# 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.**

## Panamint Valley fault zone, northern Panamint Valley section (Class A) No. 67a

**Last Review Date: 2000-05-16**

## Compiled in cooperation with the California Geological Survey

***citation for this record:*** **Bryant, W.A., compiler, 2000, Fault number 67a, Panamint Valley fault zone, northern Panamint Valley 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 02:04 PM.**

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| **Synopsis** | **General:** Major Holocene active oblique-slip range-front fault zone characterized by both Holocene normal dip-slip and dextral strike-slip offset (Smith, 1976 #1646; Bryant, 1989 #1459; Zhang and others, 1990 #199). Panamint Valley fault zone is divided into sections in this compilation, from north to south: Northern Panamint Valley [67a], Wildrose [76b], Southern Panamint Valley [67c], and Brown Mountain [67d]. The fault zone extends from the complex left compressional step over to the Hunter Mountain-Saline Valley fault zone [66] southeast along the eastern side of Panamint Valley and complexly intersects with the Garlock fault |

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| | zone [69] along the Brown Mountain fault. Reheis (1991 #1602) suggested that the southern end of the Hunter Mountain fault zone extended into northern Panamint Valley and ends just north of Wildrose graben. Smith (1976 #1646) and Zellmer (1980 #1705) considered the junction between the Hunter Mountain [67] and Panamint Valley faults to be at the northern end of Panamint Valley south of Hunter Mountain. In this compilation the northern end of the Panamint Valley fault zone is considered to be delineated by the shallow northeast-dipping thrust fault along the south side of Hunter Mountain mapped by Smith (1976 #1646). The Panamint Valley fault zone is delineated by well-defined geomorphic features indicative of Holocene dextral and normal faulting (Smith, 1979 #1647; Bryant, 1989 #1459; Zhang and others, 1990 #199). Burchfiel and others (1987 #1454) reported a long term slip rate of 2-3.2 mm/yr for the Hunter Mountain-Saline Valley fault zone, based on dextral displacement of Hunter Mountain batholith contact. Zhang and others (1990 #199) reported latest Pleistocene to Holocene minimum dextral slip rates of 1.74?0.65 mm/yr and 2.36?0.79 mm/yr for the Panamint Valley fault zone (Southern Panamint Valley section [67c]), although ages of offset deposits are not well-constrained. Zhang and others (1990 #199) reported that large surface-rupturing earthquakes may occur as characteristic 3-m events, based on their observations of dextrally offset stream channels in multiples of 3 m. Zhang and others (1990 #199) concluded that the average recurrence interval for large surface-rupturing earthquakes on the Southern Panamint Valley section [67c] is between 860 yr and 2,360 yr, based on an assumed 3.2?0.5-m characteristic event and a Holocene slip rate of 2.36?0.79 mm/yr.<br><br>**Sections:** This fault has 4 sections. There is insufficient evidence to delineate seismogenic segments. The sections defined in this compilation are based on geomorphic expression, style of faulting, and geometry. From north to south the sections are: Northern Panamint Valley [67a], Wildrose [67b], Southern Panamint Valley [67c], and Brown Mountain [67d]. |
| **Name comments** | **General:** Panamint Valley fault zone was first described and named by Noble (1926 #1592), who considered the fault to be a normal dip-slip range-front fault. The Brown Mountain fault was first mapped and named by Muehlberger (1954 #6065).<br><br>**Section:** Section name proposed in this compilation. Section extends from complex connection with the Hunter Mountain-Saline Valley fault zone [66] southeast to the prominent change in |

