

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](#).

Zia fault (Class A) No. 2046

Last Review Date: 2015-04-13

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

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Synopsis	The down-to-the-east Zia fault offsets Santa Fe Group sediment exposed in the Zia badlands, on the Llano de Albuquerque, and in younger Quaternary deposits. Upper Santa Fe Group sediment may have been offset about 60 m across the Zia fault since early Quaternary time.
Name comments	The Zia fault is one of several north-trending normal faults named by Kelley (1977 #1106) in the Zia badlands in the northern part of the Albuquerque-Belen basin. Galusha (1966 #1296), G.O. Bachman (unpublished mapping, 1975) and Manley (1978 #1404) mapped the northern end of the Zia fault in the Sky Village NE and Bernalillo NW quadrangles, respectively. Galusha (1966

	<p>#1296) and Manley (1978 #1404) used the name Rincon fault in the Bernalillo NW quadrangle, but we retain the name Zia fault herein due to apparent common usage in recent publications (Wong and others, 1995 #1155; Hawley and Whitworth, 1996 #1303). Recent mapping (Hawley and Whitworth, 1996 #1303; Cather and others, 1997 #1763; Connell, 2008 #7454) extends the Zia fault much further south than the original trace of the fault as mapped by Kelley (1977 #1106).</p>
County(s) and State(s)	<p>BERNALILLO COUNTY, NEW MEXICO SANDOVAL COUNTY, NEW MEXICO</p>
Physiographic province(s)	<p>BASIN AND RANGE</p>
Reliability of location	<p>Good Compiled at 1:100,000 scale.</p> <p><i>Comments:</i> Fault trace from Manley (1978 #1404) in the Bernalillo NW quadrangle, G.O. Bachman (unpubl. mapping, 1975) in the Sky Village NE quadrangle, Cather and others (1997 #1763) in the Sky Village SE quadrangle, and unpublished air photo mapping by the compiler (1997) in the Sky Village NE, Sky Village SE, and Volcano Ranch quadrangles, all recompiled at 1:100,000 scale on a topographic base map. The fault location is also evident in high-resolution aeromagnetic data (U.S. Geological Survey and SIAL Geosciences Inc., 1997 #1722; Grauch and Millegan, 1998 #1721).</p> <p>The southern trace of the Zia fault is open to interpretation. Cather and others (1997 #1763) mapped the Zia fault as a queried trace with a southward strike along the eastern margin of the Sky Village SE (now Arroyo de las Calabacillas) 7.5-minute quadrangle. However, the compiler used the mapping of Hawley and Whitworth (1996 #1303), airphoto analysis (S.F. Personius, unpubl. mapping, 1997), and geophysical data (U.S. Geological Survey and SIAL Geosciences Inc., 1997 #1722; Grauch and Millegan, 1998 #1721) to infer a more southwestward trace of the Zia fault across the Sky Village SE quadrangle. The latter trace is used in the compilation because the fault appears to have better topographic expression, and thus may have younger movement.</p>
Geologic setting	<p>The Zia fault is one of several down-to-the-east intrabasin faults in the northern part of the Albuquerque-Belen basin.</p>

Length (km)	32 km.
Average strike	N15°E
Sense of movement	Normal
Dip Direction	E
Paleoseismology studies	Site 2046-1. Referred to as the Zia trench site is located near the southern rim of Ceja de-Rio Jemez (the northern limit of the Llano de Albuquerque geomorphic surface). McCalpin and Harrison (2001 #6924) excavated three trenches at this site in order to better observe the stratigraphy. The middle trench crosses the steepest, highest part of the fault scarp and reveals evidence for at least 5 faulting events. Displacement in these events ranged from 0.6 to 2.6 m, with an average of 1.3 m. The study includes two independent age estimates from soil-carbonate accumulation and luminescence ages. Soil-carbonate age estimates are preferred because the thermoluminescence ages (56–416 ka) were deemed unreliable because all dates are in an inverted stratigraphic order. The soils in the upper 3 m of the trench required 10–32 k.y. to form, and the strong soils at the base of the trench required an additional 32 k.y.
Geomorphic expression	The Zia fault is well exposed in Santa Fe Group sediment in the Zia badlands north of the Llano de Albuquerque. Farther south, the fault forms broad, dissected fault scarps across the Llano de Albuquerque and on younger surficial deposits.
Age of faulted surficial deposits	Manley (1978 #1404) described minor (0.5 m) offset of middle or upper (?) Pleistocene alluvium by the Zia fault in the Bernalillo NW quadrangle. Kelly (1997 #1106) estimated approximately 60 m of throw in Upper Santa Fe Group sediment (Pliocene to early Pleistocene) across the Zia fault. In most places, the Zia fault offsets the early Pleistocene Llano de Albuquerque surface and middle (?) Pleistocene surficial deposits.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) <i>Comments:</i> McCalpin and Harrison (2001 #6924) conclude that the most recent surface rupture at the trench site occurred about 11 ka as inferred from soil-carbonate age estimates. Furthermore, the most recent event is older than the Holocene unconformity

