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Quaternary Fault and Fold Database of the United States

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Oquirrh fault zone (Class A) No. 2398

Last Review Date: 2004-06-01

Compiled in cooperation with the Utah Geological Survey

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Synopsis	Moderately well studied Holocene range-front normal fault along the western base of the Oquirrh Mountains in eastern Tooele Valley. The fault's scarp morphology is more similar to the Bonneville shoreline (14.5 ka) than to the Drum Mountains fault scarps [2432], which have been dated at about 9 ka. Trenching studies at Big and Pole Canyons indicate the most recent event occurred between 4.3 and 6.9 ka, with two prior events, one between 20.3 and 26.4 ka and another sometime before 32.8 ka. Earthquakes on the central sections of the Wasatch fault zone [2351] during the late Holocene do not appear to have influenced activity on the Oquirrh fault zone. Earthquake-timing, recurrence-interval, and displacement-rate estimates for the Oquirrh fault

	zone reflect the consensus values of the Utah Quaternary Fault Parameters Working Group (Lund, 2004 #6733). Preferred values reported in Lund (2004 #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. Confidence limits incorporate both epistemic (*e.g.*, data limitation) and aleatory (*e.g.*, process variability) uncertainty (Lund, 2004 #6733).
Name comments	**Fault ID:** Refers to fault number 7-15 of Hecker (1993 #642).
County(s) and State(s)	TOOELE COUNTY, UTAH
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Mapped or discussed by Everitt and Kaliser (1980 #4524), Barnhard and Dodge (1988 #429), Olig and others (1996 #1369), and Solomon (1996 #1368). Fault traces simplified from 1:24,000-scale mapping of Solomon (1996 #1368).
Geologic setting	Generally north-trending normal fault along the western base of the Oquirrh Mountains. The Oquirrh Mountains are the easternmost and highest of three distinctive north-south mountain ranges in the Basin and Range west of the high central part of the Wasatch Range. Surficial geology in Tooele Valley to the west is dominated by lake deposits and alluvium. Several buried faults that do not cut surficial deposits are postulated in the vicinity of the Oquirrh fault zone which may be older and not related to the fault zone. One such fault, the Occidental fault, may have been reactivated by Oquirrh fault zone activity (Solomon, 1996 #1368).
Length (km)	21 km.
Average strike	N1°E
Sense of movement	Normal
Dip	66–85° W.

	Comments: Olig and others (1996 #1369) measured 66–77° in Pole Canyon trench in Bonneville lacustrine and pre-Bonneville fluvial deposits: 85° W. measured in Big Canyon trench in Pre-Bonneville deposits juxtaposed against Bonneville lacustrine deposits.
Paleoseismology studies	Olig and others (1996 #1369) excavated trenches at two sites where the trace of the fault crosses Lake Bonneville deposits overlain by modern alluvium/colluvium. Three trenches were excavated at the Big Canyon site (site 2398-1), about 2 km southeast of Lake Point and 0.3 km west of the mouth of Big Canyon. Radiocarbon age estimates on bulk-soil samples from debris-flow deposits directly overlain by colluvial-wedge material, and from unfaulted fluvial deposits that bury the fault scarp, constrain timing of the most recent faulting event. A single (76-m-long) trench was excavated at the Pole Canyon site (site 2398-2), 2.7 km southwest of the Big Canyon site and 1.7 km northwest of the mouth of Pole Canyon. A lack of diagnostic stratigraphy and dateable organic material precluded resolving the timing of the most recent surface-faulting event beyond a post-Bonneville age. Radiocarbon age estimates from charcoal contained in an unfaulted marsh deposit and a faulted fluvial deposit constrain timing of the penultimate event. A radiocarbon age estimate from charcoal contained in fluvial sediments that bury the eroded free face of the antepenultimate event provides a minimum limiting age for this event.
Geomorphic expression	Scarps on lake deposits and alluvium. Everitt and Kaliser (1980 #4524) and Barnhard and Dodge (1988 #429) divide the fault into two sections: a northern section expressed as Quaternary fault scarps on basin-fill sediments, and a southern section expressed as a prominent break in slope at the base of the range front. Profiles of scarp heights at Big Canyon in the northern fault section yield scarp heights ranging from 12 to 18 m, maximum slope angles of 24° to 32°, and surface offsets of 4.0 to 6.8 m (Olig and others, 1996 #1369). Net vertical displacement at Big Canyon from the most recent event on the fault was an estimated 2.2 m (Olig and others, 1996 #1369). Large displacements documented on the northern section of the fault zone imply a rupture length greater than 12 km (the length of the northern trace), suggesting both sections of the fault probably form a single rupture segment extending from Stockton to Great Salt Lake (Olig and others, 1996 #1369).