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| | strike (from northwest to north-northwest) about 3 km northwest of Wildrose Canyon. Reheis (1991 #1602) proposed that the Hunter Mountain-Saline Valley fault zone [66] extended into northern Panamint Valley and terminated just north of the Wildrose graben.<br><br>**Fault ID:** Refers to numbers 247 (Panamint Valley fault) and 269 (Brown Mountain fault) of Jennings (1994 #2878). |
| **County(s) and State(s)** | INYO COUNTY, CALIFORNIA |
| **Physiographic province(s)** | BASIN AND RANGE |
| **Reliability of location** | Good<br>Compiled at 1:100,000 scale.<br><br>*Comments:* Locations based on digital revisions to Jennings (1994 #2878) using original mapping by Hall (1971 #1521), Moyle (1969 #6514), and Bryant (1989 #1459) at 1:62,500; aerial photographic interpretation by Reheis (1991 #1602) at 1:100,000. Mapping of selected fault strands by Smith (1976 #1646) is at various scales to 1:24,000. |
| **Geologic setting** | Major oblique-slip fault characterized by both dextral strike-slip and normal dip-slip faults. Panamint Valley fault zone is located within the Death Valley extension region, the most active part of the southern Basin and Range province (Zhang and others, 1990 #199). The Panamint Valley fault zone is a Holocene active range-front fault that extends from the northern Panamint Valley southeast to the Garlock fault zone [69]. Dextral slip is probably transferred northward to the Hunter Mountain-Saline Valley fault zone [66] along a complex compressional left step at the northern end of Panamint Valley indicated by north-dipping Quaternary thrust faults (Smith, 1975 #1219; Smith, 1976 #1646). Reheis (1991 #1602) suggested that the southern end of the Hunter Mountain fault zone [66] extended into northern Panamint Valley and ended just north of Wildrose graben. Smith (1976 #1646) and Zellmer (1980 #1705) considered the junction between the Hunter Mountain [66] and Panamint Valley faults to be at the northern end of Panamint Valley south of Hunter Mountain. In this compilation, the northern end of the Panamint Valley fault zone is considered to be delineated by the shallow northeast-dipping thrust fault along the south side of Hunter Mountain mapped by |

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| | Smith (1976 #1646). To the southeast, the Panamint Valley fault zone complexly joins the sinistral strike-slip Garlock fault zone [69] along the dextral Brown Mountain fault [67d]. Late Quaternary and Holocene displacement is characterized by both normal dip-slip and dextral strike-slip displacement. Dip-slip faults commonly occur along the range front and dextral strike-slip faults occur west of the range front. Johnson (1957 #6513) estimated that cumulative down-to-west vertical displacement may total as much as 1,800 m. Smith (1979 #1647) reported that 300-600 m of Quaternary dextral offset and as much as 3-4.5 km of cumulative dextral strike-slip displacement characterize the Panamint Valley fault zone. Normal dip-slip displacement may total as much as 10 km (Smith, 1976 #1646). Burchfiel and others (1987 #1454) reported that cumulative dextral strike-slip displacement may total as much as 8-10 km since late Miocene time. |
| **Length (km)** | This section is 27 km of a total fault length of 104 km. |
| **Average strike** | N36°W (for section) versus N22°W,N36°W (for whole fault) |
| **Sense of movement** | Right lateral, Normal, Reverse<br><br>*Comments:* Recently active traces of the Northern Panamint Valley section are characterized by predominantly dextral strike-slip displacement, based on geomorphic expression and dextral displacement of Quaternary deposits (Smith, 1976 #1646; Bryant, 1989 #1459). Older Quaternary active range-front normal faults roughly parallel the Holocene active dextral faults (Smith, 1976 #1646; Bryant, 1989 #1459). The northern extend of the Northern Panamint Valley fault zone may complexly join with the Hunter Mountain-Saline Valley fault zone [66] along a compressional left-step-over along more west-trending faults (Smith, 1976 #1646; Burchfiel and others, 1987 #1454). The southern end of the Northern Panamint Valley section changes to a more northerly strike and is characterized by dextral strike-slip with a significant normal dip-slip (down to west) component (Smith, 1976 #1646; Bryant, 1989 #1459). |
| **Dip** | near vertical to 70° NE.<br><br>*Comments:* Bryant (1989 #1459) observed a near vertically dipping fault zone exposed in a stream channel margin in a Holocene alluvial fan. Just south of Towne Pass Road a stream-cut exposure revealed a 15-m-wide fault zone in Plio-Pleistocene |

