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Quaternary Fault and Fold Database of the United States

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Spokane Bench fault, southern section (Class A) No. 681b

Last Review Date: 1993-04-26

Compiled in cooperation with the Montana Bureau of Mines and Geology

citation for this record: **Machette, M.N., compiler, 1993, Fault number 681b, Spokane Bench fault, southern 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 02:02 PM.**

Synopsis	**General:** This intrabasin normal fault forms a prominent scarp on the western and southern edges of Spokane Bench, east of Helena. The northern section of the fault is mostly concealed beneath young unconsolidated deposits, whereas a scarp on Tertiary sediment is present along the south section. **Sections:** This fault has 2 sections. Fault divided into two sections on the basis of trend and previous mapping that defined two separate faults.
Name	**General:** Johns and others (1982 #259) referred to the northern

comments	part of this structure as the Lake Helena fault. First published use of the Spokane Bench name appears to have been by Schmidt (1986 #533) and is the name that is used here. The fault was unnamed in compilation of Witkind (1975 #317) and on maps by Stickney and Bingler (1981 #559) and Stickney (1987 #251). Fault extends from outlet of Lake Helena southerly and southeasterly to east of Clasoil, Montana. **Section:** This informally named section refers to an unnamed fault of Witkind (1975 #317). Fault extends from a point about 3 km northeast of East Helena southeastward to Clasoil, a small town about 10 km east of East Helena. **Fault ID:** Refers to fault 152 (unnamed, extends southward from Lake Helena) of Witkind (1975 #317) and fault 123 (Lake Helena fault) of Johns and others (1982 #259).
County(s) and State(s)	BROADWATER COUNTY, MONTANA JEFFERSON COUNTY, MONTANA LEWIS AND CLARK COUNTY, MONTANA
Physiographic province(s)	NORTHERN ROCKY MOUNTAINS
Reliability of location	Good Compiled at 1:250,000 scale. *Comments:* Location based primarily on 1:50,000-scale map of Stickney (1987 #251), but modified to connect with the northern section of the fault (681a) as suggested by topography.
Geologic setting	Down-to-the-west, intrabasin, normal fault that forms a prominent scarp at the western and southern margins of Spokane Bench. Johns and others (1982 #259) report 30 m of Quaternary displacement on the fault. At the northern end, there may be as much as 100 m of offset between Tertiary sediment and pre-Tertiary sedimentary bedrock (Schmidt, 1986 #533). Further south, the fault turns to the southeast and forms a down-to-the-southwest scarp that opposes the northward gradient between higher bedrock terrain and Spokane Bench.
Length (km)	This section is 12 km of a total fault length of 20 km.
Average strike	N51°W (for section) versus N30°W (for whole fault)
Sense of	Normal

movement	Normal
Dip Direction	SW
Paleoseismology studies	
Geomorphic expression	This fault is marked by a southwest-facing scarp that opposes the northerly gradient between high bedrock terrain (to the south) and Spokane Bench. The scarp is very small at Clasoil, but is progressively larger to the west. It reaches 20 m in height at Diehl Lane, where it is coincident with a northwesterly trending stream channel. Along most of its length, the scarp deflects or controls the path of streams.
Age of faulted surficial deposits	Fault displaces Spokane Bench and drops it down to the west, presumably beneath younger Quaternary material. Spokane Bench is underlain by Tertiary(?) fluvial and lacustrine sediments, which are considered to be as old as Oligocene (Schmidt, 1986 #533) to as young as late Pliocene or early Pleistocene (Johns and others, 1982 #259). The bench may in fact be an erosional surface that is unconformable on the underlying materials (Pardee, 1950 #46), which are tilted. Thus, although the faults are known to cut Tertiary sediment, they also deform Spokane Bench, which could be as young as early Pleistocene.
Historic earthquake	
Most recent prehistoric deformation	undifferentiated Quaternary (<1.6 Ma) *Comments:* Stickney (1987 #251) reported early Quaternary to late Tertiary movement, whereas Witkind (1975 #317) considered the fault to be Quaternary.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* Low slip rate inferred from the 20-m-high fault scrap on Spokane Bench.
Date and Compiler(s)	1993 Michael N. Machette, U.S. Geological Survey, Retired
References	#4 Anderson, A.L., 1956, Geology and mineral resources of the Salmon quadrangle, Lemhi County, Idaho: Idaho Bureau of Mines

	and Geology Pamphlet 106, 102 p., 6 pls. #259 Johns, W.M., Straw, W.T., Bergantino, R.N., Dresser, H.W., Hendrix, T.E., McClernan, H.G., Palmquist, J.C., and Schmidt, C.J., 1982, Neotectonic features of southern Montana east of 112°30' west longitude: Montana Bureau of Mines and Geology Open-File Report 91, 79 p., 2 sheets. #46 Pardee, J.T., 1950, Late Cenozoic block faulting in western Montana: Geological Society of America Bulletin, v. 61, p. 359-406. #533 Schmidt, R.G., 1986, Geology, earthquake hazards, and land use in the Helena area, Montana—A review: U.S. Geological Survey Professional Paper 1316, 64 p., 3 pls., scale 1:48,000 and 1:25,000. #251 Stickney, M.C., 1987, Quaternary geologic map of the Helena valley, Montana: Montana Bureau of Mines and Geology Geologic Map 46, 1 pl., scale 1:50,000. #559 Stickney, M.C., and Bingler, E.C., 1981, Earthquake-hazard evaluation of the Helena valley area, Montana: Montana Bureau of Mines and Geology Open-File Report 83, 30 p., 1 pl., scale 1:24,000. #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.