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Quaternary Fault and Fold Database of the United States

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Wasatch fault zone, Malad City section (Class A) No. 2351a

Last Review Date: 2010-10-25

Compiled in cooperation with the Idaho Geological Survey

citation for this record: **Haller, K.M., and Lewis, R.S., compilers, 2010, Fault number 2351a, Wasatch fault zone, Malad City 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). Section extends from north of Malad City, Idaho, southward to about 4 km southeast of Cherry Creek, Idaho (Machette and others, 1992 #607). The southern end of this section coincides with what Machette and others called the Woodruff spur, which is a westward projecting bedrock spur in the Malad Range. In the adjacent valley, gravity data suggests an associated, prominent subsurface saddle in the bedrock (Peterson, 1974 #5342).
County(s) and	

County(s) and State(s)	ONEIDA COUNTY, IDAHO
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Poor Compiled at 1:100,000 scale. *Comments:* Fault trace is based on an unpublished 1:750,000-scale map used for a smaller scale map shown in Pierce and Morgan (1975 #320) and unpublished 1:24,000-scale reconnaissance mapping of S.F. Personius (1992, pers. communication). Location of the fault 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	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 40 km of a total fault length of 357 km.
Average strike	N14°W (for section) versus N10°W (for whole fault)
Sense of movement	Normal
Dip Direction	W
Paleoseismology studies	
Geomorphic expression	The Malad Range rises 300-900 m above the valley floor along a steep relatively continuous escarpment. However, fault scarps on alluvium are discontinuous and are generally buried by lake deposits.
Age of faulted surficial deposits	Late Pleistocene (Machette and others, 1992 #607)
Historic	

earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:* Lacustrine deposits of the Bonneville lake cycle (32-10 ka) are not offset across the fault; however, geologic reconnaissance shows that fault scarps are present on late Quaternary deposits (Cluff and others, 1974 #4617; Machette and others, 1992 #607).
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* A low slip-rate category is assigned based on the absence of evidence indicating that surface faulting post dates Lake Bonneville deposits so no surface faulting has occurred in the past 15 k.y.
Date and Compiler(s)	2010 Kathleen M. Haller, U.S. Geological Survey Reed S. Lewis, Idaho Geological Survey
References	#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.

	#5342 Peterson, D.L., 1974, Bouguer gravity map of part of the northern Lake Bonneville basin, Utah and Idaho: U.S. Geological Survey Miscellaneous Field Studies Map MF-627, scale 1:250,000. #6552 Pope, A.D., Blair, J.J., and Link, P.K., 2001, Geologic map of the Wakley Peak quadrangle, Bannock and Oneida Counties, Idaho: Idaho Geological Survey Technical Report 01-4, 1 sheet, scale 1:24,000.