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La Jencia fault, southern section (Class A) No. 2109b

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

citation for this record: **Machette, M.N., and Chamberlin, R.M., compilers, 2016, Fault number 2109b, La Jencia fault, southern 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 02:21 PM.**

Synopsis	**General:** The La Jencia fault is one of a dozen or so faults in the Rio Grande rift that have been investigated in detail. The fault's trace was mapped in detail, more than 50 scarp profiles were measured to document offset and scarp morphology, and four trenches were excavated in the late 1970s to help document the fault's chronology. No radiometric dating was performed, but detailed analyses of soil development were used to estimate times of movement and suggest a segmentation scheme for the fault. New dating techniques such as AMS radiocarbon or luminescence could be used to refine the fault's chronology.

	Sections: This fault has 2 sections. This 32-km-long fault was previously divided into 6 segments on the basis of apparent timing of movement. However, these short segments (3–8 km long) probably do not reflect truly independent rupture segments. Therefore, for descriptive purposes, the segments are combined into two sections herein strictly on a geometric basis, the northern section trending north from U.S. Highway 60 and the southern section trending southeast and south from U.S. Highway 60.
Name comments	**General:** First recognized as a young range-bounding fault by Kirk Bryan in 1933 (cited on p. 73 in Loughlin and Koschmann, 1942 #1273), it was shown in a general manner and named the Magdalena fault by Kelley (1954 #1222). It was not mapped in detail until the late 1970s (Machette, 1978 #1223). Machette (Machette and McGimsey, 1983 #1024) renamed it for La Jencia Creek, a stream that drains La Jencia basin, the northern part of the Magdalena Mountains, and the southern part of the Bear Mountains, northwest of Socorro. The fault extends south from a point about 2 km south of Bear Springs Canyon (Sec. 20, T. 1 S., R. 3 W.) and crosses U.S. Highway 60 about 7 km east of Magdalena. The fault can be traced south along the mountain front and associated piedmont to Six Mile Canyon, a distance of 32 km. **Section:** Includes segments A, B, and C of Machette (1988 #1221). This section extends from U.S. Highway 60, about 7 km east of Magdalena, south to Six Mile Canyon. **Fault ID:** Fault number 12 of Machette (1982 #1401) and fault number 11 of Machette and McGimsey (1983 #1024).
County(s) and State(s)	SOCORRO COUNTY, NEW MEXICO
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Trace from 1:24,000-scale geologic mapping by Chamberlin and Osburn (2006 #7442) coupled with accurate placement using photogrammetric methods. Older maps show the fault at scales of 1:48,000 (Machette 1988 #1221), 1:187,500 (Kelley, 1954 #1222), and 1:250,000 (Machette and McGimsey,

	1983 #1024).
Geologic setting	La Jencia fault bounds the eastern margin of the strongly uplifted and west-tilted Magdalena Mountains and the more subdued Bear Mountains (to the north). Both ranges have embayed range-fronts, suggesting a lack of significant Quaternary faulting. However, La Jencia fault forms the tectonic margin between the mountains to the west and the Cenozoic La Jencia basin to the east. The basin probably has a half-graben geometry, with the eastern part formed by west-dipping rocks of the Socorro and Lemitar Mountains. The Magdalena Mountains are comprised of Precambrian rocks, with an overlying (eroded) section of Paleozoic sedimentary rocks and a thick sequence of intracaldera ignimbrites and volcaniclastic rocks. The Bear Mountains are of similar composition (outflow ignimbrites), but are not so strongly uplifted. Late Cenozoic (<26 Ma) uplift across the La Jencia fault probably exceeds 1,000 m, and may be as much as 1,500 m locally (Machette, 1988 #1221). Chamberlin and Love (2016 #7482, fig.9) estimate as much as 2 km of post-6 Ma throw on the La Jencia fault east of the Bear Mountains.
Length (km)	This section is 20 km of a total fault length of 32 km.
Average strike	N35°W (for section) versus N19°W (for whole fault)
Sense of movement	Normal *Comments:* From trenching and geomorphic relations, Machette (1988 #1221) inferred primarily normal dip-slip movement at the surface.
Dip	70° NE to vertical *Comments:* Machette (1988 #1221) showed typical dip angles of 70° NE to vertical, all within 3–4 m of the surface. Owing to the strongly backtilted nature of the adjacent ranges, the fault may have a considerably shallower dip in the subsurface.
Paleoseismology studies	Machette (1988 #1221) published a detailed study of the fault that was based on a comprehensive analysis of scarp morphology, soil development, and trenching of four sites. On this section of the fault, he trenched two sites. The northern site (2109-3) is on segment B, whereas the southern site (2109-4) is on segment A. No trenches were excavated on segment C owing to restricted

