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Wasatch fault zone, Collinston section (Class A) No. 2351c

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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). Refers to fault number 6-5 of Hecker (1993 #642).
County(s) and State(s)	CACHE COUNTY, UTAH BOX ELDER COUNTY, UTAH
Physiographic province(s)	BASIN AND RANGE

Reliability of location	Poor Compiled at 1:50,000 scale. *Comments:* The location of the Collinston section north of the Wellsville Mountains is poorly constrained and subject to interpretation. Gravity data and topography suggested to Machette and others (1992 #607) that the fault is west of the Junction Hills (the low hills north of the Wellsville Mountains), and ends where it intersects the prominent east-trending Short Divide fault at the south end of Clarkston Mountain. Cluff and others (1974 #4617) mapped the Wasatch fault zone as continuous around the south end of Clarkston Mountain, whereas Machette and others (1992 #607) recognized a 7-kilometer left step and gap in late Pleistocene faulting between the Collinston and Clarkston Mountain sections, and interpreted Cluff and others' (1974 #4617) supposed connecting fault as a shoreline. Goessel and others (1999 #4984) suggest that at the northern end of the Wellsville Mountains, displacement on the Collinston section is transferred several kilometers eastward to the Beaver Dam fault; they tentatively suggest the northern boundary of the Collinston section is in the area between the northern Wellsville Mountains and the Cache Butte divide. Biek and others (2003 #6758) infer Machette and others' (1992 #607) shoreline to be a wave-modified fault scarp, possibly related to the Beaver Dam fault or a down-to-the-south cross fault between the Clarkston Mountain and Collinston sections. Location of fault based on mapping by Doelling (1980 #4482), Machette and others (1992 #607), Oviatt (1986a #4629; 1986b #4630), and 1:50,000 scale mapping of Personius (1990 #1232).
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 30 km of a total fault length of 357 km.
Average strike	N21°W (for section) versus N10°W (for whole fault)
Sense of movement	Normal

Dip Direction	W
Paleoseismology studies	
Geomorphic expression	West-facing escarpment along the western flank of the Malad Range (Clarkston Mountain) and Wellsville Mountains. Machette and others (1992 #607) place the boundary between the Collinston and Brigham City sections at a reentrant near the mouth of Jim May Canyon, 2 km northeast of Honeyville, where the trend of the fault and amount of pre-Bonneville displacement changes.
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:* Faulting generally predates the transgressive phase of Lake Bonneville (~30 ka). A 2-km-long scarp in alluvium (equivalent in age to the Provo level of Lake Bonneville) at the south end of the section is probably related to sympathetic or subsidiary rupturing from faulting on the Brigham City section. The remainder of the section shows no evidence of Holocene faulting (Machette and others, 1992 #607).
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* At the south end of the section, alluvium estimated from soil-profile development to be several hundred thousand years old is displaced 12 m. Thus, we selected the <0.2 mm/yr slip-rate category to characterize the fault's behavior.
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	
	#6758 Biek, R.F., Oaks, R.Q., Jr., Janecke, S.U., Solomon, B.J., and Swenson Barry, L.M., 2003, Geologic maps of the Clarkston and Portage quadrangles, Box Elder and Cache Counties, Utah and Franklin and Oneida Counties, Idaho: Utah Geological Survey Map 194, 41 p. pamphlet, 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. #4482 Doelling, H.H., 1980, Geology and mineral resources of Box Elder County, Utah: Utah Geological and Mineral Survey Bulletin 115, 251 p., 1 pl., scale 1:125,000. #4984 Goessel, K.M., Oaks, R.Q., Jr., Perkins, M.E., and Janecke, S.U., 1999, Tertiary stratigraphy and structural geology, Wellsville Mountains to Junction Hills, north-central Utah, *in* Spangler, L.E., and Allen, C.J., eds., Geology of northern Utah and vicinity: Utah Geological Association Publication 27, p. 45-69. #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. #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.

#4629 Oviatt, C.G., 1986, Geologic map of the Cutler Dam quadrangle, Box Elder and Cache Counties, Utah: Utah Geological and Mineral Survey Map 91, 7 p. pamphlet, scale 1:24,000.

#4630 Oviatt, C.G., 1986, Geologic map of the Honeyville quadrangle, Box Elder and Cache Counties, Utah: Utah Geological and Mineral Survey Map 88, 13 p. pamphlet, scale 1:24,000.

#1232 Personius, S.F., 1990, Surficial geologic map of the Brigham City segment and adjacent parts of the Weber and Colliston segments, Wasatch fault zone, Box Elder and Weber Counties, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-1979, 1 sheet, scale 1:24,000.