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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.

Greys River fault (Class A) No. 728

Last Review Date: 1994-03-21

citation for this record: **McCalpin, J.P., compiler, 1994, Fault number 728, Greys River fault, 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	Complex fault scarps in densely-forested terrain at the base of a steep range front. Data from three trenches at one location indicate that similar amounts of slip have characterized the past two faulting events; however, the history of faulting suggests highly variable recurrence intervals during the late Quaternary.
Name comments	Originally mapped but unnamed by Rubey (1973 #822). Name first used by Jones and McCalpin (1992 #813) and informally introduced by McCalpin (1993 #796). Fault extends from about 1 km south of Blind Trail Creek south to the East Fork of the Greys River as shown by Rubey (1973 #822) and Jones (1995 #3910). **Fault ID:** Not shown on any previous compilation.
County(s) and State(s)	LINCOLN COUNTY, WYOMING
Physiographic	

Physiographic province(s)	MIDDLE ROCKY MOUNTAINS
Reliability of location	Good Compiled at 1:250,000 scale. *Comments:* Fault location from 1:62,500-scale mapping of Rubey (1973 #822), supplemented by unpublished 1:24,000-scale mapping that was recompiled at 1:48,000 scale by Jones (1995 #3910). Although Rubey's mapping stopped at 43° N.; the study by Jones (1995 #3910) supports a northern termination of the Quaternary fault at this same latitude. Fault traces were recompiled at 1:250,00 scale on a topographic base map.
Geologic setting	This high-angle down-to-west normal fault bounds the west side of the Wyoming Range. Fault probably soles into the Laramide-age Darby thrust fault. McCalpin (1993 #796) indicated that the throw of the fault may be 300–1000 m based on cross sections of Rubey (1973 #822).
Length (km)	50 km.
Average strike	N3°W
Sense of movement	Normal *Comments:* Normal movement indicated by Rubey (1973 #822).
Dip	10–70° W. *Comments:* According to cross section 1 (fig. 14) of Webel (1987 #815), the fault dips 70° at the surface and joins the Laramide-age Darby thrust at depth of about 2 km, the latter of which flattens progressively to less than 10° at depth of 8.2 km.
Paleoseismology studies	Site 728-1. Jones and McCalpin (1992 #813) excavated three trenches across fault scarps on upper Pleistocene outwash deposits at Sheep Creek, a tributary to the Grey's River. The trenches revealed evidence of one late and one middle Holocene earthquake; their timing is constrained by eight radiocarbon ages. No stratigraphic evidence for earlier earthquakes was present, even though the trenched deposits are thought to be about 15 ka. The most recent faulting event resulted in about 5 m of slip and the earlier event about 4.3 m of slip.

Geomorphic expression	Fault scarps generally are 3- to 11-m high (Jones and McCalpin, 1992 #813); along most of the range front, complex step faults are present in bedrock-cored colluvium.
Age of faulted surficial deposits	Upper Triassic and Jurassic bedrock is in fault contact with Permian-Pennsylvanian or lower Triassic bedrock along most of the length of the fault; locally Triassic bedrock is faulted as mapped by Rubey (1973 #822).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* The most recent event is late Holocene: it is bracketed by radiocarbon ages of 1,910±60 14C yr BP and 2,110±60 14C yr BP (Jones and McCalpin, 1992 #813; McCalpin, 1993 #796).
Recurrence interval	2,970-3,400 14C yr (about 2.0-5.2 ka) *Comments:* Recurrence interval from Jones and McCalpin (1992 #813) based on dated paleoearthquakes at 1,910–2,110 14C yr BP and 5,080 14C yr BP. This short recurrence interval suggests an earthquake cluster (two closely spaced events) that may not be characteristic of the longer late Quaternary history of the fault. However, no displacement occurred between about 5 ka and 15 ka. This 10-k.y. interval of quiescence implies considerable variability in recurrence times (McCalpin, 1993 #796).
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* No rates of coseismic deformation are published, but the most recent displacement of 5 m occurred after an interval of 2970–3400 14C yrs, which suggests moderately high slip rates. This short recurrence interval suggests an earthquake cluster (two closely spaced events) that may not be characteristic of the longer late Quaternary slip rate of the fault. In fact, inferred late Quaternary slip rates are much lower because of the variability in the recurrence intervals. The previous 4.3 m of slip occurred over an interval of more than 10 k.y., which results suggests much lower possible slip rate that are consistent with the assigned slip-rate category. Wong and others (2000 #4484) suggested fault slip rates ranging from 0.04–1.9 mm/yr, each with separate weighting. These reported slip rates are based on data of McCalpin (1992 #813). They place a 60 percent weighting on a rate of 0.7 mm.yr,

	which we consider to be a maximum vertical displacement rate for the late Quaternary. Considering the above discussion and the evidence for an earthquake cluster in the middle Holocene, we categorize the Greys River fault in the 0.2–1.0 mm/yr bracket and recognize that it may have considerably higher rates over short intervals of geologic time (several thousand years). A similar treatment was afforded the nearby Rock Creek fault [729].
Date and Compiler(s)	1994 James P. McCalpin, GEO-HAZ Consulting, Inc.
References	#3910 Jones, L.C.A., 1995, The Quaternary geology of the eastern side of the Greys River Valley and the neotectonics of the Greys River fault in western Wyoming: Logan, Utah State University, unpublished M.S. thesis, 116 p., 7 pls., scale 1:48,000. #813 Jones, L.C.A., and McCalpin, J.P., 1992, Quaternary faulting on the Grey's River fault, a listric normal fault in the overthrust belt of Wyoming: Geological Society of America Abstracts with Programs, v. 24, no. 6, p. 20. #796 McCalpin, J.P., 1993, Neotectonics of the northeastern Basin and Range margin, western USA: Zeitschrift fuer Geomorphologie N. Folge, v. 94, p. 137-157. #822 Rubey, W.W., 1973, Geologic map of the Afton quadrangle and part of the Big Piney quadrangle, Lincoln and Sublette Counties, Wyoming: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-686, 2 sheets, scale 1:62,500. #815 Webel, S., 1987, Significance of backthrusting in the Rocky Mountain thrust belt, *in* Miller, W.R., ed., The thrust belt revisited: Wyoming Geological Association, 38th Annual Field Conference, Jackson Hole, Wyoming, September 8-11, 1987, Guidebook, p. 37-53.