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Quaternary Fault and Fold Database of the United States

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Eastern Bear Lake fault, northern section (Class A) No. 2364a

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 2364a, Eastern Bear Lake fault, northern section, 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 02:57 PM.**

Synopsis	**General:** Long, range-front, normal fault that bounds the west side of the Bear Lake Plateau and Pruess Range. The fault zone contains multiple strands in some locations, and defines the eastern edge of the Bear Lake graben, an 80-km-long, north-trending topographic low that extends from Idaho into Utah. The history of this fault is defined by reconnaissance mapping along the northern two sections and additional detailed site studies, including trenching, along the southern section. Late Pleistocene slip rates increase from south to north along the eastern Bear Lake fault zone, which is consistent with the tectonic geomorphology.

	However, slip rates on the southern part of the fault zone have apparently decreased over the past 50 k.y. Earthquake-timing, recurrence-interval, and slip-rate estimates for the southern section of the eastern Bear Lake fault as reported in this compilation reflect the consensus values of the Utah Quaternary Fault Parameters Working Group (Lund, 2005 #6733). The preferred values reported in Lund (2005 #6733) approximate mean values based on available paleoseismic-trenching data, and the minimum and maximum values approximate two-sigma (5th and 95th percentile) confidence limits. The confidence limits incorporate both epistemic (data limitation) and aleatory (process variability) uncertainty (Lund, 2005 #6733). **Sections:** This fault has 3 sections. McCalpin (1990 #4419) divides the fault into a northern, central, and southern segments on the basis of fault-rupture patterns, strike of fault scarps, youthfulness of fault scarps, and subsurface geophysical data; this subdivision is used in this compilation.
Name comments	**General:** The earliest known name for this fault is "Bear Lake fault" (Mansfield, 1927 #4416); in this publication Mansfield notes that "there seems therefore little doubt that this part of the valley wall is determined by fault." But on Plate 1, the fault is shown only extending about 9 km south of Dingle. The name "eastern Bear Lake fault" came into use only after detailed fault studies were completed and the nearby western Bear Lake fault [622], which bounds the west side of the valley, was recognized (McCalpin, 1990 #4419). Evans (1991 #4425) uses the name "East Bear Lake fault." The fault, as mapped and described by McCaplin (1990 #4419) extends along the west edge of the Bear Lake Plateau and Preuss Range from about 3.5 km northeast of Georgetown, Idaho, to about 3.6 km south of Laketown, Utah. **Section:** The names established by McCalpin (1990 #4419) are followed in this compilation for the three parts of the eastern Bear Lake fault; also called the N segment in McCalpin (1993 #796). Section extends from about 3.5 km northeast of Georgetown, Idaho, south to about 0.4 km north of U.S. Highway 89, east of Montpelier, Idaho. **Fault ID:** Refers to fault number 24 ("fault east side Bear Lake [east side of graben]") of Witkind (1975 #320) in Idaho. Section 2364c in this compilation refers to fault number 11-8 ("southern segment of the eastern Bear Lake fault") of Hecker (1993 #642).
County(s) and	

County(s) and State(s)	BEAR LAKE COUNTY, IDAHO
Physiographic province(s)	MIDDLE ROCKY MOUNTAINS
Reliability of location	Poor Compiled at 1:250,000 scale. *Comments:* In general, the fault is poorly expressed along this section, and scarps are discontinuous. The fault location is based on the approximately 1:475,000-scale map of McCalpin (1990 #4419), and its location is further constrained by satellite imagery and topography at scale of 1:100,000. Reference satellite imagery is ESRI_Imagery_World_2D with a minimum viewing distance of 1 km (1,000 m).
Geologic setting	West-dipping normal (possibly listric) fault bounding the west side of the Bear Lake Plateau in Utah and Preuss Range in Idaho. This fault and the complimentary western Bear Lake fault [622] define the Bear Lake graben, an asymmetric basin as much as 3-km deep extending from Idaho into Utah. These faults are part of a belt of right-stepping en-echelon faults that extend from the northern Wasatch Range in Utah to the Yellowstone area in Wyoming (McCalpin, 1990 #4419). Interpretation of high-resolution seismic-reflection profiles adjacent to the southern part of the fault shows changes in the location of depocenters adjacent to the master fault through time, which probably mirrors the general pattern of slip on the fault (Colman, 2006 #7012). Net Tertiary slip is 1.9–4.0 km (Evans, 1991 #4425).
Length (km)	This section is 19 km of a total fault length of 78 km.
Average strike	N11°W (for section) versus N1°W (for whole fault)
Sense of movement	Normal *Comments:* (McCalpin, 1990 #4419)
Dip	W *Comments:* Interpretations of the fault geometry vary. Some investigators document the fault as having a high angle (Mansfield, 1927 #4416; Williams and others, 1962 #4409; Armstrong and Cressman, 1963 #4417), and others maintain that it is listric and soles into the Meade thrust at depth (Evans, 1991

	#4425). Coogan and Royse (1990 #7006) suggest that the fault dips 65 degrees at the surface and becomes flat at a depth of 5.8 km below sea level.
Paleoseismology studies	
Geomorphic expression	The character of this part of the fault is not well documented; however, McCalpin (1990 #4419; 1993 #796) suggests there are some scarps present. Only two possible short, northeast-striking faults cutting late Pleistocene or Holocene deposits have been observed north of Bennington (Reheis and others, 2009 #7004).
Age of faulted surficial deposits	
Historic earthquake	
Most recent prehistoric deformation	middle and late Quaternary (<750 ka) *Comments:* Mason (1992 #463) provides this estimate for the timing of movement on the northern end of the eastern Bear Lake fault, the basis for this estimate is unknown. Reheis and others (2009 #7004) report that late Quaternary displacement has been minimal or zero.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* Based on the lack of compelling evidence for late Quaternary movement, a low slip rate is inferred. Evans (1991 #4425) calculates long-term (10 m.y. and 17 m.y.) slip rates of 0.17 mm/yr and 0.1 mm/yr respectively, which are less than half of the long-term rates further south.
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.

#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.

#7006 Coogan, J.C., and Royse, F., Jr., 1990, Overview of recent developments in thrust belt interpretation, *in* Roberts, S., ed., Geologic field tours of western Wyoming and parts of adjacent Idaho, Montana, and Utah: Geological Survey of Wyoming Public Information Circular, v. 29, p. 89-124.

#4425 Evans, J.P., 1991, Structural setting of seismicity in northern Utah: Utah Geological Survey Contract Report 91-15, 37 p.

#642 Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p., 6 pls., scale 1:500,000.

#6733 Lund, W.R., 2005, Consensus preferred recurrence interval and vertical slip rate estimates—Review of Utah paleoseismic-trenching data by the Utah Quaternary Fault Parameters Working Group: Utah Geological Survey Bulletin 134, compact disk.

#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.

#463 Mason, D.B., 1992, Earthquake magnitude potential of active faults in the Intermountain seismic belt from surface parameter scaling: Salt Lake City, University of Utah, unpublished M.S. thesis, 110 p.

#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.

#7004 Reheis, M.C., Laabs, B.J.C., and Kaufman, D.S., 2009, Geology and geomorphology of Bear Lake Valley and upper Bear River, Utah and Idaho, *in* Rosenbaum, J.G., and Kaufman D.S.,

	eds., Paleoenvironments of Bear Lake, Utah and Idaho, and its catchment: Geological Society of America Special Paper 450, p. 15-48. #4409 Williams, J.S., Willard, A.D., and Parker, V., 1962, Recent history of Bear Lake Valley, Utah-Idaho: American Journal of Science, v. 260, p. 24-36. #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.