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.

Hurricane fault zone, Ash Creek section (Class A) No. 998b

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Compiled in cooperation with the Utah Geological Survey

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Synopsis	**General:** The Hurricane fault is a long, generally north-trending fault zone with substantial Quaternary normal displacement near the western margin of the Colorado Plateaus province in Arizona and Utah. The Hurricane Cliffs are a fault-generated steep, curvilinear, west-facing bedrock escarpment several hundred meters high. Displacement decreases southward; there has been 200–400 m of Cenozoic normal displacement across the fault zone along most of its length in Arizona. Near the Utah border, displacement increases to at least 450 m and probably continues to increase into Utah.

	Sections: This fault has 6 sections. The Hurricane fault is divided into sections based on gross geomorphic expression, structural characteristics, and what is known about the recent rupture history of the fault. Although parts of the Hurricane escarpment south of the Colorado River is fairly linear and steep, no definitive evidence of Quaternary activity on this southern section [998f] of the fault has been reported. The Whitmore Canyon section [998e], between the Colorado River and the Mt. Trumbull area, last ruptured in the latest Pleistocene to early Holocene and has had recurrent late Quaternary activity. The escarpment associated with the fault in this section is steep, but is sinuous and erosionally embayed. The Mt. Trumbull area is probably a section boundary, because there is very little topographic relief across the Hurricane fault and Pliocene volcanic rocks have only been displaced a moderate amount. Northward along the Shivwitz section [998d], the curvilinear fault escarpment (the Hurricane Cliffs) increases to several hundred meters in height. Low fault scarps on colluvium, alluvium, and bedrock are common along the base of the Cliffs in this section, and record late Quaternary fault activity. The northern end of the Shivwitz section is defined by a major convex bend in the fault zone, across which total fault displacement increases by at least 50 percent. The Anderson Junction section [998c] begins at this convex bend and continues north into Utah. The fault escarpment is very steep and curvilinear, and scarps along the base of the Cliffs record at least 20 m of late Quaternary displacement. The youngest rupture on this section was probably in the early Holocene, but the northern extent of this rupture is uncertain. The next section to the north, the Ash Creek section [998b] is exhibits more complex fault geometry along the steep base of the Hurricane Cliffs. The northernmost section, Cedar City section [998a] is defined based on the timing of the most recent event. The major section boundaries are at zones of structural complexity.
Name comments	**General:** Early work by Gardner (1941 #2190) refers to the "Hurricane fault." The fault extends from about 2 km east of Cedar City, Utah, to about 5 km west of Peach Springs, Arizona, on U.S. Highway 66. **Section:** Section extends from the near Murie Creek south to about 1 km south of U.S. Highway 89 near Mt. Carmel Junction.
County(s) and State(s)	IRON COUNTY, UTAH WASHINGTON COUNTY, UTAH
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:250,000 scale.

	Comments: Location of fault based on 1:250,000-scale mapping by Anderson and Christenson (1989 #828); also mapped by Averitt (1962 #4439).
Geologic setting	The Hurricane fault zone is one of several long, down-to-the-west, normal faults located in what is effectively a 150-km-wide transition zone between the Colorado Plateaus and Basin and Range. Substantial late Cenozoic displacement on the Grand Wash [1005], Washington [1004], Hurricane, and Sevier/Toroweap [997] faults has resulted in the formation of a series of broad plateaus and escarpments that step down to the west. Along most of its length, the Hurricane fault is marked by a high, steep bedrock escarpment with relatively thin Quaternary deposits along its base. Paleozoic strata have been vertically displaced by hundreds of meters across the Hurricane fault. Pliocene and Quaternary basalt flows have been displaced by substantial amounts, and upper Quaternary alluvium and colluvium have been faulted as well. Stewart and Taylor (1996 #3473) document 450 m of stratigraphic separation in Quaternary basalt displaced by the fault, and a total separation of 2,520 m across a portion of the Hurricane fault near Anderson Junction. Cenozoic displacement is only 200–400 m across the fault zone along most of its length in Arizona. Several swarms of historical seismicity have occurred adjacent to, but cannot be correlated directly with, the north end of the Hurricane fault. The earliest of these swarms (1942) included two approximately magnitude 5 earthquakes (Arabasz and Smith, 1979 #4438; Richins and others, 1981 #4443). The 1992 M5.8 St. George earthquake was likely on the Hurricane fault (Pechmann and others, 1995 #4442).
Length (km)	This section is 32 km of a total fault length of 238 km.
Average strike	N22°E (for section) versus N11°E,N39°E,N39°E,N39°E (for whole fault)
Sense of movement	Normal
Dip	52–66° W. *Comments:* Fault contact between alluvium and bedrock (66° W.) and within bedrock (52° W.) (Stenner and others, 1999 #4444).
Paleoseismology studies	
Geomorphic	The trace of the Ash Creek section follows a northeast-trending zone of

