# 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.**

## South Granite Mountains fault system, Crooks Mountain section (Class A) No. 779a

**Last Review Date: 1999-05-17**

***citation for this record:*** **Machette, M.N., compiler, 1999, Fault number 779a, South Granite Mountains fault system, Crooks Mountain section, 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 03:16 PM.**

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| **Synopsis** | **General:** This 125-km-long, west-northwest trending, north-dipping fault system is located along the north margin of a low chain of anomalous west-northwest-trending mountain ranges within the Wyoming Basin province of central Wyoming. Two episodes of movement have been documented on the fault system. The first was near the end of the Eocene when the Granite Mountains (to the north) were uplifted at least 3 km, and during the Pliocene to Quaternary when the fault system was reactivated in the opposite sense (down-to-the-north) resulting in subsidence of the previously uplifted Precambrian-cored Sweetwater Arch. Part of this subsidence was accommodated by the Split Rock syncline [778], which lies north of the South Granite Mountains fault system. There has been a thorough reconnaissance of the fault system and detailed paleoseismic investigations at two locations along its middle portion. This study revealed clear |

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| | evidence for Quaternary deformation on the three central faults (sections) of the system, but Quaternary deformation has not been proven for the distal sections (Class B structures). Pleistocene to Holocene displacement was found in the Green Mountain and Ferris Mountains areas, and minor Quaternary displacement was found in the Muddy Gap area. However, all five sections are considered to be of potential Quaternary age because of the prevalence of lineaments, springs, alignment of vegetation and fault scarps. Trenching has shown that a displacement of about 0.5 m (net vertical) is typical of the average surface-rupturing event on the Ferris Mountains section of the fault system. In addition, using reported average to maximum displacement ratios for historic faulting events, they proposed that the active (late Quaternary) sections of the South Granite Mountains fault system might have a maximum surface faulting event of 1–1.5 m displacement.<br><br>**Sections:** This fault has 5 sections. Geomatrix Consultants (1988 #2980) defined five segments (herein considered as sections) for the South Granite Mountains fault system. From west to east, these are the Crooks Mountain [779a], Green Mountains [779b], Muddy Gap [779c], Ferris Mountains [779d] and Seminoe Mountains [779e] sections. Quaternary movement (Class A structures) has been documented in the Green Mountain area, along the Ferris Mountains, and in the Muddy Gap area. As such, only these three sections are described in detail; the Crooks Mountain (779a) and Seminoe Mountains [779e] sections are considered to be of Class B (potential Quaternary) structures, pending further investigations. |
| **Name comments** | **General:** Named for its location south of the Granite Mountains. However, the fault is in fact much closer to the mountain chain formed by the Green, Ferris, and Seminoe Mountains, which it borders on their north sides. The fault system is defined by Geomatrix Consultants (1988 #2980) as having five sections; the western end of the system is near Alkali Creek on the western end of the Crook Mountains and the eastern end is at Saylor Creek, north of Horseshoe Ridge at the eastern end of the Seminoe Mountains.<br><br>**Section:** Named for Crooks Mountain. All but the western 7 km of this section is along the northern side of Crooks Mountain. Geomatrix Consultants (1988 #2980) defined the eastern end of this north-northwest trending fault section as at the break between the Green Mountains and Crooks Mountain structural blocks. The |

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| | western end of the section is slightly east of the Sweetwater River. As such, Geomatrix Consultants (1988 #2980) reported the section to be 34 km long.<br><br>**Fault ID:** Referred to as normal fault 3 on figure 2-1 of Geomatrix Consultants (1988 #2973) and fault 242 of Witkind (1975 #819). |
| **County(s) and State(s)** | FREMONT COUNTY, WYOMING |
| **Physiographic province(s)** | WYOMING BASIN |
| **Reliability of location** | Poor<br>Compiled at 1:250,000 scale.<br><br>*Comments:* Trace based on map of entire fault system (fig. 3-1) at about 1:330,000 scale Geomatrix Consultants (1988 #2980). This trace is a generalization from Love and others (1979 #3470) and Love and Christiansen (1985 #2287). Trace transferred from 1:330,000-scale map of Geomatrix Consultants (1988 #2980) to 1:250,000-scale map with topographic-base, Geomatrix Consultants (1988 #2980) also showed the fault and older structures at 1:250,000 scale map (plate 2) with topographic-base. The fault is shown in a generalized fashion at 1:500,000 scale by Witkind (1975 #819) and Geomatrix Consultants (1988 #2980), and at 1:1,000,000 scale by Case and others (1997 #3449). |
| **Geologic setting** | The South Granite Mountains fault system trends west-northwest along the northern flanks a chain of low mountain ranges comprised of Crooks Mountain (on the west), the Green Mountains, Ferris Mountains, and Seminoe Mountains (on the east). The fault system forms the southern margin of the Sweetwater Arch, a west-northwest-trending asymmetric Laramide-age anticline consisting of a steeply dipping southern limb and a gently dipping northern limb (Love, 1970 #3445). The central to western portion of the arch is comprised of Precambrian granitic knobs that protrude above Miocene to Pliocene sediment. The southern limb is comprised of the South Granite Mountains. After being buried by conglomerate in the Eocene, the arch started to subside via structural downwarping along the Split Mountain syncline and by normal displacement along the North and South Granite Mountain fault systems. Subsidence continued into the Pliocene, but Quaternary movement has only been |

