Valley, Idaho: Logan, Utah State University, unpublished M.S. thesis, 162 p., 2 pls.

#320 Witkind, I.J., 1975, Preliminary map showing known and suspected active faults in Idaho: U.S. Geological Survey Open-File Report 75-278, 71 p. pamphlet, 1 sheet, scale 1:500,000.

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