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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.

Beaverhead fault, Nicholia section (Class A) No. 603e

Last Review Date: 2010-11-09

Compiled in cooperation with the Idaho Geological Survey

***citation for this record:* Haller, K.M., Wheeler, R.L., and Adema, G.W., compilers, 2010, Fault number 603e, Beaverhead fault, Nicholia 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 03:02 PM.**

Synopsis	**General:** Detailed mapping and reconnaissance studies of scarp morphology are the sole source of data for this fault; a segmentation model has been proposed based on these data. No detailed site studies, such as trenching, have been conducted. **Sections:** This fault has 6 sections. Haller (1988 #27) defined six segments of Beaverhead fault; however, because of reconnaissance nature of this study, the same boundaries are used in this compilation to define the extent of our sections.
Name	**General:** Although Beaverhead fault was mapped and discussed

comments	by numerous authors as early as 1928 (Shenon, 1928 #77), Skipp (1985 #291) may be one of the earliest to name this structure. The fault extends from east of town of Tendoy, Idaho, on the north end where range front steps to east southward to northern margin of Snake River Plain. **Section:** Defined as Nicholia segment by Haller (1988 #27). The northern end of the section is near Gilmore Summit, and scarps are absent along northern 8 km. Scarps on alluvium extend from near Mud Creek southward to Timber Canyon. It includes North Nicholia, Nicholia, South Nicholia, and Scott Canyon segments in Montana Bureau of Mines and Geology digital database (Stickney, written commun., 1992) and Nicholia scarp of Stickney and Bartholomew (1987 #85). **Fault ID:** Refers to number 112 ("unnamed fault") in Witkind (1975 #320).
County(s) and State(s)	CLARK COUNTY, IDAHO LEMHI COUNTY, IDAHO
Physiographic province(s)	NORTHERN ROCKY MOUNTAINS
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Location of the scarps is based on 1:250,000-scale maps of Haller (1988 #27; original mapping at 1:24,000 or 1:62,500 scale), further constrained by satellite imagery and topography at scale of 1:24,000. Reference satellite imagery is ESRI_Imagery_World_2D with a minimum viewing distance of 1 km.
Geologic setting	This part of east-central Idaho and southwest Montana is made of Precambrian and Paleozoic rocks that were shortened by folding and faulting and was thrust northeastward during the late Mesozoic. Mid- to late Cenozoic extension broke the thrust complex into northwest-trending basins and ranges and continues today. The Beaverhead fault is a high-angle, down-to-the-southwest, range-front, normal fault that separates the Beaverhead Mountains to the northeast from the Lemhi River and Birch Creek valleys on the southwest. Densmore and others (2005 #7016) suggest that maximum throw across the Beaverhead fault is 4-6 km.

Length (km)	This section is 25 km of a total fault length of 121 km.
Average strike	N43°W (for section) versus N39°W (for whole fault)
Sense of movement	Normal *Comments:* Scott and others (1985 #76) indicate movement along this part of the fault is normal dextral. However, the concavity of this part of the fault may indicate a sinistral component to the overall extensional faulting; the concavity might also represent a tear fault, with largely dextral motion where the fault trace trends southwest, and pure normal faulting along the main, northwestward trending part of the fault. Slip indicators are required to tell which is the case.
Dip Direction	SW
Paleoseismology studies	
Geomorphic expression	Section spans a major embayment in range front. Nearly continuous, prominent scarps are present on the southern 34 km of the section (Haller, 1988 #27; Crone and Haller, 1991 #186).
Age of faulted surficial deposits	Upper Pleistocene (about 15 ka) glacial outwash, and upper Pleistocene and undifferentiated Pleistocene alluvium (Scott, 1982 #278).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Age estimates for most recent event are poorly constrained between Holocene and approximately 30 ka, but the inferred age of faulted deposits suggest an age of less than 15 ka. Morphologies of probable single-event fault scarps indicate most recent faulting event occurred approximately 30 ka. But deposits thought to be latest Pleistocene (<15 ka), based on soil characteristics, have single-event scarps. Thus Haller (1988 #27) concludes movement probably occurred shortly after late glacial deposits were emplaced (about 15 ka). In contrast, Stickney and Bartholomew (1987 #85) suggest that a 2-km-long section of scarps south of the old town site of Nicholia (called Nicholia scarp) are Holocene in age, and a combined length of 13 km of scarps north and south of Nicholia are older than 15 ka

Recurrence interval	*Comments:* Although data to determine a recurrence interval are not available, evidence indicates a record of multiple faulting events. Probable single-event scarps are present on 15 ka deposits, and multiple-event scarps are on deposits thought to be approximately 25 ka (Haller, 1988 #27).
Slip-rate category	Less than 0.2 mm/yr *Comments:* Scott and others (1985 #76) suggested a slip rate of 0.3 mm/yr for central part of Beaverhead fault based on an analogy with the central part of the Lost River fault [601] along which 4 m of offset has occurred in the past 15 k.y. More recent, fault specific geomorphic studies suggest that this part of the fault has a very low slip rate based on 2.4- to 3.5-m-high scarps on deposits estimated to be about 25 ka (Haller, 1988 #27). Payne and others (2008 #7017) report high rates of right-lateral shear resulting from high strain rates in the undeforming Snake River Plain to low strain rates north of the central part of the Lost River and Lemhi Ranges and the Beaverhead Mountains based on campaign GPS surveys; they furthermore characterize the rate of differential slip within the Centennial shear zone as increasing from 0.9 ?0.3 mm/yr near the Lost River fault [601] to 1.7 ?0.2 mm/yr near the Beaverhead fault [603]. The rate of slip may continue to increase northeastward to the Centennial fault [643]. However, Puskas and Smith (2009 #7018) argue against the high velocities; they conclude the differential motion across this boundary is less than 0.5 mm/yr.
Date and Compiler(s)	2010 Kathleen M. Haller, U.S. Geological Survey Russell L. Wheeler, U.S. Geological Survey, Emeritus Guy W. Adema, Idaho Geological Survey
References	#186 Crone, A.J., and Haller, K.M., 1991, Segmentation and the coseismic behavior of Basin and Range normal faults—Examples from east-central Idaho and southwestern Montana, *in* Hancock, P.L., Yeats, R.S., and Sanderson, D.J., eds., Characteristics of active faults: Journal of Structural Geology, v. 13, p. 151-164. #7016 Densmore, A.L., Dawers, N.H., Gupta, S., and Guidon, R., 2005, What sets topographic relief in extensional footwalls?: Geology, v. 33, no. 6, p. 453-456.

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#7018 Puskas, C.M., and Smith, R.B., 2009, Intraplate deformation and microplate tectonics of the Yellowstone hot spot and surrounding western US interior: Journal of Geophysical Research-Solid Earth, v. 114, B04410, doi:10.1029/2008JB005940.

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#76 Scott, W.E., Pierce, K.L., and Hait, M.H., Jr., 1985, Quaternary tectonic setting of the 1983 Borah Peak earthquake, central Idaho: Bulletin of the Seismological Society of America, v. 75, p. 1053–1066.

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Questions or comments?