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| | (?) lacustrine clay with fault planes dipping from about 70? NE. to vertical. The significant normal component at the southern end of the Northern Panamint Valley section delineates a major range-front fault with down-to-the west normal displacement (Smith, 1976 #1646; Bryant, 1989 #1459). |
| **Paleoseismology studies** | |
| **Geomorphic expression** | Northern Panamint Valley section is delineated by moderately to well-defined geomorphic features indicative of Holocene dextral strike-slip faulting such as dextrally deflected drainages, beheaded drainages, linear ridges, ponded alluvium, linear scarps in latest Pleistocene and Holocene alluvium, linear tonal contrasts in Holocene alluvium (Bryant, 1989 #1459). The southern end of the Northern Panamint Valley section is delineated by geomorphic evidence of dextral normal displacement such as linear ridges, faceted spurs in bedrock, aligned saddles, and scarps to 2 m high on latest Pleistocene to early Holocene alluvial fans (Bryant, 1989 #1459). |
| **Age of faulted surficial deposits** | Fault offsets alluvium of post-latest high stand pluvial Lake Panamint (15?5 ka; Smith, 1976 #1646). Bryant (1989 #1459) reported fault exposures in Holocene alluvial fan deposits that have poorly developed rock varnish, desert pavement, and have poorly developed soil profiles. |
| **Historic earthquake** | |
| **Most recent prehistoric deformation** | latest Quaternary (<15 ka)<br><br>*Comments:* Timing of the most recent paleoevent along the Northern Panamint Valley section is not precisely known. Traces of the Northern Panamint Valley section offset alluvium and alluvial fan deposits that post-date the 15?5 ka desiccation of pluvial Lake Panamint (Smith, 1979 #1647). Bryant (1989 #1459) observed faulted alluvial fan deposits that may be mid- to late Holocene, based on the relative age dating of alluvial fan surface characterized by well-preserved constructional surfaces, incipient rock varnish, poorly developed desert pavement, weak to moderate Stage I pedogenic carbonate development in gravel deposits predominantly composed of carbonate clasts (Bryant, 1989 #1459). Smith (1979 #1647) reported that the age of the most recent event is not known, but speculated that it probably |

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| | occurred at least several hundred years ago. |
| **Recurrence interval** | *Comments:* Recurrence intervals for the Northern Panamint Valley section are not known. Zhang and others (1990 #199) identified dextral displacements in multiples of 3: the youngest offset is 3 m and dextral offsets of 6 m and 12 m were observed at many places between Manly Peak Canyon and Goler Wash Canyon (Southern Panamint Valley section [67c]). Zhang and others (1990 #199) concluded that the average recurrence interval for large surface rupturing earthquakes on the Southern Panamint Valley section [67c] is between 860 and 2,360 yr, based on a 3.2?0.5 m characteristic event and a Holocene slip rate of 2.36?0.79 mm/yr. Smith (1979 #1647) estimated a mean recurrence interval of about 700-2,500 yr for the Panamint Valley fault zone, based on an assumed 1.4-2.6 m offset per event and 20 m total offset in the past 10-20 ka. |
| **Slip-rate category** | Between 1.0 and 5.0 mm/yr<br><br>*Comments:* The Holocene slip rate for the Northern Panamint Valley section is not known. Zhang and others (1990 #199) reported latest Pleistocene to Holocene minimum dextral slip rates of 1.74?0.65 mm/yr and 2.36?0.79 mm/yr for the Southern Panamint Valley section [67c]. Petersen and others (1996 #4860) assigned a slip rate of 2.5 mm/yr (with minimum and maximum assigned slip rates of 1.5 mm/yr and 3.5 mm/yr, respectively) to the entire fault for probabilistic seismic hazard assessment for the State of California. |
| **Date and Compiler(s)** | 2000<br>William A. Bryant, California Geological Survey |
| **References** | #1459 Bryant, W.A., 1989, Panamint Valley fault zone and related faults, Inyo and San Bernardino Counties, California: California Division of Mines and Geology Fault Evaluation Report FER-206, 33 p., 1 pl., scale 1:62,500.<br><br>#1454 Burchfiel, B.C., Hodges, K.V., and Royden, L.H., 1987, Geology of Panamint Valley-Saline Valley pull-apart system, California—Palinspastic evidence for low-angle geometry of a Neogene range-bounding fault: Journal of Geophysical Research, v. 92, no. B10, p. 10,422-10,426. |

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#1647 Smith, R.S.U., 1979, Holocene offset and seismicity along the Panamint Valley fault zone, western Basin and Range province, California: Tectonophysics, v. 52, p. 411-415.

#1705 Zellmer, J.T., 1980, Recent deformation in the Saline Valley region, Inyo County, California: Reno, University of Nevada, unpublished Ph.D. dissertation, 168 p., 7 pls., scale 1:50,000.

#199 Zhang, P., Ellis, M., Slemmons, D.B., and Mao, F., 1990, Right-lateral displacements and the Holocene slip rate associated with prehistoric earthquakes along the southern Panamint Valley fault zone—Implications for southern Basin and Range tectonics and coastal California deformation: Journal of Geophysical Research, v. 95, no. B4, p. 4857—4872.