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Teton fault, southern section (Class A) No. 768d

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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 southern segment or section of the main range-bounding Teton fault; it extends from Taggart Lake to Phillips Canyon. This section was defined as the south segment of the Teton fault by Susong and others (1987 #2295).
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 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 20 km of a total fault length of 59 km.
Average strike	N28°E (for section) versus N19°E (for whole fault)

Sense of movement	Normal *Comments:* At Stewart Draw [site 768d-1], 32 m of vertical slip and 26 m of left-lateral slip were reported by Susong and others (1987 #2295) and Smith and others (1993 #2294), which yields a net slip of about 41 m. At this same site, Pierce and Good (field notes, Aug. 5, 1993) measured left-lateral offset of 11 m and 15 m in traverses up-and-down the moraine crest (respectively) and 13-15 m of vertical offset. The average of these values yield a net slip of about 19 m.
Dip	>45 *Comments:* There is no direct 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 constraining 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	Two studies have been conducted along this section. The first at Stewart Draw (site 768-2] documents the amount and sense of lateral slip along the fault. The second site study involves the only trenches excavated in Teton National Park, to date. Trenching at Granite Creek (site 768-1) yielded evidence for a surface-rupturing event just before 7,150?120 yr BP and a postulated second (younger) event that is older than 5 ka (Byrd and Smith, 1990 #191; Smith and others, 1993 #2294; Byrd and others, 1994 #2263).
Geomorphic expression	Scarps are present on late Pleistocene (Pinedale) glacial moraines and on Pleistocene(?) colluvium.
Age of faulted surficial deposits	Pinedale (latest Pleistocene) moraines, and Pinedale and Holocene colluvium and alluvium.
Historic	

earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Multiple events in the Holocene, the most recent of which is older than 5 ka and younger than about 7,150?120 yr BP (Byrd and Smith, 1990 #191; Smith and others, 1993 #2294; Byrd and others, 1994 #2263).
Recurrence interval	2-4 k.y. (<8 ka) *Comments:* The timing of the two most recent surface-faulting events is based on the trenching. The data is reported in a number of subsequent publications as follows: Smith and others, (1993 #2294) and Byrd and others (1994 #2263) report that the timing of the earliest known surface offset to be prior 7,150?120 yr B.P.; they postulate the timing of the younger event to be older than 5 ka, suggesting a possible recurrence of about 2 k.y. or less. O?Connell and others (2003 #7040) indicate the timing of the surface ruptures to be 7,900 and 4,000 years, respectively, and thus, suggesting a recurrence of about 4 k.y.
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* For the four biggest scarps at Granite Creek, Byrd (1995, table 3.1) reports surface offsets that average about 14 m over about 15,000 yr. At the site near the Granite Creek trench, Smith and others (p. 652, 1993 #2294) calculated a slip rate of 1.6 mm/yr for the interval between 7,175 and 14,000 yr ago. 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, the slip rate increased by a factor of 4?7 with respect to the ?steady-state rate? and was 1.37 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 values. O?Connell and others (2003 #7040) indicate that this part of the fault can be characterized by a slip rate of 0.3-1.0 mm/yr.
Date and Compiler(s)	2011 Kenneth L. Pierce, U.S. Geological Survey, Emeritus

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