WYOMING STATE GEOLOGICAL SURVEY
Erin A. Campbell, Director and State Geologist
Laramie, Wyoming
Interpreting the past, providing for the future

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THE TETON FAULT

Teton County, Wyoming

by

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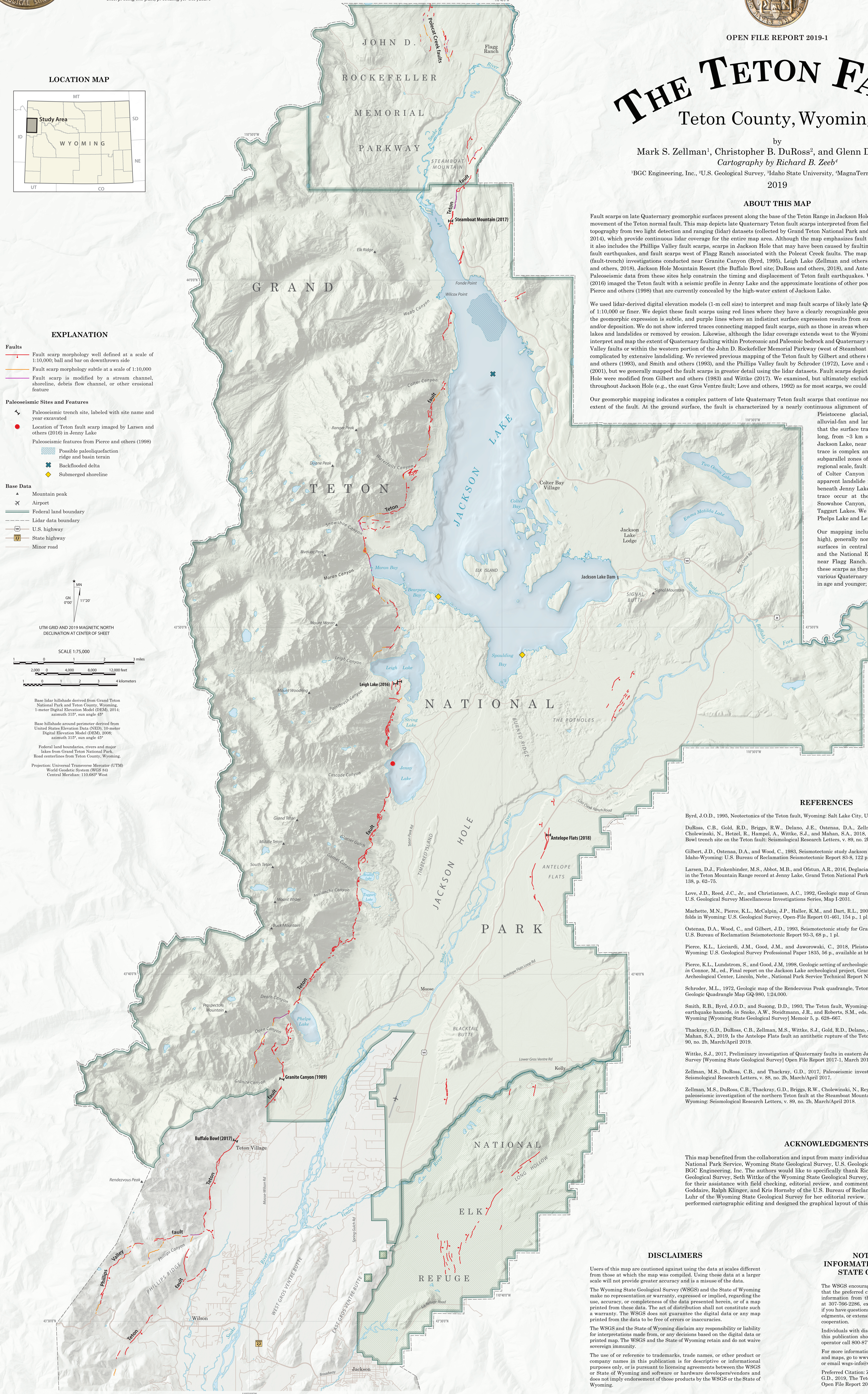
2019

LOCATION MAP



ABOUT THIS MAP

Fault scarps on late Quaternary geomorphic surfaces present along the base of the Teton Range in Jackson Hole, Wyoming, attest to geologically recent movement of the Teton normal fault. This map depicts late Quaternary Teton fault scarps interpreted from field observations (2015–2018) and surface topography from two light detection and ranging (lidar) datasets (collected by Grand Teton National Park and Teton County Conservation District in 2014), which provide continuous lidar coverage for the entire map area. Although the map emphasizes fault scarps associated with the Teton fault, it also includes the Phillips Valley fault scarps, scarps in Jackson Hole that may have been caused by faulting or strong ground shaking from Teton fault earthquakes, and fault scarps west of Flagg Ranch associated with the Polecat Creek faults. The map shows the location of five paleoseismic (fault-trench) investigations conducted near Granite Canyon (Byrd, 1995), Leigh Lake (Zellman and others, 2017), Steamboat Mountain (Zellman and others, 2018), Jackson Hole Mountain Resort (the Buffalo Bowl site; DuRoss and others, 2018), and Antelope Flats (Thackray and others, 2019). Paleoseismic data from these sites help constrain the timing and displacement of Teton fault earthquakes. We also show where Larsen and others (2016) imaged the Teton fault with a seismic profile in Jenny Lake and the approximate locations of other possible paleoseismic features described by Pierce and others (1998) that are currently concealed by the high-water extent of Jackson Lake.

