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Quaternary Fault and Fold Database of the United States

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Wasatch fault zone, Fayette section (Class A) No. 2351j

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Compiled in cooperation with the Utah Geological Survey

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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).
County(s) and State(s)	SANPETE COUNTY, UTAH
Physiographic province(s)	COLORADO PLATEAUS BASIN AND RANGE
Reliability of	Poor

location	Compiled at 1:266,000 scale. *Comments:* Mapping from Machette and others (1992 #607).
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 16 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 Direction	W
Paleoseismology studies	
Geomorphic expression	The Fayette section is the southernmost section of the Wasatch fault zone and is similar in many aspects to the northern Wasatch fault zone end-sections except that Lake Bonneville was shallower and remained below (west of) the fault. The Fayette section consists of a concave-west southeast-trending eastern trace, and a shorter north-trending western trace. Fault scarps along the section are eroded at canyon mouths, but preserved on elevated streams terraces (2–5 m above stream level). Some antiquity is suggested by the lack of scarp preservation at canyon mouths.
Age of faulted surficial deposits	Late Pleistocene and middle (?) Pleistocene alluvial fan, debris-flow and stream terrace deposits (Machette and others, 1992 #607).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Morphologically, the fault scarps plot between regression lines for data from the Drum Mountains fault scarps and the highest shoreline of Lake Bonneville, suggesting an age

	of 10–15 ka (Machette and others, 1992 #607).
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* Lack of evidence for Holocene events indicates a generally lower rate of slip than central sections of the Wasatch fault zone, perhaps similar to northern end-sections (Machette and others, 1992 #607).
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 Suzanne Hecker, U.S. Geological Survey
References	#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. #8530 Hylland, M.D., and Machette, M.N., 2008, Surficial geologic map of the Levan and Fayette segments of the Wasatch fault zone, Juab and Sanpete Counties, Utah: Utah Geological Survey Map 229, 39 p. pamphlet, 1 sheet, 1:50,000 scale. #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.