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.

Sawtooth fault (Class A) No. 640

Last Review Date: 2010-09-07

Compiled in cooperation with the Idaho Geological Survey

citation for this record: **Crone, A.J., Haller, K.M., and Lewis, R.S., compilers, 2010, Fault number 640, Sawtooth 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 03:03 PM.**

Synopsis	The Sawtooth fault is a northwest-trending normal fault that separates the Stanley basin to the northeast from the uplifted Sawtooth Mountains to the southwest. The fault is the northeastern boundary fault of a major horst block that spans the Sawtooth Mountains; the Montezuma fault is the southwestern boundary fault of this horst block. Movement on the fault has uplifted and exposed mainly Cretaceous granitic rocks of the Idaho batholith in the Sawtooth Mountains. On the downthrown side of the fault, Tertiary and Quaternary sediments are present in the Stanley basin (Tschanz and others, 1986 #6342). Until a few years ago, evidence of recent fault movement had not been rigorously documented in the geological literature. Tschanz and

	others (1986 #6342) state "The precipitous east front of the Sawtooth Range is indicative of very young movement, as is the offset of surficial deposits in Sawtooth Valley." They do not elaborate on the nature or location of the offset surficial deposits, and for virtually all of its mapped length, they show the fault as being concealed (dotted on the map) beneath Quaternary morainal deposits. Similarly, Worl and others (1991 #6339) show the fault as being concealed for most of its length. The most detailed description of Quaternary movement on the fault is presented by Geomatrix Consultants, Inc. (1989 #6333); the report emphasizes that "the recency of activity on the Sawtooth fault is the topic of much debate." The range front and the adjacent Stanley basin are covered by extensive glacial till and outwash deposits, and large, heavily forested moraines extend across the fault trace at the mouths of major valleys. Geomatrix Consultants, Inc. (1989 #6333) conducted photogeologic and aerial reconnaissance studies of the fault, and reported suggestive but inconclusive evidence of late Quaternary movement. However, recently acquired acquired Light Detection and Ranging (LiDAR) data clearly shows nearly continuous scarps under the forest canopy that further supports earlier inferences based on the sharp, linear, and precipitous character of the mountain front suggestive of Quaternary, probably late Quaternary movement on the fault.
Name comments	Umpleby and Livingston (1920 #6343) first suggested the presence of a fault that controls the western margin of the Stanley basin, but did not name the fault. Reid (1963 #6341) first used the name in a formal publication, but attributed the name to Warren Hamilton (USGS), who used it in a letter to Reid in 1960. Hamilton (1962 #6340) also showed the fault in a sketch map of fault in west-central Idaho, but did not name or specifically comment on the fault in this short paper. Subsequent papers refer to the feature as the Sawtooth fault.
County(s) and State(s)	BLAINE COUNTY, IDAHO CUSTER COUNTY, IDAHO
Physiographic province(s)	NORTHERN ROCKY MOUNTAINS
Reliability of location	Poor Compiled at 1:62,500 scale. *Comments:* A map of the entire fault has not been published to date. Reid (1963 #6341) published a general map of the fault and

	admits that the position of the fault on the map is approximate. Tschanz and others (1986 #6342) mapped parts of the fault at a scale of 1:62,500, but it is located along the western margin of their study area and substantial sections of the fault are not included in their mapping. Worl and others (1991 #6339) show the fault on their 1:250,000-scale map as a concealed fault. However, recent interpretation of LiDAR data suggests the presence of a through going fault (Thackray and others, 2009 #7010). The location of the fault in this compilation will be revised when new mapping is released.
Geologic setting	The Sawtooth fault is a northwest-trending normal fault that separates the Stanley basin to the northeast from the uplifted Sawtooth Mountains to the southwest. The fault is the northeastern boundary fault of a major horst block that spans the Sawtooth Mountains; the Montezuma fault is the southwestern boundary fault of the horst block. Movement on the fault has uplifted and exposed mainly Cretaceous granitic rocks of the Idaho batholith in the Sawtooth Mountains. On the downthrown side of the fault, Tertiary and Quaternary sediments are present in the Stanley basin (Tschanz and others, 1986 #6342). Late Quaternary lateral and terminal moraines in the larger valleys and fluvial terraces are offset by recent faulting (Thackray and others, 2009 #7010).
Length (km)	60 km.
Average strike	N32°W
Sense of movement	Normal *Comments:* The fault is considered to be a normal fault; the downdropped Stanley basin is on the hanging wall.
Dip Direction	NE *Comments:* Tschanz and others (1986 #6342) categorize it as a "high-angle normal fault" but do not indicate a dip angle.
Paleoseismology studies	
Geomorphic expression	The fault forms the prominent, linear and steep northeastern boundary of the Sawtooth Range. Relief on the range front is about 900 m. The Sawtooth Range contained extensive alpine

