

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](#).

Walnut Springs fault (Class A) No. 2102

Last Review Date: 2016-02-15

Compiled in cooperation with the New Mexico Bureau of Geology & Mineral Resources

citation for this record: Machette, M.N., and Jochems, A.P., compilers, 2016, Fault number 2102, Walnut Springs fault, 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 02:21 PM.

Synopsis

Little is known about the Quaternary history of this range-bounding fault that forms the west margin of the Fra Cristobal Mountains and eastern margin of the northern Engle Basin. Although fault scarps are reported in the literature, none have been seen on aerial photographs or during aerial reconnaissance by the compiler. The prominent wall-like escarpment that cuts across the piedmont at the western front of the mountains is formed by a dike-like body of silicified fault breccia in sediment of the upper Santa Fe Group (Palomas Formation), which suggests late Cenozoic movement on the fault. However, no studies have been conducted to discern the age and distribution of Quaternary deposits that overlie or are cut by this fault.

<p>Name comments</p>	<p>Named by Warren (1978 #1079) for Walnut Springs, which is in Walnut Canyon below Red Gap in the southern part of the Fra Cristobal Mountains. The fault has also been called the Hot Springs fault by Thompson (1961 #1712) and Nelson and others (2012 #7355), and the West Vein fault by Van Allen and others (1984 #1266) in their discussion of fluorite deposits associated with the fault. Nelson (1986 #1176) compromised and called it the Walnut Canyon-West Vein fault. Machette (1987 #960) preferred Warren's original nomenclature because the Walnut Springs fault seems to have significantly more Cenozoic displacement than the Hot Springs fault. The fault extends from the northern end of the Fra Cristobal Mountains south to its overlap with the Hot Springs fault [2100] about 6 km north of Kettle Top Butte.</p> <p>Fault ID: Referred to as fault 7 on fig. 1 in Machette (1987 #960).</p>
<p>County(s) and State(s)</p>	<p>SIERRA COUNTY, NEW MEXICO SOCORRO COUNTY, NEW MEXICO</p>
<p>Physiographic province(s)</p>	<p>BASIN AND RANGE</p>
<p>Reliability of location</p>	<p>Good Compiled at 1:24,000 scale.</p> <p><i>Comments:</i> Compiled at 1:24,000 scale using photogrammetric methods and comparison to approximately 1:34,000-scale map of Nelson and others (2012 #7355). Earlier version compiled on 1:250,000-scale topographic base from individual source maps at various scales by Warren (1978 #1079), Thompson (1961 #1712), and Van Allen and others (1984 #1266).</p>
<p>Geologic setting</p>	<p>The Walnut Springs fault bounds the west margin of the Fra Cristobal Mountains and forms the eastern margin of the northern Engle Basin for about 25 km. The most prominent expression of the fault is a wall-like escarpment formed by silicified fault breccia (Jacobs, 1956 #1711; Thompson, 1961 #1712; Van Allen and others, 1984 #1266; Nelson, 1986 #1176). This feature is well preserved along most of the proximal piedmont that borders the western front of the Fra Cristobal Mountains as illustrated in fig. 14 of Nelson (1986 #1176).</p>

Length (km)	21 km.
Average strike	N5°E
Sense of movement	Normal
Dip	65°–75° W <i>Comments:</i> According to mapping of Nelson (1986 #1176).
Paleoseismology studies	
Geomorphic expression	Although Nelson (1986 #1176) reported fault scarps on alluvial fans at the north end of the fault, none were observed along the western front of the Fra Cristobal Mountains on aerial photographs or during aerial reconnaissance by Machette (1987 #960) or Foley and others (1988 #991).
Age of faulted surficial deposits	From the dissected appearance of the piedmont, it appears that the alluvial fans are probably of middle and late Pleistocene age (Machette, 1987 #960). However, no studies have been conducted to discern the age and distribution of Quaternary deposits along this portion of the fault owing to limited public access.
Historic earthquake	
Most recent prehistoric deformation	undifferentiated Quaternary (<1.6 Ma) <i>Comments:</i> Machette (1987 #960) considered the fault to be of possible early Pleistocene age whereas Foley and others (1988 #991) considered movement on the fault to be no younger than middle Pleistocene age. The more conservative estimate of Quaternary is used herein until specific studies are conducted on the Quaternary history of the Walnut Springs fault.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr <i>Comments:</i> Low slip-rate category assigned based on lack of bona fide scarps on deposits believed to be of middle and or late Pleistocene age.
Date and	2016

Compiler(s)	Michael N. Machette, U.S. Geological Survey, Retired Andrew P. Jochems, New Mexico Bureau of Geology & Mineral Resources
References	<p>#991 Foley, L.L., LaForge, R.C., and Piety, L.A., 1988, Seismotectonic study for Elephant Butte and Caballo Dams, Rio Grande Project, New Mexico: U.S. Bureau of Reclamation Seismotectonic Report 88-9, 60 p., 1 pl., scale 1:24,000.</p> <p>#1711 Jacobs, R.C., 1956, Geology of the central front of the Fra Cristobal Mountains: Albuquerque, University of New Mexico, unpublished M.S. thesis, 47 p.</p> <p>#960 Machette, M.N., 1987, Preliminary assessment of Quaternary faulting near Truth or Consequences, New Mexico: U.S. Geological Survey Open-File Report 87-652, 40 p.</p> <p>#1176 Nelson, E.P., 1986, Geology of the Fra Cristobal Range, south-central New Mexico, <i>in</i> Clemons, R.E., King, W.E., and Mack, G.H., eds., Truth or Consequences region: New Mexico Geological Society, 37th Field Conference, October 16-18, 1986, Guidebook, p. 83-95.</p> <p>#7355 Nelson, W.J., Lucas, S.G., Krainer, K., McLemore, V.T., and Elrick, S., 2012, Geology of the Fra Cristobal Mountains, New Mexico, <i>in</i> Lucas, S.G., McLemore, V.T., Lueth, V.W., Spielmann, J.A., and Krainer, K., eds., Geology of the Warm Springs region: New Mexico Geological Society 63rd Field Conference, October 3–6, 2012, Guidebook, p. 195–210.</p> <p>#1712 Thompson, S., 1961, Geology of the southern part of the Fra Cristobal Range, Sierra County, New Mexico: Albuquerque, University of New Mexico, revision of M.S. thesis (1956), 89 p.</p> <p>#1266 Van Allen, B.R., Wilson, J.L., and Hunter, J.C., 1984, Sunset Ridge fluorite deposit, Fra Cristobal Range, Sierra County, New Mexico: <i>New Mexico Geology</i>, v. 6, p. 1-5 and 12.</p> <p>#1079 Warren, R.G., 1978, Characterization of the lower crust-upper mantle of the Engle Basin, Rio Grande rift, from a petrochemical and field geologic study of basalts and their intrusions: Albuquerque, University of New Mexico, unpublished M.S. thesis, 156 p., 1 pl., scale 1:24,000.</p>

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