Jump to Navigation

# 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.**

## Johnson Valley fault zone, Northern Johnson Valley section (Class A) No. 115a

**Last Review Date: 2000-05-23**

## Compiled in cooperation with the California Geological Survey

***citation for this record:*** **Bryant, W.A., compiler, 2000, Fault number 115a, Johnson Valley fault zone, Northern Johnson 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 02:18 PM.**

| | |
|---|---|
| **Synopsis** | **General:** Historically active dextral strike slip fault zone located in the central Mojave Desert. Fault zone in this compilation is described as two sections: Northern Johnson Valley [115a] and Southern Johnson Valley [115b] sections. Detailed reconnaissance-level geologic and geomorphic mapping exists for the fault zone (Bader and Moyle, 1960 #6644; Dibblee, 1964 #6639; Dibblee, 1967 #1342; Dibblee, 1967 #6614; Dibblee, 1967 #6657; Morton, 1980 #6636; Bryant, 1986 #6645; Manson, 1986 #6664; Bryant, 1992 #6658; Bryant, 1994 #6646). Rockwell and others (1995 #6667; 2000 #6654) reported that 5 or 6 surface |

| | |
|---|---|
| | rupturing earthquakes have occurred on the Southern Johnson Valley section in the past 25–32 k.y. Herzberg and Rockwell (1993 #6662) reported that three paleoearthquakes along the Northern Johnson Valley section were preserved in the upper 3 m of sedimentary deposits near Melville Lake. The most recent paleoevent along the Northern Johnson Valley section at the Melville Gap site [115a-1] occurred about 5.8 ? 0.3 ka (Rockwell and others, 2000 #6654). Late Pleistocene slip rate for the Johnson Valley fault zone is not known, but geomorphic expression of the fault is similar to the Homestead Valley fault [116], which has a late Pleistocene slip rate of 0.4–0.6 mm/yr (Hecker and others, 1993 #6660). Southern Johnson Valley section is characterized by a late Pleistocene (<25 k.y.) recurrence interval of 5–6 k.y. (Rockwell and others, 2000 #6654). Minor surface rupture associated with the 1979 Homestead Valley earthquake occurred along traces of the Southern Johnson Valley section (Hill and others, 1980 #3360). Up to 3 m of dextral strike-slip surface fault rupture associated with the 1992 $M_w$7.3 Landers earthquake occurred along traces of the southern Johnson Valley fault (Bryant, 1992 #6658; Sieh and others, 1993 #3406).<br><br>**Sections:** This fault has 2 sections. In this compilation the Johnson Valley fault zone is divided into two sections based on the change in strike from N. 45? W. for the Northern Johnson Valley section to N. 5° W. for the Southern Johnson Valley section. The boundary is also delineated by the termination of surface rupture associated with the 1992 Landers earthquake. Sowers and others (1994 #6668) divided the Southern Johnson Valley section into three reaches, based on geomorphic expression. |
| **Name comments** | **General:** The Johnson Valley fault zone (which includes Upper Johnson Valley fault, West Johnson Valley, Kickapoo fault) was first mapped in part by Vaughn (1922 #5801) (central strands) and Gardner (1940 #6648) (northern strands). Dibblee (1964 #6639) first named the Johnson Valley fault.<br><br>**Section:** Section name proposed in this compilation. The Northern Johnson Valley section extends from the east side of the Fry Mountains southeast to near Bodick Road where surface fault rupture associated with the 1992 Landers earthquake terminated and near the change in strike from N. 45° W. to N. 2° W. The Northern Johnson Valley section includes the Johnson Valley fault, Western Johnson Valley fault, and Upper Johnson Valley |

