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Quaternary Fault and Fold Database of the United States

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Wasatch fault zone, Clarkston Mountain section (Class A) No. 2351b

Last Review Date: 2004-04-01

Compiled in cooperation with the Idaho Geological Survey and the Utah Geological Survey

citation for this record: **Black, B.D., DuRoss, C.B., Hylland, M.D., McDonald, G.N., Haller, K.M., and Hecker, S., compilers, 2004, Fault number 2351b, Wasatch fault zone, Clarkston Mountain 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 03:00 PM.**

Synopsis	**General:** The Wasatch fault zone is one of the longest and most tectonically active normal faults in North America. The fault zone shows abundant evidence of recurrent Holocene surface faulting and has been the subject of detailed studies for over three decades. Half of the estimated 50 to 120 post-Bonneville surface-faulting earthquakes in the Wasatch Front region have been on the Wasatch fault zone. Earthquake-timing, recurrence-interval, and

	displacement-rate estimates for the Brigham City, Weber, Salt Lake City, Provo, Nephi, and Levan sections of the Wasatch fault zone reflect the consensus values of the Utah Quaternary Fault Parameters Working Group (Lund, 2005 #6733). Lund (2005 #6733) did not evaluate the Clarkston Mountain, Collinston, and Fayette sections due to a lack of fault-trench data. 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 10 sections. The nearly 350-km-long Wasatch fault zone has traditionally been divided into seismogenic segments that are thought to rupture at least somewhat independently. The established model is used to define the sections described in this report. The southern eight sections are entirely in Utah. To the north, the Clarkston Mountain section straddles the state line between Idaho and Utah and the northernmost (Malad City) section is entirely in Idaho. The chronology of surface-faulting earthquakes on the Wasatch fault is one of the best dated chronologies in the world and includes 16 earthquakes since 5.6 ka, with an average repeat time of 350 yr. Four of the central five sections [2351e-h] ruptured in the last hundreds to about a thousand years ago, whereas the next section to the north, Brigham City [2351d], has not ruptured in the past 2,125 yr. Vertical displacement rates of 1–2 mm/yr are typical for the central sections during Holocene time. In contrast, middle and late Quaternary (<150–250 ka) rates on these sections are about an order of magnitude lower. This substantial change in the displacement rate may indicate a causal relation between increased Holocene rates of deformation and isostatic rebound/crustal relaxation following deep lake cycles such as Bonneville.
Name comments	**General:** **Section:** All section names follow those proposed by Machette and others (1991 #189; 1992 #607). Refers to fault number 6-16 of Hecker (1993 #642).
County(s) and State(s)	BOX ELDER COUNTY, UTAH ONEIDA COUNTY, IDAHO
Physiographic	

Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Mapped or discussed by Cluff and others (1974 #4617), Machette and others (1992 #607), and Biek and others (2003 #6734). Map traces from Cluff and others (1974 #4617). The location of the part of the section in Idaho is from Kaliser (1976 #5343), which appears to largely follow Cluff and others (1974 #4617).
Geologic setting	Generally north-trending, range-bounding normal fault along the western side of the Malad Range (Clarkston Mountain), Wellsville Mountains, Wasatch Range, and San Pitch Mountains. The Wasatch fault zone marks the eastern boundary of the Basin and Range in northern Utah. Alluvial-fan deposits and lacustrine deposits of Pleistocene Lake Bonneville dominate the surficial geology along the fault zone.
Length (km)	This section is 19 km of a total fault length of 357 km.
Average strike	N5°W (for section) versus N10°W (for whole fault)
Sense of movement	Normal
Dip	45° W. *Comments:* Based on well-developed fault breccia on faceted spurs along the west flank of Clarkson Mountain (Biek and others, 2003 #6734).
Paleoseismology studies	
Geomorphic expression	Steep linear escarpment along the western flank of the Malad Range (Clarkston Mountain). A short, prominent scarp on Late Pleistocene alluvial-fan deposits at the entrance to Elgrove Canyon is 5 m high and predates the Bonneville shoreline (Biek and others, 2003 #6734). Section boundaries are based on structural and geomorphic relations only and are more tenuous than the boundaries of other Wasatch fault zone sections to the south. Machette and others (1992 #607) place the boundary between the Clarkston Mountain and Collinston sections at Short

	Divide, which is marked by a prominent east-striking down-to-the-south normal fault that places Tertiary lacustrine sediment against Paleozoic rock.
Age of faulted surficial deposits	Late Pleistocene lacustrine, and alluvial fan deposits, and middle (?) Pleistocene alluvial fan deposits.
Historic earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:* Regressional shorelines below the Provo level wrap around, and thus postdate, a probable fault escarpment, and deep-water sediments of Lake Bonneville are not faulted.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr
Date and Compiler(s)	2004 Bill D. Black, Utah Geological Survey Christopher B. DuRoss, Utah Geological Survey Michael D. Hylland, Utah Geological Survey Greg N. McDonald, Utah Geological Survey Kathleen M. Haller, U.S. Geological Survey Suzanne Hecker, U.S. Geological Survey
References	#6734 Biek, R.F., 2003, Geologic map of the Hurricane quadrangle, Washington County, Utah: Utah Geological Survey Map 187, 61 p. pamphlet, 2 sheets, scale 1:24,000. #4617 Cluff, L.S., Glass, C.E., and Brogan, G.E., 1974, Investigation and evaluation of the Wasatch fault north of Brigham City and Cache Valley faults, Utah and Idaho—A guide to land-use planning with recommendations for seismic safety: Technical report to U.S. Geological Survey, Menlo Park, California, under Contract 14-08-001-13665, 147 p., scale 1:12,000. #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.

#7194 Hylland, M.D., 2007, Surficial-geologic reconnaissance and scarp profiling on the Collinston and Clarkston Mountain segments of the Wasatch fault zone, Box Elder County, Utah—Paleoseismic inferences, implications, for adjacent segments and issues for diffusion-equation scarp-age modeling: Utah Geological Survey Special Study 121, 18 p.

#5343 Kaliser, B.N., 1976, Final report to the U.S. Geological Survey Earthquake Hazard Reduction Program, U.S.G.S Grant no. 14-080001-G-166: Utah Geological and Mineral Survey Report of Investigation 108, 231 p., 5 pls.

#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.

#607 Machette, M.N., Personius, S.F., and Nelson, A.R., 1992, Paleoseismology of the Wasatch fault zone—A summary of recent investigations, interpretations, and conclusions, *in* Gori, P.L., and Hays, W.W., eds., Assessment of regional earthquake hazards and risk along the Wasatch front, Utah: U.S. Geological Survey Professional Paper 1500, p. A1-A71.

#189 Machette, M.N., Personius, S.F., Nelson, A.R., Schwartz, D.P., and Lund, W.R., 1991, The Wasatch fault zone, Utah—Segmentation and history of Holocene earthquakes, *in* Hancock, P.L., Yeats, R.S., and Sanderson, D.J., eds., Characteristics of active faults: Journal of Structural Geology, v. 13, p. 137-150.