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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.

Sweetwater fault (Class A) No. 645

Last Review Date: 2011-01-21

Compiled in cooperation with the Montana Bureau of Mines and Geology

citation for this record: **Haller, K.M., compiler, 2011, Fault number 645, Sweetwater fault, 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 02:04 PM.**

Synopsis	Much of the fault has been studied only by reconnaissance investigations. In general, little specific evidence is published about the nature, timing, or extent of displacement.
Name comments	Source of name is probably Schmidt and Hendrix (1981 #1070), who map the fault but do not describe it. Also referred to as the Timber Hill fault by Fritz and Sears (1993 #1235). Stickney and Bartholomew (1987 #85; 1987 #242) show this fault south of and parallel to Sweetwater Creek and extending along the northern flank of Timber Hill. **Fault ID:** Refers to number 6 (Sweetwater fault) of Stickney and Bartholomew (1987 #85) and Sweetwater fault of Stickney and

	Bartholomew (1987 #242; written commun. 1992 #556).
County(s) and State(s)	BEAVERHEAD COUNTY, MONTANA MADISON COUNTY, MONTANA
Physiographic province(s)	NORTHERN ROCKY MOUNTAINS
Reliability of location	Poor Compiled at 1:50,000 scale. *Comments:* Location of the fault is based on Montana Bureau of Mines and Geology digital data (Stickney and Bartholomew, written commun. 1992 #556) and 1:500,000-scale map of Stickney and Bartholomew (1987 #242), further constrained by satellite imagery and topography at scale of 1:50,000. Reference satellite imagery is ESRI_Imagery_World_2D with a minimum viewing distance of 1 km.
Geologic setting	High-angle, down-to-the-northeast, range-front normal fault bounds the south side of the Sweetwater Basin. The Sweetwater fault appears to be roughly coincident with a thrust fault shown on the geologic map of Dillon (Ruppel and others, 1993 #646). Vertical, normal separation is about 200 m in past 6 m.y. (Fritz and Sears, 1993 #1235).
Length (km)	13 km.
Average strike	N53°W
Sense of movement	Normal *Comments:* (Pierce and Morgan, 1990 #222; Ostenaa and Wood, 1990 #318)
Dip Direction	NE
Paleoseismology studies	
Geomorphic expression	Well-preserved scarps are present at the mouths of most small drainages (Ostenaa and Wood, 1990 #318). Scarps are absent on Holocene deposits, and 1- to 2-m-high scarps are present on upper Pleistocene deposits (Stickney and Bartholomew, 1987 #85).
Age of faulted surficial	

deposits	
Historic earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:* Stickney and Bartholomew (1987 #85; 1987 #242; written commun. 1992 #556) indicate that the most recent faulting event occurred 13-150 ka. Pierce and Morgan (1990 #222), however, show this fault as having postglacial (<15 ka) movement. Ostenaa and Wood (1990 #318) indicate that the most recent event occurred less than 15-25 ka on table 1-1 and less than 12-25 ka on table 2-1, but they state that no clearly recognizable Holocene deposits are displaced. Thus, this compilation uses a conservative estimate for the most recent movement because the faulting history is poorly understood.
Recurrence interval	10-40 k.y. *Comments:* Ostenaa and Wood (1990 #318) infer this average recurrence interval based on the late Quaternary slip rate (0.05-0.1 mm/yr) and slip of 1-2 m per event, as indicated by the height of single-event scarps. A recurrence interval of 10-20 k.y. is shown on table 1-1 and 10-40 k.y. on table 2-1; however, they refer to the later recurrence interval in the text.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Stickney and Bartholomew (1987 #85) document 250 m of offset of the 4 Ma Timber Butte basalt (revised to 6 Ma by Kreps and others, 1992 #1236) across the Sweetwater fault, from which they state that the average slip rate is 0.06 cm/yr. However, these data yield a slip rate of 0.06 mm/yr as noted by Ostenaa and Wood (1990 #318) who also suggest a similar late Quaternary slip rate (0.05-0.1 mm/yr) based on the 1- to 2-m-high scarps on upper Pleistocene deposits. Long-term slip rate is significantly less than 0.04 mm/yr if revised age of Timber Hill basalt is taken into account. Fritz and Sears (1993 #1235) indicate that the basalt is offset 200 m, which further reduces the long-term slip rate. Interestingly, Densmore and others (2009 #7037) report a minimum local rock uplift rate of 36 ? 2 mm/k.y. for the Sweetwater fault footwall.
Date and Compiler(s)	2011 Kathleen M. Haller, U.S. Geological Survey

References	#7037 Densmore, A.L., Hetzel, R., Ivy-Ochs, S., Krugh, W.C., Dawers, N., and Kubik, P., 2009, Spatial variations in catchment-averaged denudation rates from normal fault footwalls: Geology, v. 37, p. 1139-1142. #1235 Fritz, W.J., and Sears, J.W., 1993, Tectonics of the Yellowstone hotspot wake in southwestern Montana: Geology, v. 21, p. 427-430. #1236 Kreps, J., Fritz, W.J., Sears, J.W., and Wampler, J.M., 1992, The 6 Ma Timber Hill basalt flow—Implications for late-Cenozoic drainage systems and the onset of Basin-and-Range style faulting, southwestern Montana: Geological Society of America Abstracts with Programs, v. 24, no. 6, p. 22. #318 Ostenaa, D., and Wood, C., 1990, Seismotectonic study for Clark Canyon Dam, Pick-Sloan Missouri Basin Program, Montana: U.S. Bureau of Reclamation Seismotectonic Report 90-4, 78 p., 1 pl. #222 Pierce, K.L., and Morgan, L.A., 1990, The track of the Yellowstone hotspot—Volcanism, faulting, and uplift: U.S. Geological Survey Open-File Report 90-415, 68 p., 1 pl. #646 Ruppel, E.T., O'Neill, J.M., and Lopez, D.A., 1993, Geologic map of the Dillon 1° x 2° quadrangle, Idaho and Montana: U.S. Geological Survey Miscellaneous Investigations Map I-1803-H, 1 sheet, scale 1;250,000. #1070 Schmidt, C.J., and Hendrix, T.E., 1981, Tectonic controls for thrust belt and Rocky Mountain foreland structures in the northern Tobacco Root Mountains—Jefferson Canyon area, southwestern Montana, *in* Tucker, T.E., ed., Guidebook to southwest Montana: Montana Geological Society, 1981 Field Conference and Symposium, p. 167-180. #242 Stickney, M.C., and Bartholomew, M.J., 1987, Preliminary map of late Quaternary faults in western Montana: Montana Bureau of Mines and Geology Open-File Report 186, 1 pl., scale 1:500,000. #85 Stickney, M.C., and Bartholomew, M.J., 1987, Seismicity and late Quaternary faulting of the northern Basin and Range province, Montana and Idaho: Bulletin of the Seismological

	Society of America, v. 77, p. 1602-1625. #556 Stickney, M.C., and Bartholomew, M.J., 1992 written commun., Preliminary map of late Quaternary faults in western Montana (digital data): Montana Bureau of Mines and Geology (digital version of MBMG Open-File Report 186), 1 pl., scale 1:500,000.