| | |
|---|---|
| | fault. The Western and Upper Johnson Valley faults were first mapped by Dibblee (1967 #1342); Bryant (1994 #6646) first proposed these names.<br><br>**Fault ID:** Refers to number 415 (Johnson Valley fault) of Jennings (1994 #2878). |
| **County(s) and State(s)** | SAN BERNARDINO COUNTY, CALIFORNIA |
| **Physiographic province(s)** | BASIN AND RANGE |
| **Reliability of location** | Good<br>Compiled at 1:62,500 scale.<br><br>*Comments:* Locations based on digital revisions to Jennings (1994 #2878) using original mapping by Bryant (1992 #6658; 1994 #6646), Manson (1986 #6664), and Morton and others (1980 #6636) at 1:24,000; mapping by Dibblee (1964 #6639; 1967 #6614; 1967 #6657), and Bader and Moyle (1960 #6644) at 1:62,500. |
| **Geologic setting** | Historically active dextral strike-slip fault zone located in the central Mojave Desert. The north to northwest-striking Johnson Valley fault zone is part of a series of subparallel dextral strike-slip faults in the central Mojave Desert. Johnson Valley fault zone is part of the Eastern California shear zone (Dokka and Travis, 1990 #3188). The Johnson Valley fault extends from the eastern flank of the Fry Mountains southeast across Johnson and Homestead valleys. These valleys are bajadas underlain by late Pleistocene and Holocene sandy granitic alluvium (Sowers and others, 1994 #6668). The Southern Johnson Valley section is located near the eastern side of the San Bernardino Mountains and extends to about 1.5 km north of the sinistral Pinto Mountain fault zone [118]. Cumulative dextral displacement along the Johnson Valley fault zone is not well constrained. Manson (1986 #6664) reported that the Johnson Valley fault may have as much as 1.6 km of dextral slip, based on offset bedrock units mapped by Dibblee (1967 #6614) south of Melville Lake. Dokka and Travis (1990 #3188) estimated that the Lenwood fault [111], a dextral strike-slip fault just west of the Johnson Valley fault, has cumulative dextral slip of about 1.5 km. |
| **Length (km)** | This section is 32 km of a total fault length of 51 km. |

| | |
|---|---|
| **Average strike** | N31°W |
| **Sense of movement** | Right lateral<br><br>*Comments:* Fault zone is delineated by moderately to locally well defined geomorphic evidence of dextral strike-slip displacement (Morton and others, 1980 #6636; Manson, 1986 #6664; Bryant, 1992 #6658; 1994 #6646). Manson (1986 #6664) suggested that there may be about 1.6 km of dextral offset based on displaced bedrock units south of Melville Lake mapped by Dibblee (1967 #6614). |
| **Dip Direction** | V<br><br>*Comments:* Dibblee (1967 #6614) shows a near vertical to vertically dipping fault in cross section E–E' |
| **Paleoseismology studies** | Site 115-1, Melville Gap site of Herzberg and Rockwell (1993 #6662), Herzberg (1996 #6661), and Rockwell and others (2000 #6654) involved excavation of one trench across traces of the northern section of the Johnson Valley fault. Trench exposed faulted sedimentary deposits and evidence of two and possibly three earthquakes in the past 11 k.y. Rockwell and others (1995 #6667; 2000 #6654) dated scarp-derived colluvial wedges using thermoluminescence and infrared-optically stimulated luminescence. |
| **Geomorphic expression** | The Northern Johnson Valley section is delineated by moderately to locally well defined geomorphic features indicative of latest Pleistocene and Holocene dextral displacement, such as abrupt bedrock scarps, dextrally deflected drainages, linear drainages, beheaded drainages and linear vegetation contrasts and scarps on latest Pleistocene and Holocene alluvium (Morton and others, 1980 #6636; Manson, 1986 #6664; Bryant, 1994 #6646) |
| **Age of faulted surficial deposits** | Herzberg and Rockwell (1993 #6662) reported that the Northern Johnson Valley section offsets sedimentary deposits between 9.1 ka and 9.4 ka, based on 14C dating of detrital charcoal. |
| **Historic earthquake** | |
| **Most recent prehistoric deformation** | latest Quaternary (<15 ka)<br><br>*Comments:* The most recent paleoevent occurred between 9.1 ka |

