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# 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.**

## Needles fault zone (Class B) No. 2507

**Last Review Date: 2004-07-01**

## Compiled in cooperation with the Utah Geological Survey

***citation for this record:*** **Black, B.D., DuRoss, C.B., and Hecker, S., compilers, 2004, Fault number 2507, Needles fault zone, 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 02:55 PM.**

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| **Synopsis** | Poorly understood diffuse zone of suspected Holocene faulting along the Colorado River, which may have formed from gravity tectonics and salt flowage. Because of their possible non-seismogenic origin, we considered these features to be Class B structures. |
| **Name comments** | **Fault ID:** Refers to fault number 18-11 in Hecker (1993 #642). |
| **County(s) and State(s)** | GARFIELD COUNTY, UTAH<br>SAN JUAN COUNTY, UTAH<br>WAYNE COUNTY, UTAH |

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| **Physiographic province(s)** | COLORADO PLATEAUS |
| **Reliability of location** | Poor<br>Compiled at 1:340,000 scale.<br><br>*Comments:* Mapped or discussed by Baker (1933 #4973), McGill and Stromquist (1974 #5000), Stromquist (1976 #5011), Hite (1982 #4992), Huntoon (1982 #586; 1988 #4994), Woodward-Clyde Consultants (1982 #5025), Biggar (1987 #4975), and Oviatt (1988 #5006). Fault traces from 1:340,000-scale geologic mapping of Woodward-Clyde Consultants (1982 #5025). |
| **Geologic setting** | The Needles fault zone consists of a diffuse zone of east- to northeast-oriented normal faults along Cataract Canyon, in and adjacent to Canyonlands National Park, in the Paradox Basin of eastern Utah. Extensional faulting may have initiated by a combination of (1) gravitational slip of sedimentary strata on evaporite deposits (Huntoon, 1982 #586, 1988 #4994; Crider and others, 2002 #6759), (2) mobilization and down-dip flowage of evaporites toward the Colorado River (Baker, 1933 #4973, McGill and Stromquist, 1974 #5000; Stromquist, 1976 #5011), and/or (3) salt dissolution and collapse (Hite, 1982 #4992). The gravitational-slip model may explain the formation of the anticlines resulting from compression across the floors of Cataract Canyon and its deep tributary canyons (Huntoon, 1982 #586, 1988 #4994). Extension may have begun in the late Cenozoic, and is considered active today (Huntoon, 1988 #4994; Crider and others, 2002 #6759). |
| **Length (km)** | 32 km. |
| **Average strike** | N10°E |
| **Sense of movement** | Normal |
| **Dip Direction** | Unknown<br><br>*Comments:* Varies. |
| **Paleoseismology studies** | |
| **Geomorphic expression** | The faults bound grabens of varying ages. Youthfulness of faulting is suggested by good preservation of an abandoned, pre- |

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| | graben drainage network and persistence of grabens as closed depressions. Sinkholes, some which may be historical, in many closed graben valleys may have formed by opening of bedrock fissures or, alternatively, by periodic flushing of material from old fissures. Stream braiding and aggradation within the grabens also suggest recent (Holocene?) subsidence. Changes in drainage patterns from north to south and the relatively simple, linear pattern of grabens at the eastern margin of the area suggest graben formation has progressed northward and eastward, away from the river. The oldest grabens (closest to the river) are inferred to have begun forming between about 1.4 Ma (based on a conservatively high estimate of canyon incision) and 85 ka (extrapolated from a 65 ka age for shallow graben sediments located a quarter of the distance from the river to the eastern margin of the graben system). Thus, some grabens may have formed as early as during early Pleistocene time. The long-term rate of extension across the fault zone is estimated at 2-20 mm/yr, based on geodetic and satellite radar interferometry (InSAR) monitoring of the deformation (Crider and others, 2002 #6759). |
| **Age of faulted surficial deposits** | Holocene(?). |
| **Historic earthquake** | |
| **Most recent prehistoric deformation** | latest Quaternary (<15 ka)<br><br>*Comments:* Based on drainage disruption, 14C and TL ages, and soil development. |
| **Recurrence interval** | |
| **Slip-rate category** | Less than 0.2 mm/yr<br><br>*Comments:* Development of extensional grabens from west to east has apparently occurred at accelerated rates of 5-14 mm/yr associated with downcutting episodes on the Colorado River, and the process may be ongoing. However, any slip rate associated with deep tectonic processes is probably <0.2 mm/yr. |
| **Date and Compiler(s)** | 2004<br>Bill D. Black, Utah Geological Survey<br>Christopher B. DuRoss, Utah Geological Survey |

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| | Suzanne Hecker, U.S. Geological Survey |
| **References** | #4973 Baker, A.A., 1933, Geology and oil possibilities of the Moab District, Grand and San Juan Counties, Utah: U.S. Geological Survey Bulletin 841, 95 p.<br><br>#6759 Crider, J.G., Owen, S.E., and Marsic, S.D., 2002, Monitoring active deformation in the grabens of Canyonlands National Park: Online, Geological Society of America Abstracts with Programs, , accessed November 3, 2004.<br><br>#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.<br><br>#4992 Hite, R.J., 1982, Task 1B—Geology, technical progress report for the quarter 1 July-30 September, 1982: Unpublished consultant's report for Battelle Memorial Institute, Office of Nuclear Waste Isolation, ONWI-9.<br><br>#4994 Huntoon, P., 1988, Late Cenozoic gravity tectonic deformation related to the Paradox salts in the Canyonlands area of Utah, *in* Doelling, H.H., Oviatt, C.G., and Huntoon, P.W., eds., Salt deformation in the Paradox region: Utah Geological and Mineral Survey Bulletin 122, p. 79-93.<br><br>#586 Huntoon, P.W., 1982, The Meander anticline, Canyonlands, Utah—An unloading structure resulting from horizontal gliding on salt: Geological Society of America Bulletin, v. 93, p. 941-950.<br><br>#5000 McGill, G.E., and Stromquist, A.W., 1974, A model for graben formation by subsurface flow; Canyonlands National Park, Utah: Amherst, University of Massachusetts, Department of Geology and Geography Contribution No. 15, p. 79.<br><br>#5011 Stromquist, A.W., Jr., 1976, Geometry and growth of grabens, lower Red Lake Canyon area, Canyonlands National Park, Utah: University of Massachusetts Department of Geology and Geography Contribution 28, p. 118. |

Questions or comments?

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