	that occurred about 2,380–2,740 cal. yr BP.
Recurrence interval	<p>10–21 k.y. (<119 ka)</p> <p><i>Comments:</i> McCalpin and Harrison (2001 #6924) base their estimate of long-term average recurrence by assuming five events have occurred since the formation of buried soils 5 and 6, which have a soil-carbonate age estimate of greater than 63 ka and an optically stimulated luminescence (OSL) age of 119 ka. McCalpin and Harrison (2001 #6924) suggest that if the most recent event occurred at 11 ka, then the four preceding recurrence cycles spanned 52–108 k.y., which results in an average recurrence interval of 10–21 k.y.</p>
Slip-rate category	<p>Less than 0.2 mm/yr</p> <p><i>Comments:</i> The five events inferred from the middle trench have a cumulative down-to-the-east vertical displacement of 6.5 m, which occurred over the past 63–119 ka. McCalpin and Harrison (2001 #6924) suggest that the resulting average long-term vertical displacement rate is 0.055–0.1 mm/yr.</p>
Date and Compiler(s)	<p>2015</p> <p>Stephen F. Personius, U.S. Geological Survey Kathleen M. Haller, U.S. Geological Survey</p>
References	<p>#1763 Cather, S.M., Connell, S.D., Heynekamp, M.R., and Goodwin, L.B., 1997, Geology of the Arroyo de las Calabacillas [Sky Village SE] 7.5-minute quadrangle, Sandoval County, New Mexico: New Mexico Bureau of Mines and Mineral Resources Open-File Geologic Map 9, 8 p. pamphlet, 1 sheet, scale 1:24,000.</p> <p>#7454 Connell, S.D., 2008, Geologic map of the Albuquerque-Rio Rancho metropolitan area and vicinity, Bernalillo and Sandoval Counties, New Mexico: New Mexico Bureau of Geology and Mineral Resources Geologic Map 78, scale 1:50,000.</p> <p>#1296 Galusha, T., 1966, The Zia Sand Formation, new early to medial Miocene beds in New Mexico: American Museum Novitates 2271, 12 p.</p> <p>#1721 Grauch, V.J.S., and Millegan, P.S., 1998, Mapping intrabasinal faults from high-resolution aeromagnetic data: The Leading Edge, v. 17, p. 53-55.</p>

#1303 Hawley, J.W., and Whitworth, T.M., compilers, 1996, Hydrogeology of potential recharge areas for the basin- and valley-fill aquifer systems, and hydrogeochemical modeling of proposed artificial recharge of the upper Santa Fe aquifer, northern Albuquerque basin, New Mexico: New Mexico Bureau of Mines and Mineral Resources Open-File Report 402-D, 575 p.

#1106 Kelley, V.C., 1977, Geology of Albuquerque basin, New Mexico: New Mexico Bureau of Mines and Mineral Resources Memoir 33, 60 p., 2 pls.

#1404 Manley, K., 1978, Geologic map of Bernalillo NW quadrangle, Sandoval County, New Mexico: U.S. Geological Survey Geologic quadrangle Map GQ-1446, 1 sheet, scale 1:24,000.

#6924 McCalpin, J.P., and Harrison, J.B.J., 2001, Paleoseismicity of Quaternary faults near Albuquerque, New Mexico: Final Technical Report, Second Year, to U.S. Geological Survey for Contract 99HQGR0056, 58 p.

#1722 U.S. Geological Survey, and SIAL Geosciences, Inc., 1997, Description of digital aeromagnetic data collected north and west of Albuquerque, New Mexico: U.S. Geological Survey Open-File Report 97-286, 40 p.

#1155 Wong, I., Kelson, K., Olig, S., Kolbe, T., Hemphill-Haley, M., Bott, J., Green, R., Kanakari, H., Sawyer, J., Silva, W., Stark, C., Haraden, C., Fenton, C., Unruh, J., Gardner, J., Reneau, S., and House, L., 1995, Seismic hazards evaluation of the Los Alamos National Laboratory: Technical report to Los Alamos National Laboratory, Los Alamos, New Mexico, February 24, 1995, 3 volumes, 12 pls., 16 appen.

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