| | |
|---|---|
| | and 9.4 ka, based on 14C dates on detrital charcoal obtained from deposits above and below the most recent paleoevent (Herzberg and Rockwell, 1993 #6662). Rockwell and others (1995 #6667; 2000 #6654) reported that the most recent paleoevent occurred about 5.8±0.3 ka, based on thermoluminescence and infrared-optically stimulated luminescence ages derived from unit 3 located just below a scarp-derived colluvial wedge at the Melville Gap site (site 115-1). Rockwell and others (1995 #6667; 2000 #6654) note the discrepancy between the thermoluminescence dates and the 14C dates. |
| **Recurrence interval** | *Comments:* Rockwell and others (2000 #6654) reported that 2 and possibly 3 earthquakes have occurred along the Northern Johnson Valley section in the past 11 ka at the Melville Gap (site 115-1). The most recent event occurred about 5.8±0.3 ka. Timing of the penultimate and pre-penultimate events is not well constrained. The age of the penultimate event is bracketed by thermoluminescence dates on the base of unit 4 (7.5±0.5 ka) and the age of the most recent event—Rockwell and others (2000 #6654) infer that the earthquake probably occurred soon after deposition of unit 4, about 7.5 ka. The pre-penultimate event may have occurred between 7.5 ka and 11.2 ka. However, Rockwell and others (2000 #6654) infer that the pre-penultimate event may have been either a triggered slip event, or a smaller earthquake on the Northern Johnson Valley section. |
| **Slip-rate category** | Between 0.2 and 1.0 mm/yr<br><br>*Comments:* Hecker and others (1993 #6660) reported a late Pleistocene slip rate of 0.4–0.6 mm/yr of the Homestead Valley fault [116]. The geomorphic expression of the Johnson Valley fault zone generally is similar to the Homestead Valley fault and it is assumed that the late Pleistocene slip rate is similar. Slip rate assigned by Petersen and others (1996 #4860) for probabilistic seismic hazard assessment for the State of California was 0.6 mm/yr (with minimum and maximum assigned slip rates of 0.2 mm/yr and 1.0 mm/yr, respectively. |
| **Date and Compiler(s)** | 2000<br>William A. Bryant, California Geological Survey |
| **References** | #6644 Bader, J.S., and Moyle, W.R., 1960, Data on water wells and springs in the Yucca Valley-Twentynine Palms area, San Bernardino and Riverside Counties, California: California |

Department of Water Resources Bulletin 91-2, 163 p., scale 1:62,500.

#6645 Bryant, W.A., 1986, Pinto Mountain, Mesquite Lake, Copper Mountain, and related faults, San Bernardino County, California: California Division of Mines and Geology Fault Evaluation Report, FER-181 (microfiche copy in California Division of Mines and Geology Open-File Report 90-14), scale 1:24,000.

#6658 Bryant, W.A., 1992, Surface fault rupture along the Johnson Valley, Homestead Valley, and related faults associated with the Ms 7.5 28 June 1992 Landers earthquake: California Department of Conservation, Division of Mines and Geology Fault Evaluation Report FER-234, 21 p., scale 1:24,000.

#6646 Bryant, W.A., 1994, Surface fault rupture along the Homestead Valley, Emerson, and related faults associated with the Mw 7.3 28 June 1992 Landers earthquake: California Department of Conservation, Division of Mines and Geology Fault Evaluation Report FER-239, 18 p., scale 1:24,000.

#6639 Dibblee, T.W., Jr., 1964, Geologic map of the Rodman Mountains quadrangle, San Bernardino County, California: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-430, scale 1:62,500.

#1342 Dibblee, T.W., Jr., 1967, Geologic map of the Joshua Tree quadrangle, San Bernardino and Riverside Counties, California: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-516, 3 p. pamphlet, 1 sheet, scale 1:62,500.

#6614 Dibblee, T.W., Jr., 1967, Geologic map of the Old Woman Springs quadrangle, San Bernardino County, California: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-518, scale 1:62,500.

#6657 Dibblee, T.W., Jr., 1967, Geologic map of the Emerson Lake quadrangle, San Bernardino County, California: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-490, scale 1:62,500.