Age of faulted surficial deposits	Holocene.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Scarp morphology is more similar to the Bonneville shoreline scarps than to the Drum Mountains fault scarps [2432], which have been dated at about 9 ka. This suggests an age close to, but not greater than, the Provo shoreline (which is offset across the fault). Trenching studies at Big and Pole Canyons indicate the most recent event occurred between 4.3 and 6.9 ka, with two prior events, one between 20.3 and 26.4 ka and another sometime before 32.8 ka (Olig and others, 1996 #1369). Earthquakes on the central sections of the Wasatch fault zone [2351] during the late Holocene do not appear to have influenced activity on the Oquirrh fault zone (Olig and others, 1996 #136). Displacement on the East Great Salt Lake fault zone [2369] may transfer to the Oquirrh fault zone (Dinter and Pechmann, 1999 #4526). Lund (2004 #6733) reports the following paleoearthquake chronology, based on paleoseismic trenching results from the northern part of the fault zone, which indicate three surface-faulting earthquakes (Olig and others, 1996 #1369): Z between 4800 and 7900 cal yr BP, Y between 20,300 and 26,400 14C yr BP, X >26,400 14C yr BP. Earthquakes on the central sections of the Wasatch fault zone [2351] during the late Holocene do not appear to have influenced activity on the Oquirrh fault zone (Olig and others, 1996 #136). However, fault displacement on the Antelope Island section of the Great Salt Lake fault zone [2369c] to the north may transfer to the Oquirrh fault zone (Dinter and Pechmann, 1999 #4526, 2000 #6882, 2005 #6752). Additionally, Olig and others (2001 #5003) believe that the Oquirrh fault zone and the Southern Oquirrh Mountains fault zone [2399] may have ruptured coseismically, at least during the Holocene and late Pleistocene.

Recurrence interval	20 k.y. (preferred), minimum 5 k.y., maximum 50 k.y. *Comments:* Consensus recurrence-interval range reported in Lund (2004 #6733), based on the single inter-event period of 12.4–21.6 k.y., with an average of , 17.0 k.y., between events Y and Z (Olig and others, 1996 #1369). The broad uncertainty range reflects the poorly constrained earthquake chronology (Lund, 2004 #6733).
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Rates of vertical deformation are 0.1–0.2 mm/yr mm/yr since about 33 ka, based on data from the Big and Pole Canyon trench sites (Olig and others, 1996 #1369). Slip rate category referenced here based on Lund (2004 #6733), whom documents a paleoseismic vertical rate of 0.2 mm/yr (preferred), and a consensus minimum-maximum range of 0.05–0.4 mm/yr, based on 2.0–2.7 m of displacement during event Z (Olig and others, 1996 #1369), and a Y-Z interevent period of 12.4–21.6 ky. The long-term geologic vertical displacement rate is estimated at 0.1–0.2 mm/yr since ~33 ka, based on data from the Big and Pole Canyon trench sites (Olig and others, 1996 #1369).
Date and Compiler(s)	2004 Bill D. Black, Utah Geological Survey Christopher B. DuRoss, Utah Geological Survey Greg N. McDonald, Utah Geological Survey Suzanne Hecker, U.S. Geological Survey
References	#429 Barnhard, T.P., and Dodge, R.L., 1988, Map of fault scarps formed on unconsolidated sediments, Tooele 1° x 2° quadrangle, northwestern Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-1990, 1 sheet, scale 1:250,000. #4526 Dinter, D.A., and Pechmann, J.C., 1999, Sublacustrine paleoseismology—Evidence for recent earthquakes on the East Great Salt Lake fault, Utah: Association of Engineering Geologists, 42nd Annual Meeting Abstracts with Program, p. 62-63. #6882 Dinter, D.A., and Pechmann, J.C., 2000, Paleoseismology of the East Great Salt Lake fault: U.S. Geological Survey National Earthquake Hazards Reduction Program, Annual Summary, v. 42, USGS External Grant award no. 98HQGR1013, 6 p. Available at http://erp-web.er.usgs.gov/reports/annsum/vol42/ni/ni_vol42.htm.

#4524 Everitt, B.L., and B.N., K., 1980, Geology for assessment of seismic risk in the Tooele and Rush Valleys, Tooele County, Utah: Utah Geological and Mineral Survey Special Studies 51, 33 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.

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#5003 Olig, S.S., Gorton, A.E., Black, B.D., and Forman, S.L., 2001, Paleoseismology of the Mercur fault and segmentation of the Oquirrh-East Great Salt Lake fault zone, Utah: Technical report to U.S. Geological Survey, Reston, Virginia, under Contract 98HQGR1036, January 25, 2001, variously paginated.

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#1368 Solomon, B.J., 1996, Surficial geology of the Oquirrh fault zone, Tooele County, Utah, *in* Lund, W.R., ed., The Oquirrh fault zone, Tooele County, Utah—Surficial geology and paleoseismicity: Utah Geological Survey Special Study 88, p. 1-17, 1 pl., scale 1:24,000, http://ugspub.nr.utah.gov/publications/special_studies/SS-88.pdf.