

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](#).

Spokane Bench fault, northern section (Class A) No. 681a

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 681a, Spokane Bench fault, northern 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	<p>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 Binger (1981 #559) and Stickney (1987 #251). Fault extends from outlet of Lake Helena southerly and southeasterly to east of Clasoil, Montana.</p> <p>Section: Refers to unnamed fault of Witkind (1975 #317) and to the Lake Helena fault of Johns and others (1982 #259). This section extends from the east side of Lake Helena southward to a point about 3 km northeast of East Helena, where it joins the southern section. Johns and others (1982 #259) considered it to be a continuation of the Regulating Reservoir fault [680] and (together) possibly a splay of their larger Helena Valley fault [Spokane Hills fault, 679].</p> <p>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).</p>
County(s) and State(s)	LEWIS AND CLARK COUNTY, MONTANA
Physiographic province(s)	NORTHERN ROCKY MOUNTAINS
Reliability of location	<p>Good Compiled at 1:250,000 scale.</p> <p><i>Comments:</i> Location based primarily on 1:48,000-scale map of Schmidt (1986 #533). Stickney (1987 #251) shows the fault as having two right-stepping echelon strands.</p>
Geologic setting	<p>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.</p>
Length (km)	This section is 10 km of a total fault length of 20 km.

Average strike	N10°W (for section) versus N30°W (for whole fault)
Sense of movement	Normal <i>Comments:</i> Johns and others (1982 #259).
Dip Direction	W
Paleoseismology studies	In 1977, the Bureau of Reclamation excavated several trenches across the scarp, west of Regulating Reservoir. These trenches were about 2 m deep and were logged by M.W. Reynolds (USGS) and M. McKeown (USBR) (Schmidt, 1986 #533). The trenches did not penetrate the primary trace of the fault, but exposed Tertiary sediment that dips as much as 70° in hanging wall of the fault and early(?) Quaternary sediment that is folded, slumped, locally shattered (sheared?) and invaded by sand dikes. Movement is presumed to have occurred on the main fault in middle or late Quaternary time (Schmidt, 1986 #533).
Geomorphic expression	According to Schmidt (1986 #533), this fault follows the base of a escarpment that is about 30 m high along the western margin of Spokane Bench. The trace of the fault is probably covered by stream gravels (Schmidt, 1986 #533) and by local alluvial-fan deposits and colluvium shed from the scarp (Stickney, 1987 #251).
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	middle and late Quaternary (<750 ka) <i>Comments:</i> Estimates range from middle or late Quaternary (Schmidt, 1986 #533) to early Quaternary or late Tertiary (Stickney, 1987 #251). Estimate of timing is based on deformation of early(?) Quaternary sediment (Schmidt, 1986

	#533).
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr <i>Comments:</i> Inferred low slip rate based on 30 m of Quaternary displacement on the fault (Johns and others, 1982 #259).
Date and Compiler(s)	1993 Michael N. Machette, U.S. Geological Survey, Retired
References	<p>#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.</p> <p>#46 Pardee, J.T., 1950, Late Cenozoic block faulting in western Montana: Geological Society of America Bulletin, v. 61, p. 359-406.</p> <p>#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.</p> <p>#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.</p> <p>#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.</p> <p>#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.</p>

[Questions or comments?](#)

[Facebook](#) [Twitter](#) [Google](#) [Email](#)

[Hazards](#)

[Design Ground Motions](#)[Seismic Hazard Maps & Site-Specific Data](#)[Faults](#)[Scenarios](#)

[Earthquakes](#)[Hazards](#)[Data](#)[Education](#)[Monitoring](#)[Research](#)

[Home](#)[About Us](#)[Contacts](#)[Legal](#)