#3188 Dokka, R.K., and Travis, C.J., 1990, Late Cenozoic strike-slip faulting in the Mojave Desert, California: Tectonics, v. 9, p.

311-340.

#6648 Gardner, D.L., 1940, Geology of the Newberry and Ord Mountains, San Bernardino County, California: California Journal of Mines and Geology, v. 36, no. 3, p. 257-292, 1 pl., scale approximately 1:250,000.

#6660 Hecker, S., Fumal, T.E., Powers, T.J., Hamilton, J.C., Garvin, C.D., Schwartz, D.P., and Cinti, F.R., 1993, Late Pleistocene-Holocene behavior of the Homestead Valley fault segment—1992 Landers, CA surface rupture [abs.]: Eos, Transactions of the American Geophysical Union, v. 74, no. 43, p. 612.

#6662 Herzberg, M., and Rockwell, R., 1993, Timing of past earthquakes on the northern Johnson Valley fault and their relationship to the 1992 rupture [abs.]: EOS, Transactions of the American Geophysical Union, v. 74, no. 43, p. 612.

#6661 Herzberg, M.L., 1996, The Neotectonic history of the Johnson Valley fault, San Bernardino County, California: San Diego, CA, San Diego State University, unpublished M.S. thesis, 67 p.

#3360 Hill, D.P., Treiman, J.A., Given, J.W., Pechman, J.C., McMillan, J.R., and Ebel, J.E., 1980, Geologic study of the Homestead Valley earthquake swarm of March 15, 1979: California Geology, v. 33, p. 60-67.

#2878 Jennings, C.W., 1994, Fault activity map of California and adjacent areas, with locations of recent volcanic eruptions: California Division of Mines and Geology Geologic Data Map 6, 92 p., 2 pls., scale 1:750,000.

#6664 Manson, M.W., 1986, Homestead Valley fault, Johnson Valley fault, and associated faults, San Bernardino County, California: California Division of Mines and Geology Fault Evaluation Report FER-180, microfiche copy in California Division of Mines and Geology Open-File Report 90-14, scale 1:24,000.

#6636 Morton, D.M., Miller, F.K., and Smith, C.C., 1980, Photoreconnaissance maps showing young-looking fault features in the southern Mojave Desert, California: U.S. Geological

Survey Miscellaneous Field Studies Map MF-1051, 7sheets, scale 1:24,000 and 1:62,500.

#4860 Petersen, M.D., Bryant, W.A., Cramer, C.H., Cao, T., Reichle, M.S., Frankel, A.D., Lienkaemper, J.J., McCrory, P.A., and Schwartz, D.P., 1996, Probabilistic seismic hazard assessment for the State of California: California Department of Conservation, Division of Mines and Geology Open-File Report 96-08 (also U.S. Geological Open-File Report 96-706), 33 p.

#6667 Rockwell, T.K., Lindvall, S., Berger, G.W., and Huntley, D.J., 1995, Timing of late Quaternary earthquakes along the southern portion of the Landers earthquake (1992; MW 7.4) rupture based on luminescence dating-Is this a new fault or business as usual? [abs.]: Geological Society of America Abstracts with Programs, v. 27, no. 6, p. A-376.

#6654 Rockwell, T.K., Lindvall, S., Herzberg, M., Murbach, D., Dawson, T., and Berger, G., 2000, Paleoseismology of the Johnson Valley, Kickapoo, and Homestead Valley faults—Clustering of earthquakes in the eastern California shear zone: Bulletin of the Seismological Society of America, v. 90, no. 5, p. 1,200-1,236.

#3406 Sieh, K., Jones, L., Hauksson, E., Hudnut, K., Eberhart-Phillips, D., Heaton, T., Hough, S., Hutton, K., Kanamori, H., Lilje, A., Lindvall, S., McGill, S.F., Mori, J., Rubin, C., Spotila, J.A., Stock, J., Thio, H.K., Treiman, J., Wernicke, B., and Zachariasen, J., 1993, Near-field investigations of the Landers earthquake sequence, April to July 1992: Science, v. 260, p. 171-176.