	glaciers during Quaternary time, and glaciers in the larger valleys beyond the range front, depositing lateral and terminal moraines across the fault trace. Tschanz and others (1986 #6342) state that the fault offsets surficial deposits, but do not report any further details. Geomatrix Consultants, Inc. (1989 #6333) report that "Geomorphic features of possible fault origin were observed during photointerpretation and aerial reconnaissance along the linear contact between bedrock of the Sawtooth Mountain front and the crests of Pinedale lateral moraines." However, more recent studies of the late Pleistocene glacial landforms suggest the approximately 14 ka deposits are offset 4-8 m, and the surfaces of Holocene fluvial deposits are offset 2.5-3 m (Thackray and others, 2009 #7010).
Age of faulted surficial deposits	Late Quaternary and Holocene. Thackray and others (2009 #7010) indicate that Pinedale moraines (generally considered to be about 14 k.y. old) and younger deposits are offset by the fault.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Most recent faulting event is inferred to be Holocene in age (Thackray and others, 2009 #7010), which is substantiated by disturbed layers in sediment cores recovered from the Redfish Lake drainage (Johnson, 2010 #7011). The cores reveal that a reasonably constant sedimentation rate of 0.03 cm/yr occurred during the Holocene. The cores also contain disturbed layers that are interpreted to be seismically generated. The earliest of the two possible earthquakes, evidence for which was observed in two of the four cores in Redfish Lake, occurred slightly before 6460 cal yr BP. The most recent event, which was observed in all four cores, occurred between 4100 and 4250 cal yr BP.
Recurrence interval	*Comments:* Although no explicit recurrence intervals have been reported in the literature, Thackray and others (2009 #7010) indicate that the difference in offset of glacial landforms and the adjacent Holocene fluvial terraces argue for a minimum of two surface faulting events since the latest Pleistocene. This interpretation is further supported by the ages derived from the Redfish Lake cores (Johnson, 2010 #7011).

Slip-rate category	Less than 0.2 mm/yr *Comments:* Offsets reported by Thackray and others (2009 #7010) on Pinedale-age deposits suggest a slip rate that would fall within this assigned category.
Date and Compiler(s)	2010 Anthony J. Crone, U.S. Geological Survey, Emeritus Kathleen M. Haller, U.S. Geological Survey Reed S. Lewis, Idaho Geological Survey
References	#6333 Geomatrix Consultants, Inc., 1989, Final report seismotectonic evaluation for Little Wood River Dam site: Technical report to U.S. Department of Interior, Bureau of Reclamation, Denver, Colorado, 104 p., 2 pls. #6340 Hamilton, W.B., 1962, Late Cenozoic structure of west-central Idaho: Geological Society of America Bulletin, v. 73, p. 511-516. #7011 Johnson, E.M., 2010, Lacrustine evidence of seismic events on the Sawtooth fault in Redfish Lake drainage, Sawtooth Mountains, central Idaho: Pocatello, Idaho State University, unpublished M.S. thesis, 125 p. #6341 Reid, R.R., 1963, Reconnaissance geology of the Sawtooth Range: Idaho Bureau of Mines and Geology Pamphlet 129, 37 p., 2 pls. #7010 Thackray, G.D., Rodgers, D.W., Johnson, E.M., and Shapley, M.D., 2009, Preliminary evaluation of a newly discovered Holocene scarp on the Sawtooth fault, central Idaho: Geological Society of America Abstracts with Programs, v. 41, no. 7, p. 55. #6342 Tschanz, C.M., Kiilsgaard, T.H., and Seeland, D.A., 1986, Geology of the eastern part of the Sawtooth National Recreation Area, Idaho: U.S. Geological Survey Bulletin 1545-A, p. 17-43, 1 pl., scale 1:62,500. #6343 Umpleby, J.B., and Livingston, D.C., 1920, A reconnaissance in south central Idaho embracing the Thunder Mountain, Big Creek, Stanley basin, Sheep Mountain, and Seafoam districts: Idaho Bureau of Mines and Geology Bulletin 3, 23 p.

	#6339 Worl, R.G., Kiilsgard, T.G., Bennett, E.H., Link, P.K., Lewis, R.S., Mitchell, V.E., Johnson, K.M., and Snyder, L.D., 1991, Geologic map of the Hailey 1° x 2° quadrangle, Idaho: U.S. Geological Survey Open-File Report 91-340, 1 sheet, scale 1:250,000.