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Quaternary Fault and Fold Database of the United States

As of January 12, 2017, the USGS maintains a limited number of metadata fields that characterize the Quaternary faults and folds of the United States. For the most up-to-date information, please refer to the interactive fault map.

Morgan fault, central section (Class A) No. 2353b

Last Review Date: 2004-06-01

Compiled in cooperation with the Utah Geological Survey

citation for this record: **Black, B.D., DuRoss, C.B., Hylland, M.D., and Hecker, S., compilers, 2004, Fault number 2353b, Morgan fault, central 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 02:57 PM.**

Synopsis	**General:** Range-front normal fault along the eastern side of Morgan Valley in the Wasatch Range. The central section has evidence of Holocene movement, whereas the northern and southern sections only show evidence for late Quaternary movement, although scarp morphology for all three fault traces is similar. The earthquake-timing, recurrence-interval, and slip-rate estimates for the central section of the Morgan fault reflect the consensus values of the Utah Quaternary Fault Parameters Working Group (Lund, 2004 #6733). Lund (2004 #6733) did not

	evaluate the northern and southern sections due to a lack of fault-trench data. The 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. The confidence limits incorporate both epistemic (e.g., data limitation) and aleatory (e.g., process variability) uncertainty (Lund, 2004 #6733). **Sections:** This fault has 3 sections. The northern section consists of a main western fault trace and an older eastern fault trace. The central section consists of a main fault trace and an antithetic fault trace inferred to the west. The southern section is a single, short, northwest-trending fault trace. The earthquake-timing, recurrence-interval, and slip-rate estimates for the central section of the Morgan fault reflect the consensus values of the Utah Quaternary Fault Parameters Working Group (Lund, 2004 #6733). Lund (2004 #6733) did not evaluate the northern and southern sections due to a lack of fault-trench data. The 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. The confidence limits incorporate both epistemic (e.g., data limitation) and aleatory (e.g., process variability) uncertainty (Lund, 2004 #6733).
Name comments	**General:** **Section:** Refers to Hecker's (1993 #642) Morgan fault, central section. **Fault ID:** Refers to fault number 11-18 of Hecker (1993 #642).
County(s) and State(s)	MORGAN COUNTY, UTAH
Physiographic province(s)	MIDDLE ROCKY MOUNTAINS
Reliability of location	Good Compiled at 1:125,000 scale. *Comments:* Mapped or discussed by Sullivan and others (1988 #4508) and Sullivan and Nelson (1992 #615). Fault location based on Sullivan and others (1988 #4508).

Geologic setting	North- to northeast-trending range-front normal fault along the eastern side of Morgan Valley in the Wasatch Range.
Length (km)	This section is 5 km of a total fault length of 17 km.
Average strike	N1°E (for section) versus N16°W (for whole fault)
Sense of movement	Normal
Dip	65° W. *Comments:* Measured on fault contact between Paleozoic bedrock and silty colluvium at the Robeson Springs trench site (Sullivan and Nelson, 1992 #6152).
Paleoseismology studies	Five trenches were excavated near the southern end of the fault, at a site (2353-2) about 150 m south of Robeson Springs exposed evidence of the most recent event (Sullivan and Nelson, 1992 #615). Stratigraphic relations and radiocarbon dating of bog deposits that predate the most recent surface-faulting event indicate a Holocene most recent event, and a series of small-displacement (0.5 to 1 m) events during the middle and late Pleistocene (Sullivan and others, 1988 #4508; Sullivan and Nelson, 1992 #615). At Mahogany Creek (site 2353-1), about 2.5 km north of the Robeson Springs site, a road cut and three trenches exposed gastropod-bearing sediments that provided age estimates (based on amino acid ratios) for correlative deposits at Robeson Springs (Sullivan and others, 1988 #4508; Sullivan and Nelson, 1992 #615). Tilted strata suggest local rotation into the fault, but the fault trace was not exposed at this site.
Geomorphic expression	A north-trending range-front main fault trace and an inferred northeast-trending antithetic fault trace to the west. Although early Holocene colluvium is faulted, scarps are not preserved along the fault. This is attributed to the steepness (20-25?) of escarpment slopes and the presumably small amounts of surface displacement. Small, single-event displacements (0.5 to 1.0 m per event) are suggested by a lack of discrete colluvial wedges. Analyses of soils developed on faulted deposits at different sites yielded age estimates that are generally between 200 and >400(?) ka, but which range from about 70 to >500 ka. The antithetic, graben-bounding fault is inferred to be along the western side of a topographic low west of the main fault.

Age of faulted surficial deposits	Holocene
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Radiocarbon age estimates on pre-event bog deposits indicate the most recent event since 8.3-9.1 ka. Lund (2004 #6733) reports the following paleoearthquake timing, based on available paleoseismic data consisting of two radiocarbon age estimates for pre-MRE bog deposits (Sullivan and others, 1988; Sullivan and Nelson, 1992): Z <8320?100 14C yr BP, <9100?250 14C yr BP.
Recurrence interval	25-100 k.y.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Lund (2004 #6733) indicates a poorly constrained geologic slip rate of 0.02 mm/yr (preferred), and a consensus minimum-maximum range of 0.01-0.04 mm/yr, based on a minimum average long-term slip rate of 0.01 to 0.02 mm/yr, calculated from 4 m of displacement in the past 200-400 k.y. (Sullivan and Nelson, 1992 #615). Due to poorly constrained recurrence intervals, the slip-rate estimates reported here are approximations based on an open-ended time interval, as they incorporate the elapsed time since the youngest event and/or the time difference between the age of a surface and the timing of the earliest event on that surface.
Date and Compiler(s)	2004 Bill D. Black, Utah Geological Survey Christopher B. DuRoss, Utah Geological Survey Michael D. Hylland, 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. #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. #615 Sullivan, J.T., and Nelson, A.R., 1992, Late Quaternary displacement on the Morgan fault, a back valley fault in the Wasatch Range of northeastern Utah, *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. I1-I19. #4508 Sullivan, J.T., Nelson, A.R., LaForge, R.C., Wood, C.K., and Hansen, R.A., 1988, Central Utah regional seismotectonic study for USBR dams in the Wasatch Mountains: Bureau of Reclamation Seismotectonic Report 88-5, 269 p.