expression	Sevier-age folds and thrust faults to from north of Toquerville near Anderson Junction to Murie Creek, displacing deformed Paleozoic and Mesozoic rocks, and undeformed Cenozoic sedimentary rocks and Quaternary basalt down to the west. At several locations, the steep range front is formed in relatively nonresistant rocks, and in areas of resistant rocks, sharp knickpoints coincide with the base of the cliffs (Anderson and Christenson, 1989 #828). Small alluvial fans adjacent to the cliffs are probably Holocene in age and appear to be unfaulted. West of the south end of the section and southwest of Pintura, fault scarps as high as 15 m cross dissected Pine Valley Mountain fan surfaces and appear to represent recurrent late Pleistocene (?) antithetic faulting that is mechanically linked to the Hurricane fault. A 3-m-high scarp on latest Pleistocene or early Holocene alluvial-fan deposits is just south of Murie Creek at the Coyote Gulch site (Stenner and others, 1999 #4444). Just north of the scarp at Coyote Gulch, a second scarp is on colluvium at the base of the Hurricane Cliffs. This scarp is more than 10 m high and has a pronounced bevel, indicating multiple surface-faulting events (Stenner and others, 1999 #4444). Quaternary basalt flows are displaced more than 360 meters across the fault at the south end of Black Ridge and over 400 meters at the north end of the ridge near Deadmans Hollow.
Age of faulted surficial deposits	Holocene (?)
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Faulted alluvial-fan deposits at Coyote Gulch contain charcoal that yielded a radiocarbon age estimate that constrains timing of the most recent event to sometime after 1,260 yr ago (Lund and others, 2001 #4611).
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* Due to a lack of recurrence-interval information, geologic vertical deformation rate estimates are reported here, which incorporate the elapsed time since the youngest event and/or the time difference between the age of a surface and the timing of the earliest event on that surface. Displaced basalt flows were geochemically correlated across the

	fault at North Black Ridge and at the Ash Creek/Anderson Junction section boundary at South Black Ridge; these flows were ^{40}Ar-^{39}Ar-dated at 0.86 Ma and 0.81 Ma, respectively, indicating a long-term displacement rate of 0.45–0.55 mm/year (Lund and others, 2001 #4611). Amoroso and others (2000 #6890) indicate that a slip rate of 0.39 mm/yr over the past 800 yr characterizes displacement of the Black Ridge basalt.
Date and Compiler(s)	2004 Bill D. Black, Utah Geological Survey Christopher B. DuRoss, Utah Geological Survey Michael D. Hylland, Utah Geological Survey Greg N. McDonald, Utah Geological Survey Suzanne Hecker, U.S. Geological Survey
References	#6890 Amoroso, L., Pearthree, P.A., Lund, W.R., Arrowsmith, J.R., and Stenner, H.D., 2000, Quaternary history, slip rate, and rupture characteristics of the Hurricane fault, northwestern Arizona and southwestern Utah: Geological Society of America Abstracts with Program, v. 32, no. 7, p. 507. #828 Anderson, R.E., and Christenson, G.E., 1989, Quaternary faults, folds, and selected volcanic features in the Cedar City 1° x 2° quadrangle, Utah: Utah Geological and Mineral Survey Miscellaneous Publication 89-6, 29 p., 1 pl., scale 1:250,000. #4438 Arabasz, W.J., and Smith, R.B., 1979, The November 1971 earthquake swarm near Cedar City, Utah, *in* Arabasz, W.J., Smith, R.B., and Richins, W.D., eds., Earthquake studies in Utah, University of Utah Seismograph Stations: University of Utah, Department of Geology and Geophysics, p. 423-432. #4439 Averitt, P., 1962, Geology and coal resources of the Cedar Mountain quadrangle, Iron County, Utah: U.S. Geological Survey Professional Paper 389, 71 p., 3 pls., scale 1:24,000. #2190 Gardner, L.S., 1941, The Hurricane fault in southwestern Utah and northwestern Arizona: American Journal of Science, v. 239, no. 4, p. 241-260. #642 Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p., 6 pls., scale 1:500,000. #6733 Lund, W.R., 2005, Consensus preferred recurrence interval and vertical slip rate estimates—Review of Utah paleoseismic-trenching data

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