

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](#).

unnamed faults in Hebgen Lake basin (Class A) No. 659

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Compiled in cooperation with the Montana Bureau of Mines and Geology

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Synopsis	Even though the largest historic earthquake in Montana resulted in surface rupture of these faults, only slightly more is known about some of them than the other faults that slipped during the Hebgen Lake earthquake. The majority of published data are in reports dating from the early 1960s.
Name comments	The numerous intrabasin faults south of the Madison Arm of Hebgen Lake that ruptured during the Hebgen Lake earthquake have been referred to by several names in the literature, but no name has widespread popular usage. Some individual features

	<p>have been referred to as "scarps near Ranger Basin station" (Ross and Nelson, 1964 #249), "Madison Arm fault" (Myers and Hamilton, 1964 #250), "graben involving faulted bedrock" (Myers and Hamilton, 1964 #250), and "faults at Horse Butte" (Myers and Hamilton, 1964 #250). Alexander and others (1994 #1252) call one of these faults the Hope Ranch fault. These faults are discussed collectively for convenience.</p> <p>Fault ID: Refers to number 16 (Hebgen Lake graben) of Stickney and Bartholomew (1987 #85), Hebgen Lake graben of Stickney and Bartholomew (1987 #242), and Madison Arm graben of Stickney and Bartholomew (written commun. 1992 #556). Johns and others (1982 #259) discuss these faults (number 34, Hebgen Lake basin) but do not show them on a map. Witkind (1975 #317) does not include these faults in his compilation.</p>
County(s) and State(s)	GALLATIN 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 on 1:62,500-scale map (Witkind, 1964 #247; Myers and Hamilton, 1964 #250).</p>
Geologic setting	<p>Predominately west-trending scarps, which broadly define a graben in the Upper Madison Valley south of Hebgen Lake. Ross and Nelson (1964 #249) speculate that these structures are continuous with the Centennial fault [643] through Targhee Pass, which they contend is a modified structural depression; however, available gravity data do not support this conclusion (Schofield, 1981 #314).</p>
Length (km)	14 km.
Average strike	N44°W
Sense of movement	<p>Normal</p> <p><i>Comments:</i> (Myers and Hamilton, 1964 #250)</p>
Dip Direction	NE; SW; NW

Paleoseismology studies	
Geomorphic expression	<p>Faults are expressed as small (<0.6-0.8 m), short (<3.5 km), discontinuous historical scarps locally superimposed on prehistoric scarps (<6 m) and local monoclinal warping (Myers and Hamilton, 1964 #250). Myers and Hamilton (1964 #250) describe some of these features in detail, as abstracted in following discussion. "Madison Arm fault and monocline" has the greatest local relief, with north-facing surface rupture expressed as <0.7 m offsets that locally grade into warped sediments. Deformation in 1959 was superimposed on a prehistoric scarp along the western end; the eastern part of the fault has no evidence of a prehistoric event. "Faults at Horse Butte" are composed of multiple scarps having varying orientations and apparently are not associated with prehistoric scarps; however, Myers and Hamilton do suggest Horse Butte does appear to be fault controlled. "Graben involving faulted bedrock," which is near Basin Ranger Station, has small (<0.3 m), discontinuous scarps with the northernmost graben-bounding scarp on south side of a rhyolite horst. The 1959 scarps are superimposed on 1.5- to 4.6-m-high scarps.</p>
Age of faulted surficial deposits	Upper Pleistocene (<40 ka) outwash (Nash, 1984 #343).
Historic earthquake	Hebgen Lake earthquake 1959
Most recent prehistoric deformation	<p>latest Quaternary (<15 ka)</p> <p><i>Comments:</i> Nash (1984 #343) estimates prehistoric faulting event occurred 2.8 ± 0.1 ka based on morphologic modeling of scarps southeast of confluence of Denny Creek and South Fork Madison River. Doser (1985 #22) reports a date of $3,250 \pm 850$ yr B.P. attributed to Nash.</p>
Recurrence interval	<p><i>Comments:</i> Although not stated as such, data from Nash (1984 #343) suggests a recurrence interval of 2.8 ± 0.1 k.y. between the past two surface-faulting events.</p>
Slip-rate category	Between 0.2 and 1.0 mm/yr

Comments: The poor topographic expression of these faults suggests low slip rates or recent inception of faulting. The largest multiple-event scarps (4.5-6 m) on upper Pleistocene deposits (15-40 ka) also support a low slip rate as well as small historic slip (<0.6-0.8 m) with implied recurrence interval of 2.8 k.y.

**Date and
Compiler(s)**

1994
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