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Quaternary Fault and Fold Database of the United States

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Blacktail fault, Cottonwood section (Class A) No. 644b

Last Review Date: 2010-11-10

Compiled in cooperation with the Montana Bureau of Mines and Geology

citation for this record: **Haller, K.M., compiler, 2010, Fault number 644b, Blacktail fault, Cottonwood 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 02:03 PM.**

Synopsis	**General:** In general, published information about the nature, timing, or extent of displacement is limited. Published maps have significant differences even in the location of the fault. One trench was excavated across the more recently active part of the range-front fault, but a younger fan surface about 1 km to the east has short scarp. **Sections:** This fault has 2 sections. The informally named sections are based on distinctly different faulting histories; segments have been discussed in the literature but it is not clear if

	the intent was to define seismogenic segments. The northwesternmost 12 km of the Blacktail fault [644a], described in Stickney and Bartholomew (1987 #85) as inactive and is the only part that has a recognizably different faulting history. The rest of the fault discussed by Stickney and Bartholomew (1987 #85) as the Cottonwood Creek scarp includes the three segments shown in the Montana Bureau of Mines and Geology digital data (Stickney and Bartholomew, written commun. 1992 #556); they are named the Northwest, Southeast, and Cottonwood segments. Detailed studies have not been completed to identify differences in timing of faulting events, and thus these parts of the fault are discussed collectively as a single section [644b]. Ostenaa and Wood (1990 #318) suggest the presence of more than one segment based on discontinuities in the fault trace and slightly better preserved scarps along the southeastern part of the fault, but they also acknowledge the absence of firm supporting evidence.
Name comments	**General:** The original source of the name Blacktail fault is probably Scholten and others (1955 #69), who described it as extending at least 24 km northwestward from near Deer Creek. Pardee (1950 #46) shows the Blacktail fault on a map and discusses it in the section on faults along the Beaverhead-Jefferson basin, but it is not given a name. The fault as shown in this compilation is based on descriptions provided by Stickney and Bartholomew (1987 #85) and the Montana Bureau of Mines and Geology digital data (Stickney and Bartholomew, written commun. 1992 #556) and extends from 1.5 km northwest of U.S. Highway 91 southeast to 1 km southeastward of Teddy Creek. **Section:** Stickney and Bartholomew (1987 #85) discuss this part of the fault as the Cottonwood scarp; the geographic name (Blacktail fault) is used in this compilation. The Northeast, Southwest, and Cottonwood segments in the Montana Bureau of Mines and Geology digital data (Stickney and Bartholomew, written commun. 1992 #556) are the three strands shown here; the Cottonwood segment is the short strand south of Cottonwood Creek. The section extends from 1.5 km northwest of Sheep Creek southeast to 1 km southeastward of Teddy Creek. **Fault ID:** Refers to feature number 13 (Blacktail fault) of Witkind (1975 #317), number 5 (Blacktail fault) of Stickney and Bartholomew (1987 #85), and Blacktail fault of Stickney and Bartholomew (1987 #242; written commun. 1992 #556).
County(s) and	

County(s) and State(s)	BEAVERHEAD COUNTY, MONTANA
Physiographic province(s)	NORTHERN ROCKY MOUNTAINS
Reliability of location	Good Compiled at 1:100,000 scale. *Comments:* Location of fault is based on Montana Bureau of Mines and Geology digital data (Stickney and Bartholomew, written commun. 1992 #556), 1:500,000-scale map of Stickney and Bartholomew (1987 #242), and description of the fault given by Stickney and Bartholomew (1987 #85). Location of fault 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.
Geologic setting	High-angle, down-to-the-northeast, range-front normal fault bounds the northeast side of the Blacktail Range. The amount of structural throw is not known; Scholten and others (1955 #69) indicate a throw of more than 750 m based on the height of the range-front escarpment. Hurlow (1995 #1063) indicates about 1 km of structural relief across fault. Mueller and Krol (2008 #7019) conclude that some of the total offset across the range-front system is accommodated by the subparallel Jake Canyon fault, which is truncated in the subsurface by the Blacktail fault.
Length (km)	This section is 27 km of a total fault length of 40 km.
Average strike	N50°W (for section) versus N50°W (for whole fault)
Sense of movement	Normal *Comments:* (Pierce and Morgan, 1990 #222; Ostenaa and Wood, 1990 #318)
Dip Direction	NE
Paleoseismology studies	Trench 644-1, located on a terrace approximately 10 m above and south of Cottonwood Creek on rangeward strand of fault, was excavated in 1986. Data are published in Bartholomew and Stickney (1987 #9) and Stickney and others (1987 #295). Trench did not expose the fault but did expose at least one colluvial wedge (Stickney, oral commun. 1994).