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| | documented on portions of the South Granite Mountains fault system. The system's east-west orientation and normal sense of movement are consistent with the north-south extensional stress regime proposed for the Wyoming foreland by Zoback and Zoback (1980 #176)(1980). |
| **Length (km)** | This section is 34 km of a total fault length of 133 km. |
| **Average strike** | N73°W (for section) versus N72°W (for whole fault) |
| **Sense of movement** | Normal<br><br>*Comments:* Down to the north in Pliocene to Quaternary time; in Eocene, movement was in opposite (down-to-the-south) sense (Love, 1970 #3445). Love (1970 #3445) suggested a minimum post-Miocene displacement of 650 m for the fault system. |
| **Dip Direction** | N<br><br>*Comments:* Appears to dip steeply (Love, 1970 #3445). |
| **Paleoseismology studies** | |
| **Geomorphic expression** | There is no evidence for deformation of late Quaternary alluvial-fan or terrace deposits along this fault section. However, a few lineaments defined by breaks in slope and vegetation lines were identified along all but the western 7 km of the fault section during photogeologic studies by Geomatrix Consultants (1988 #2980). They investigated these features in the field and found them to be associated with bedrock faulting. Thus, we cannot preclude or prove Quaternary displacement along this section of the fault. This section is considered to be a Class B feature, pending further study. |
| **Age of faulted surficial deposits** | Their are no reports about the age of faulted Quaternary deposits. |
| **Historic earthquake** | |
| **Most recent prehistoric deformation** | undifferentiated Quaternary (<1.6 Ma)<br><br>*Comments:* No evidence for late Quaternary deformation (Geomatrix Consultants, 1988 #2980), but Quaternary faulting |

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| | may be present as evidenced by fault-related lineaments along most of the fault section. This section is considered to be a Class B feature, pending further study. |
| **Recurrence interval** | |
| **Slip-rate category** | Less than 0.2 mm/yr<br><br>*Comments:* Low slip-rate category is inferred by compiler on basis of a lack of late Quaternary faulting of alluvial fan or terrace deposits along the section. |
| **Date and Compiler(s)** | 1999<br>Michael N. Machette, U.S. Geological Survey, Retired |
| **References** | #3449 Case, J.C., Larsen, L.L., Boyd, C.S., and Cannia, J.C., 1997, Earthquake epicenters and suspected active faults with surficial expression in Wyoming: Geological Survey of Wyoming Preliminary Hazards Report 97-1, 1 sheet, scale 1:1,000,000.<br><br>#2973 Geomatrix Consultants, Inc., 1988, Northwestern Wind River Basin seismotectonic evaluation: Technical report to U.S. Department of Interior, Bureau of Reclamation, Denver, under Contract 6-CS-81-07310, 116 p., 3 pls.<br><br>#2980 Geomatrix Consultants, Inc., 1988, Wyoming Basin geomorphic province seismotectonic evaluation: Technical report to U.S. Department of Interior, Bureau of Reclamation, Denver, under Contract 6-CS-81-07310, 167 p., 2 pls.<br><br>#3445 Love, J.D., 1970, Cenozoic geology of the Granite Mountain area, central Wyoming: U.S. Geological Survey Professional Paper 495-C, 154 p., 10 pls.<br><br>#2287 Love, J.D., and Christiansen, A.C., 1985, Geologic map of Wyoming: State Geologic Map, 3 sheets, scale 1:500,000.<br><br>#3470 Love, J.D., Christiansen, A.C., Earle, J.L., and Jones, R.W., 1979, Preliminary geologic map of the Casper 1° x 2° quadrangle central Wyoming: U.S. Geological Survey Open-File Report 79-961, 13 p., 1 pl., scale 1:250,000.<br><br>#819 Witkind, I.J., 1975, Preliminary map showing known and suspected active faults in Wyoming: U.S. Geological Survey |

Open-File Report 75-279, 35 p. pamphlet, 1 sheet, scale 1:500,000.

#176 Zoback, M.L., and Zoback, M., 1980, State of stress in the conterminous United States: Journal of Geophysical Research, v. 85, no. B11, p. 6113-6156.