We used lidar-derived digital elevation models (1-m cell size) to interpret and map fault scarps of likely late Quaternary age and discernible at a scale of 1:10,000 or finer. We depict these fault scarps using red lines where they have a clearly recognizable geomorphic expression, orange lines where the geomorphic expression is subtle, and purple lines where an indistinct surface expression results from surface modification from stream erosion and/or deposition. We do not show inferred traces connecting mapped fault scarps, such as those in areas where fault scarps may be concealed beneath lakes and landslides or removed by erosion. Likewise, although the lidar coverage extends west to the Wyoming-Idaho border, we did not attempt to interpret and map the extent of Quaternary faulting within Proterozoic and Paleozoic bedrock and Quaternary sediments west of the Teton and Phillips Valley faults or within the western portion of the John D. Rockefeller Memorial Parkway (west of Steamboat Mountain) where surface topography is complicated by extensive landsliding. We reviewed previous mapping of the Teton fault by Gilbert and others (1983), Love and others (1992), Ostenaa and others (1993), and Smith and others (1993), and the Phillips Valley fault by Schroder (1972), Love and others (1992), and Machette and others (2001), but we generally mapped the fault scarps in greater detail using the lidar datasets. Fault scarps depicted in eastern and southeastern Jackson Hole were modified from Gilbert and others (1983) and Wittke (2017). We examined, but ultimately excluded additional faults previously mapped throughout Jackson Hole (e.g., the east Gros Ventre fault; Love and others, 1992) as for most scarps, we could not rule out a glacial or fluvial origin.

Our geomorphic mapping indicates a complex pattern of late Quaternary Teton fault scarps that continue north and south of the previously mapped extent of the fault. At the ground surface, the fault is characterized by a nearly continuous alignment of fault scarps that vertically offset late Pleistocene glacial, and late Pleistocene to Holocene alluvial-fan and landslide deposits. These scarps indicate that the surface trace of the Teton fault is at least 72 km long, from ~3 km southwest of Wilson to ~6 km north of Jackson Lake, near Steamboat Mountain. Locally, the fault trace is complex and includes fault bends, stepovers, and subparallel zones of synthetic and antithetic faulting. At a regional scale, fault scarps are obscured by a landslide north of Colter Canyon (Ostenaa and others, 1993) and an apparent landslide north of Teton Village, and submerged beneath Jenny Lake and Jackson Lake. Bends in the fault trace occur at the mouths of Waterfalls Canyon and Snowshoe Canyon, Leigh Lake, and between Phelps and Taggart Lakes. We mapped apparent fault stepovers near Phelps Lake and Leigh Lake.

Our mapping includes groups of small (less than ~2 m high), generally north-trending scarps on late Quaternary surfaces in central Jackson Hole, between the Potholes and the National Elk Refuge, and north of Jackson Lake near Flagg Ranch. We interpreted a tectonic origin for these scarps as they continue across and vertically displace various Quaternary geomorphic surfaces (~mid-Pleistocene in age and younger; Pierce and others, 2018). Except for the scarps at the Potholes, the scarps in central Jackson Hole mostly face west, opposite (antithetic to) the Teton fault. Scarps mapped west of Flagg Ranch are likely the southern extent of the Polecat Creek faults, a subset of the Snake River Caldera faults (Ostenaa and others, 1993; Machette and others, 2001) which continue to the north beyond the extent of the lidar coverage. These scarps taper southward and become indistinct in the lidar on the north side of the Snake River.

EXPLANATION

Faults

- Fault scarp morphology well defined at a scale of 1:10,000; ball and bar on downthrown side
- Fault scarp morphology subtle at a scale of 1:10,000
- Fault scarp is modified by a stream channel, shoreline, debris flow channel, or other erosional feature

Paleoseismic Sites and Features

- Paleoseismic trench site, labeled with site name and year excavated
- Location of Teton fault scarp imaged by Larsen and others (2016) in Jenny Lake
- Paleoseismic features from Pierce and others (1998)
  - Possible paleoliquefaction ridge and basin terain
  - Backflooded delta
  - Submerged shoreline

Base Data

- Mountain peak
- Airport
- Federal land boundary
- Lidar data boundary
- U.S. highway
- State highway
- Minor road

GN 0°00'
MN 11°20'

UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:75,000

1 0 1 2 3 miles

2,000 0 4,000 8,000 12,000 feet

1 0 1 2 3 4 kilometers

Base lidar hillshade derived from Grand Teton National Park and Teton County, Wyoming, 1-meter Digital Elevation Model (DEM), 2014; azimuth 315°, sun angle 45°

Base hillshade around perimeter derived from United States Elevation Data (NED), 10-meter Digital Elevation Model (DEM), 2008; azimuth 315°, sun angle 45°

Federal land boundaries, rivers and major lakes from Grand Teton National Park. Road centerlines from Teton County, Wyoming.

Projection: Universal Transverse Mercator (UTM)
World Geodetic System (WGS 84)
Central Meridian: 110.683° West

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