Geomorphic expression	No known detailed discussion of scarps exists, but Ostenaa and Wood (1990 #318) indicate at least some scarps are on alluvium.
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 on this fault occurred between 13 and 150 ka, supported by trenching south of Cottonwood Creek (Bartholomew and Stickney, 1987 #9; Stickney and others, 1987 #295). Stickney and others (1987 #295) document that the contact between inferred upper Quaternary (Bull Lake) outwash and an upper Pleistocene mud flow is offset 5 m. Bartholomew and Stickney (1987 #9) indicate that the scarp formed during one or more late Pleistocene faulting events. Ostenaa and Wood (1990 #318) estimate that the most recent event occurred between 15 and 35 ka based on a 2-m-high scarp on upper Pleistocene (inferred to be contemporaneous with the last glacial cycle, Pinedale) fan near Cottonwood Creek. The short piedmont scarp south of Cottonwood Creek is designated as being postglacial (<13 ka) in age in Stickney and Bartholomew (1987 #242). Pierce and Morgan (1990 #222) show the Blacktail fault on their regional map as having postglacial (<15 ka) movement; however, the fault is designated as late Pleistocene (<100 ka) in the text. A conservative estimate for the most recent movement is cited in this compilation because the faulting history is poorly understood.
Recurrence interval	15-30 k.y. *Comments:* Ostenaa and Wood (1990 #318) suggest this preliminary and speculative recurrence interval based on trenching data (Stickney and others, 1987 #295) and surficial relations along this section. They note that recurrence intervals on this fault may be longer than that for other faults in this area and that the given interval is probably a minimum. The time interval for which this recurrence is valid is not documented.
Slip-rate	Less than 0.2 mm/yr

category	*Comments:* Bartholomew and others (1999 #7141) report a slip rate of 5.4 cm/1,000 yr (0.054 mm/yr) based on 6.5-m offset of Bull Lake outwash (estimated age 120 ka). However, data presented by Stickney and Bartholomew (1987 #85) points to a lower slip rate based on the small (4-5 m) amount of offset of inferred upper (<150 ka) Quaternary deposits.
Date and Compiler(s)	2010 Kathleen M. Haller, U.S. Geological Survey
References	#9 Bartholomew, M.J., and Stickney, M.C., 1987, Late Quaternary faulting in southwestern Montana: Geological Society of America Abstracts with Programs, v. 19, p. 258-259. #7141 Bartholomew, M.J., Lewis, S.E., Russell, G.S., Stickney, M.C., Wilde, E.M., and Kish, S.A., 1999, Late Quaternary history of the Beaverhead River Canyon, southwestern Montana, *in* Hughes, S.S., and Thackray, G.D., eds., Guidebook to the Geology of Eastern Idaho: Idaho Museum of Natural History, p. 237-250. #6899 Bartholomew, M.J., Stickney, M.C., and Wasklewicz, T.A., 2004, Interaction between the northern Basin and Range and the Yellowstone stress fields near the Red Rock fault, southwestern Montana: Geological Society of America Abstracts with Programs, v. 36, no. 4, p. 12. #1063 Hurlow, H.A., 1995, Late Pliocene or younger paleostress directions from fractured clasts, Sixmile Creek Formation, lower Red Rock Valley, SW Montana: Geological Society of America Abstracts with Programs, v. 27, no. 4, p. 16. #7019 Muller. P.D., and Krol, M.A., 2008, Re-interpretation of the range-bounding faults of the Blacktail Mountains, SW Montana—Implications for Cenozoic tectonic history: Geological Society of America Abstracts with Programs, v. 40, no. 1, p. 52. #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. #46 Pardee, J.T., 1950, Late Cenozoic block faulting in western Montana: Geological Society of America Bulletin, v. 61, p. 359-

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#69 Scholten, R., Keenmon, K.A., and Kupsch, W.O., 1955, Geology of the Lima region, southwestern Montana and adjacent Idaho: Geological Society of America Bulletin, v. 66, p. 345-404.

#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.

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#295 Stickney, M.C., Bartholomew, M.J., and Wilde, E.M., 1987, Trench logs across the Red Rock, Blacktail, Lima Reservoir, Georgia Gulch, Vendome and Divide faults, Montana: Geological Society of America Abstracts with Programs, v. 19, p. 336-337.

#317 Witkind, I.J., 1975, Preliminary map showing known and suspected active faults in western Montana: U.S. Geological Survey Open-File Report 75-285, 36 p. pamphlet, 1 sheet, scale 1:500,000.

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