Jump to Navigation

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.

Emigrant fault, northern section (Class A) No. 642a

Last Review Date: 2010-11-17

Compiled in cooperation with the Montana Bureau of Mines and Geology

citation for this record: **Haller, K.M., compiler, 2010, Fault number 642a, Emigrant 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 02:03 PM.**

Synopsis	**General:** Detailed mapping and reconnaissance studies of scarp morphology are the sole source of data for this fault; segmentation model has not been proposed based on these data. No detailed site studies, such as trenching, have been conducted. **Sections:** This fault has 2 sections. Seismogenic segments are not defined for this fault. The fault is marked by short discontinuous scarps that have similar morphologic characteristics (Personius, 1982 #241). According to Personius (1982 #244), scarp-morphology data do not clearly define difference in timing of

	displacement along this fault, even though the fault's geometry has an abrupt bend and a left-stepping echelon pattern in the central part of the fault that could suggest a possible structural complexity.
Name comments	**General:** One of the earliest references to name the Emigrant fault is Pardee (1950 #46), who describes the fault as extending from Pine Creek southwestward to Yankee Jim Canyon. Also referred to as the Deep Creek fault (Bonini and others, 1972 #265; Personius, 1982 #241; 1982 #244; 1986 #252) and Emigrant Valley fault (U.S. Coast and Geodetic Survey, 1959 #630). **Section:** This informally named section includes the Strong's Ranch scarp and Pool Creek scarp of Personius (1982 #241; 1982 #244; 1986 #252); Pool Creek scarp of Stickney and Bartholomew (1987 #85; 1987 #242); and Deep Creek segment of Stickney and Bartholomew (written commun. 1992 #556). Johns and others (1982 #259) show this part of the fault as number 71 (Deep Creek fault) but the description provided for number 72 (Deep Creek West fault) appears to be more applicable to this section. **Fault ID:** Refers to number 15 (Emigrant fault) of Witkind (1975 #317); numbers 70 (Emigrant fault), 71 (Deep Creek fault), and 72 (Deep Creek West fault) of Johns and others (1982 #259); number 17 (Emigrant fault) of Stickney and Bartholomew (1987 #85); and Emigrant fault of Stickney and Bartholomew (1987 #242; written commun. 1992 #556).
County(s) and State(s)	PARK COUNTY, MONTANA
Physiographic province(s)	MIDDLE ROCKY MOUNTAINS
Reliability of location	Good Compiled at 1:50,000 scale. *Comments:* Location of fault primarily based on Lopez and Reiten (2003 #7142) further constrained by satellite imagery and topography at scale of 1:50,000. Reference satellite imagery is ESRI_Imagery_World_2D with a minimum viewing distance of 1 km. Additional scarps are from 1:125,000-scale map of Personius (1982 #241).
Geologic setting	High-angle, down-to-the-northwest, range-front normal fault

	bounding the west side of the Beartooth uplift. Fault is generally several hundreds of meters west of the topographic range front (Bonini and others, 1972 #265; Personius, 1982 #241). Pierce and Morgan (1992 #539) indicate that the fault was active between 8 and at least 15 Ma and since 0.5 Ma with an interval of quiescence between, based on regressing displacement at a late Quaternary rate to fit the observed tilt in 5.4 and 8 Ma basalts in the valley. Units below the basalts suggest displacement totaling more than 1 km during the Miocene. Gravity data of Bonini and others (1972 #265) indicate total displacement of 5.6-6.1 km.
Length (km)	This section is 2 km of a total fault length of 43 km.
Average strike	(for section) versus N46°W (for whole fault)
Sense of movement	Normal *Comments:* (Bonini and others, 1972 #265)
Dip	80° W *Comments:* Location of dip, from Bonini and others (1972 #265), probably along the northernmost part of the fault that Personius (1982 #241) describes as being in bedrock. Bonini and others (1972 #265) indicate that a model of a vertical fault best fits the gravity data.
Paleoseismology studies	
Geomorphic expression	Faceted spurs are preserved only locally, remnant pediments are absent, scarps on alluvium are discontinuous and as high as 50 m (Personius, 1982 #241). Hot springs occur along trace (Witkind, 1975 #317).
Age of faulted surficial deposits	Upper Pleistocene (Pinedale ?) glacial drift, upper Pleistocene alluvium, and undifferentiated upper Pleistocene glacial deposits; Paleozoic-Mesozoic and Precambrian bedrock at northern end (Personius, 1982 #241). Much of the length of the fault is thought to be continuous through deposits of late Quaternary age but scarps are not preserved in many locations (parts shown by dotted line).
Historic earthquake	

Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:* Personius (1982 #241) estimates 100-200 ka as a reasonable time of faulting for the Strong's Ranch scarp. Based on to the morphology of this scarp, an age of less than 150 ka seems reasonable and is used here. However, the age of the Pool Creek scarp might possibly be 20-50 ka (Personius, 1982 #244).
Recurrence interval	15?10 k.y. *Comments:* Mason (1992 #463) indicates this recurrence interval for unspecified period of time based on data of Personius (1982 #241; 1982 #244) and Stickney and Bartholomew (1987 #85).
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Short-term slip rate is higher than the apparent long-term rate. Late to middle Quaternary deposits (100-200 ka) have scarps as high as 35 m high. Displacement since early Pleistocene is possibly 200-300 m based on elevations of displaced glacial till (Personius, 1982 #241). Ruleman and others (2000 #7020) document 12-m-high Holocene fault scarps further suggesting Pleistocene-Holocene slip rates of 0.5-1.0 mm/yr; they do not mention the location of their observation. In addition, Ruleman (2002 #5133) suggests a slip rate of less than 0.53 mm/yr based on the sinuosity of the range front and basal facet heights.
Date and Compiler(s)	2010 Kathleen M. Haller, U.S. Geological Survey
References	#265 Bonini, W.E., Kelley, W.N., Jr., and Hughes, D.W., 1972, Gravity studies of the Crazy Mountains and the west flank of the Beartooth Mountains, Montana, *in* Lynn, J., Balster, C., and Warne, J., eds., Crazy Mountains Basin: Montana Geological Society, 21st Annual Geological Conference, September 22-24, 1972, Guidebook, p. 119-127. #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. #7142 Lopez, D.A., and Reiten, J.C., 2003, Preliminary geologic map of Paradise Valley, south-central Montana: Montana Bureau

of Mines and Geology Open-File Report 480, 22 p., 1 sheet, 1:50,000 scale.

#463 Mason, D.B., 1992, Earthquake magnitude potential of active faults in the Intermountain seismic belt from surface parameter scaling: Salt Lake City, University of Utah, unpublished M.S. thesis, 110 p.

#46 Pardee, J.T., 1950, Late Cenozoic block faulting in western Montana: Geological Society of America Bulletin, v. 61, p. 359-406.

#241 Personius, S.F., 1982, Geologic setting and geomorphic analysis of Quaternary fault scarps along the Deep Creek fault, upper Yellowstone valley, south-central Montana: Bozeman, Montana State University, unpublished M.S. thesis, 77 p., 1 sheet, scale 1:125,000.

#244 Personius, S.F., 1982, Geomorphic analysis of the Deep Creek fault, upper Yellowstone valley, south-central Montana, *in* Reid, S.G., and Foote, D.J., eds., Geology of Yellowstone Park area: Wyoming Geological Association, 33rd Annual Field Conference, Mammoth Hot Springs, Wyoming, September 15-18, 1982, Guidebook, p. 203-212.

#252 Personius, S.F., 1986, Quaternary faulting along the Deep Creek fault upper Yellowstone valley, southwestern Montana, *in* Locke, W.W., ed., Quaternary geomorphic evolution of the Yellowstone region: Rocky Mountain Cell, Friends of the Pleistocene, September 6-8, 1986, Guidebook, p. 3-30.

#539 Pierce, K.L., and Morgan, L.A., 1992, The track of the Yellowstone hot spot—Volcanism, faulting, and uplift, *in* Link, P.K., Kuntz, M.A., and Platt, L.B., eds., Regional geology of eastern Idaho and western Wyoming: Geological Society of America Memoir 179, p. 1-53, 1 pl.

#5133 Ruleman, C.A., III, 2002, Quaternary tectonic activity within the northern arm of the Yellowstone tectonic parabola and associated seismic hazards, southwest Montana: Bozeman, Montana State University, unpublished M.S. thesis, 158 p.

#7020 Ruleman, C., Lageson, D.R., Stickney, M.C., 2000, Paradise Valley seismic gap, Southwest Montana: Geological

Society of America Abstracts with Programs, v. 32, no. 5, p. 37.

#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.

#556 Stickney, M.C., and Bartholomew, M.J., 1992 written commun., Preliminary map of late Quaternary faults in western Montana (digital data): Montana Bureau of Mines and Geology (digital version of MBMG Open-File Report 186), 1 pl., scale 1:500,000.

#630 U.S. Coast and Geodetic Survey, 1959, Preliminary report—Hebgen Lake, Montana earthquakes, August 1959: U.S. Department of Commerce, 15 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.