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Quaternary Fault and Fold Database of the United States

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Hurricane fault zone, Cedar City section (Class A) No. 998a

Last Review Date: 2004-06-01

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:** Lund and others (2001 #4611) proposed a new section (Cedar City section) along the northern part of the fault. The basis for this was evidence of differences in the timing of surface faulting at two sites along the fault. The boundary between the Cedar City and Ash Creek sections is likely at a pronounced right bend in the fault at Murie Creek just north of Coyote Gulch (Lund and others, 2001 #4611). The boundary between the Ash Creek and Anderson Junction sections is north of Toquerville, where the fault intersects a zone of Sevier-age folds and thrust faults and bends to the northeast (Stewart and Taylor, 1996 #3473).

County(s) and State(s)	IRON COUNTY, UTAH WASHINGTON COUNTY, UTAH
Physiographic province(s)	BASIN AND RANGE COLORADO PLATEAUS
Reliability of location	Good Compiled at 1:250,000 scale. *Comments:* Location of fault based on mapping from Anderson and Christenson (1989 #828). Also mapped or discussed by Averitt (1962 #4439) and Lund and others (2001 #4611).
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 45 km of a total fault length of 238 km.
Average strike	N39°E (for section) versus N11°E,N39°E,N39°E,N39°E (for whole fault)
Sense of movement	Normal
Dip Direction	NW
Paleoseismology	Trenching was attempted across the scarp at Shurtz Creek, but large

studies	boulders prevented exposure of the fault zone (Lund and others, 2001 #4611).
Geomorphic expression	The trace of the Cedar City section follows a northeast-trending zone of Sevier-age folds and thrust faults from a pronounced right bend in the fault trace near Murie Creek to Cedar City. The fault displaces deformed Paleozoic and Mesozoic rocks, and undeformed Cenozoic sedimentary rocks and Quaternary basalt down to the west. Small alluvial fans adjacent to the cliffs are probably Holocene in age and appear to be unfaulted. North of the Middleton site (north of Shurtz Creek) and extending to near Cedar City, the fault is buried by a series of late Pleistocene landslide deposits. The landslide deposits do not appear to be faulted.
Age of faulted surficial deposits	Holocene (?)
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Timing of the most recent event on a range-front fault strand at Shurtz Creek, on a 13-m-high fault scarp first described by Averitt (1962 #4439) in coarse bouldery alluvium, is not known, but is likely latest Pleistocene in age. Timing of the most recent event on scarps in older Pleistocene deposits at the Bauer site south of Shurtz Creek and the Middleton site north of Shurtz Creek is also unknown. Unfaulted alluvial-fan deposits at the Middleton site contain charcoal that yielded radiocarbon age estimates that constrain timing of the most recent event to sometime prior to 1,530 yr ago; how much prior is uncertain. However, the absence of young fault scarps suggests a considerable period of time since the last surface-faulting earthquake (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 displacement 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. A minimum displacement rate of 0.11–0.21 mm/yr is based on

	10.5 m of vertical displacement across an alluvial-fan surface estimated between 100 (Stenner and others, 1999 #4444) and 50 ka (Lund and others, 2001 #4611) at Shurtz Creek. A basalt flow high on the north wall of Cedar Canyon has been ^{40}Ar-^{39}Ar dated at 0.63 Ma; the calculated rate of stream incision of Coal Creek at the bottom of the canyon provides a proxy for long-term slip on the Cedar City section of 0.53 mm/yr (Lund and others, 2001 #4611). The assigned slip-rate category is based on the late Quaternary rate of Stenner and others (1999 #4444).
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
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