	access. Site 2109-3. This trench yielded evidence for two faulting events, the youngest of which occurred at about 15 ka and the older at least 500 ka. These time estimates are based on the development of moderately to strongly developed soils that were calibrated against soils on similar-age deposits; these age estimates may be in error by as much as 50 percent (compiler's assertion). The younger event (15 ka) displaces a 500-ka soil (middle Pleistocene) about 5 m. The penultimate event, estimated to have occurred somewhat before 500 ka during deposition of the piedmont slope deposits, resulted in <2 m of offset that was completely obliterated by continued deposition of piedmont-slope deposits at the site. Site 2109-4. This trench yielded evidence for a single faulting event that occurred at about 5–6 ka (middle Holocene). This time estimate is based on the faulted piedmont having weakly developed soils, which were calibrated against soils on similar-age deposits in southern New Mexico; they may be in error by as much as 50 percent (compiler's assertion). This young event offset alluvial deposits about 2.2 m in the trench, but adjacent scarps range from 0.7–2.6 m in height. There is no geologic evidence for a penultimate event at the site.
Geomorphic expression	The fault forms prominent east- and northeast-facing scarps on alluvial fans and piedmont slopes at the eastern base of the Magdalena Mountains. The scarps are as little as 1 m high to as much as 6.5 m high, and generally decrease in height south of Water Canyon. Machette (1988 #1221) measured almost 50 scarp profiles along this section of the fault, and separated it into three segments (A, B, and C). His plots of maximum scarp-slope angle against scarp height suggested that the scarps were all <15 ka, considerably younger than those along the northern section (segment D) just to the north of U.S. Highway 60. The scarps between the highway and Water Canyon (segments B and C) are formed on moderately sloping proximal piedmont-slope deposits close to the range front, whereas those south of Water Canyon (segment A) are as much as 2–3 km east of the range front and are formed on gently sloping medial piedmont-slope deposits.
Age of faulted surficial deposits	Machette (1988 #1221) suggested that most of the faulted proximal piedmont slope along segments B and C is of middle Pleistocene age (i.e., 130–750 ka) on the basis of detailed field

	and laboratory analyses of soil development. Conversely, most of the medial piedmont slope that is faulted along segment A is believed to be of late to latest Pleistocene age (i.e., 10–130 ka) on the basis of detailed analyses of soil development. However, no numerical ages were obtained from deposits exposed along the fault. Field studies were performed before dating techniques, such AMS dating of carbon and luminescence dating of eolian sediment, were being applied to paleoseismic studies (Machette, 1988 #1221). Younger alluvial deposits, inset into the piedmont are faulted as much as older surficial units, suggesting that the scarps are primarily the result of a single surface-faulting event, rather than multiple events as seen on the northern section of the fault.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Timing constrained by analysis of scarp morphology, trenching investigations, and detailed analyses of soil development on faulted and unfaulted deposits (Machette, 1988 #1221). Estimated times for the most recent paleoevent range from 5–6 ka on segment A (southern part of section) to 15 ka on segments B and C (central and northern part of section).
Recurrence interval	>500 k.y. *Comments:* The only piece of information on recurrence for this section comes from trench at site 2109-3, which provides evidence that the most recent faulting occurred about 15 ka, whereas the penultimate event occurred sometime before 500 ka. This long-term recurrence is supported by the presence of single-event scarps along the entire fault section.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Low slip-rate category assigned based on the long, assumed recurrence interval of more than 500 k.y.
Date and Compiler(s)	2016 Michael N. Machette, U.S. Geological Survey, Retired Richard M. Chamberlin, New Mexico Bureau of Geology & Mineral Resources
References	#7482 Chamberlin, R.M., and Love D.W., 2016, Block diagrams and cross sections illustrating geologic and tectonic evolution of

	the Sevilleta National Wildlife Refuge, Rio Grande rift, central New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-file Report 579, 16p. #7442 Chamberlin, R.M., and Osburn, G.R., 2006, Geologic map of the Water Canyon 7.5-minute quadrangle, Socorro County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 118, scale 1:24,000. #1222 Kelley, V.C., 1954, Tectonic map of a part of the upper Rio Grande area, New Mexico: U.S. Geological Survey Oil and Gas Investigations Map OM-157, 1 sheet, scale 1:190,080. #1273 Loughlin, G.F., and Koschmann, A.H., 1942, Geology and ore deposits of the Magdalena mining district, New Mexico: U.S. Geological Survey Professional Paper 200, 168 p., 5 pls. #1220 Machette, M.N., 1986, History of Quaternary offset and paleoseismicity along the La Jencia fault, central Rio Grande rift, New Mexico: Bulletin of the Seismological Society of America, v. 76, p. 259-272. #1221 Machette, M.N., 1988, Quaternary movement along the La Jencia fault, central New Mexico: U.S. Geological Survey Professional Paper 1440, 82 p., 2 pls. #1024 Machette, M.N., and McGimsey, R.G., 1983, Map of Quaternary and Pliocene faults in the Socorro and western part of the Fort Sumner 1° x 2° quadrangles, central New Mexico: U.S. Geological Survey Miscellaneous Field Studies Map MF-1465-A, 12 p. pamphlet, 1 sheet, scale 1:250,000. #1223 Machette, M.N., compiler, 1978, Preliminary geologic map of the Socorro 1° by 2° quadrangle, central New Mexico: U.S. Geological Survey Open-File Report 78-607, 1 sheet, scale 1:250,000.

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