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Quaternary Fault and Fold Database of the United States

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Teton fault, northern section (Class A) No. 768b

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Synopsis	**General:** The Teton fault is a major range-bounding fault along the eastern margin of the Teton Range. Spectacular post-glacial (<15 ka) scarps are present along 60 km of the fault trace and can be seen from the valley floor owing to their large height. Post-glacial offset is as much as 30 m along the middle part of the range, but diminishes to the north and south, mimicking the overall height of the range. Although quite active in the latest Quaternary, the fault has been seismically quiet in historic time. **Sections:** This fault has 6 sections. Three sections have been defined for main range front, but we add a more northerly section and two associated subsidiary faults (herein sections) that are within the range.
Name comments	**General:** Referred to as the Teton fault by Love and Reed (1968 #3796). This fault bounds the eastern margin of the Teton Range and Steamboat Mountain (north of Jackson Lake), and extends from Steamboat Mountain on the north to Phillips Creek on the south. The original location of the fault trace was compiled on and digitized from a 1:62,500-scale base map

	of Grand Teton National Park; the location was refined based on publicly available LiDAR data. Gilbert and others (1983 #1338) and Wong and others (2000 #4484) considered the inferred projection of the Hermitage Point fault to be a possible splay or continuation of the Teton fault, but it is not included herein owing to lack of associated scarps and equivocal evidence that it has been active in Quaternary time (Wong and others, 2000 #4484). **Section:** This part of the fault is commonly referred to as the northern segment or section of the main range-bounding Teton fault; it extends east of Wilcox Point (on Jackson Lake) south to Moran Bay (on Jackson Lake).
County(s) and State(s)	TETON COUNTY, WYOMING
Physiographic province(s)	MIDDLE ROCKY MOUNTAINS
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Originally compiled from 1:24,000-scale map of Ostenaa and others (sheet 1, 1993 #2290) and Smith and others (sheet 1, 1993 #2294). Location of scarps further constrained by LiDAR data (http://opentopo.sdsc.edu/gridsphere/gridsphere?cid=standarddems) and topography at scale of 1:24,000.
Geologic setting	The Teton fault is a major range-bounding fault that forms the eastern margin of the Teton Range. Initial movement on the fault is commonly associated with the arrival of the Yellowstone hotspot in this part of northwestern Wyoming; however, there is no consensus regarding the total amount of offset and age of initiation of faulting. Reported total displacement is 2.5–3.5 km (Byrd and others, 1994 #2263), 6–9 km (Smith and others 1993 #2294), and 10 km (Love, 1977 #3796). Faulting may have begun about 5 to 6 m.y. ago (Pierce and Morgan, 1992 #2297) or during the Miocene (5–13 Ma, Smith and others, 1993 #2294). Gravity models, the about 10° westward tilting of the approximately 2-Ma Huckleberry Ridge Tuff, and the absence of basement-sourced Precambrian clasts in Jackson Hole sediments all suggest that the displacement on the Teton fault was small prior to about 5 Ma and that the majority of the offset has accrued since about 2 Ma (Foster and others, 2010 #7045).
Length (km)	This section is 12 km of a total fault length of 59 km.

Average strike	N18°E (for section) versus N19°E (for whole fault)
Sense of movement	Normal *Comments:* In addition to dip-slip movement, there may be left-lateral (sinistral) offset similar to the middle [768b] and southern [768c] sections, but lateral offset has not been documented for this section.
Dip	>45° E. *Comments:* There is no data to constrain fault dip. However, gravity models suggest a low (ca. 33°) dip (Behrendt and others, 1968 #3798) and kinematic models suggest a 45–70° dip (Byrd and others, 1994 #2263). Recorded earthquakes are too few and too poorly located to clearly define the dip of the fault, but their spatial distribution is consistent with a dip of less than 50° (O'Connell and others, 2003 #7040). The nearly linear strike of the fault trace along topography of the mountain front, however, suggests the fault dip is steep. The inferred low (33°) dip (Behrendt and others, 1968 #3798), from the gravity data maybe imaging older, basin-bounding structure(s) rather than the dip of the late Quaternary seismogenic fault (O'Connell and others, 2003 #7040). Byrd and others (1994 #2263) used kinematic models to suggest the fault dips between 45 and 70°.
Paleoseismology studies	Site 768b-4. Geoarcheological studies of the Snake River delta suggested that an earthquake event caused submergence about 2,000 years ago and a strong shaking event occurred about 4,000 years ago (Pierce and Good, 1992 #2291).
Geomorphic expression	Scarps are present on late Pleistocene (Pinedale) glacial moraines and on Pleistocene (?) and Holocene colluvium.
Age of faulted surficial deposits	Pinedale-age glacial moraines, Pinedale and Holocene colluvium. Holocene deposits of the Snake River delta have been downdropped and shaken (disturbed) by faulting.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Downdropping of the hanging wall on the Teton fault and associated westward tilting toward the fault best explain the sudden submergence event that is recorded about 2,000 years ago.

Recurrence interval	2 k.y. (0–4 ka) *Comments:* Geoarcheological studies of the Snake River delta suggest earthquake events about 2,000 and 4,000 years ago, which indicate a single recurrence interval of about 2,000 years (Pierce and Good, 1992 #2291; Pierce and others, 1998 #2292).
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Poorly constrained rate based late glacial deposits having 11–18 m of fault offset near middle of section at Coulter Canyon (Smith and others, 1993 #2294) and 5.7 m of fault offset near northern end (Ostenaa and others, 1993 #2290). These offsets suggest possible slip rates in the assigned category. However, slip rates do appear to vary considerably depending on the time frame considered. Figure 10 of White and others (2009 #7042) suggests that the slip rate inferred for 14–8 k.y. is an order of magnitude higher than the mid to late Holocene slip rate. Hampel and others (2007 #7043) agree and conclude that approximately 70 percent of the postglacial slip on the Teton fault occurred before 8 ka based on three-dimensional finite-element modeling of melting of the Yellowstone ice cap. In their model, slip rate increased by a factor of 4?7 with respect to the "steady-state rate" and was 2.16 mm/yr along this part of the fault during removal of the ice load (16±14 ka). Other studies define slip rates for seismic hazard modeling. Wong and others (2000 #4484) used fault slip rates ranging from 0.5–4.0 mm/yr, each with separate assigned weights. These reported slip rates are the same for all three main fault sections, are model dependent, and do not represent actual measured values. Seventy percent weight was placed on 1.5–2.2 mm/yr value. O'Connell and others (2003 #7040) indicate that this part of the fault can be characterized by a slip rate of 0.3–0.7 mm/yr.
Date and Compiler(s)	2011 Kenneth L. Pierce, U.S. Geological Survey, Emeritus Kathleen M. Haller, U.S. Geological Survey
References	#3798 Behrendt, J.C., Tibbetts, B.L., Bonini, W.E., and Lavin, P.M., 1968, A geophysical study in Grand Teton National Park and vicinity, Teton County Wyoming: U.S. Geological Survey Professional Paper 516-E, 23 p., 3 pls., scale 1:250,000. #2263 Byrd, J.O.D., Smith, Robert B., and Geissman, John W., 1994, The Teton fault, Wyoming—Topographic signature, neotectonics, and mechanisms of deformation: Journal of Geophysical Research, v. 99, no. B10, p. 20,095–20,122. #1338 Gilbert, J.D., Ostenaa, D., and Wood, C., 1983, Seismotectonic

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