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Quaternary Fault and Fold Database of the United States

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Alamogordo fault, McGregor section (Class A) No. 2054d

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

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Synopsis	**General:** The Alamogordo fault is a long range-bounding fault that forms the structural boundary between the Sacramento Mountains (to the east) and the Tularosa Basin (to the west) in the southern Rio Grande rift. Conspicuous, nearly continuous fault scarps extend from near the north end of the Phillips Hills southward to about 22 km northeast of Orogrande, New Mexico. Detailed geologic and geomorphic mapping has been completed along most of the fault north of the McGregor Range. Near Alamogordo, numerous scarp profiles and dating of exposures

	constrain the timing of 3–5 late Quaternary surface-rupturing earthquakes that resulted in 5–10 m of cumulative slip. In addition, mountain-front morphology and geophysical data are used to identify the Deadman section [2054c], extending south of Alamogordo, as the most active part of the fault. **Sections:** This fault has 4 sections. The northern and southern sections are defined herein on the basis of fault location relative to the main escarpment of the Sacramento Mountains as well as continuity and apparent age of scarps. The central two sections are defined based on the frequency of late Quaternary surface ruptures and systematic differences of short- and long-term throw. These differences in throw are measured using fault-scarp height, elevation of stratigraphic markers on the mountain front, the elevation of the crest of the Sacramento Mountains with respect to the base of the mountain front, and estimation of basin-fill depth using geophysical data (Koning, 1999; #5535).
Name comments	**General:** First mapped by Otte (1959 #983) and later by Pray (1961 #984), this fault was initially named the Sacramento fault (Kelly and Thompson, 1964 #7254) but subsequently renamed the Alamogordo fault (Machette, 1987 #847) for its proximity to the town of Alamogordo, New Mexico. The fault is characterized by conspicuous fault scarps that extend from near the north end of the Phillips Hills (about 60 km north of Alamogordo, New Mexico), south through Tularosa and Alamogordo, and into the McGregor Bombing Range. The southernmost scarps end near Otero County Road 506, about 45 km south of Alamogordo. **Section:** This section of the fault is named for the McGregor Bombing Range, which occupies the northeastern part of Fort Bliss. This section of the fault departs from the range front, crosses a broad piedmont, and forms the western margin of low bedrock-cored hills southeast of the Sacramento Mountains. It extends from Bug Scuffle Canyon south to Otero County Road 506 (Pipeline Canyon 7.5-minute quadrangle). **Fault ID:** Previously referred to as fault 7 on figure 1 and table 2 of Machette (1987 #847), the southernmost part of 2054a and the northern part of 2054b (Machette and others, 1998 #2848).
County(s) and State(s)	OTERO COUNTY, NEW MEXICO
Physiographic province(s)	BASIN AND RANGE

Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* The fault was mapped from aerial photographs (scale of approximately 1:24,000) using stereogrammetry software (Stereo Analyst for ARCGIS 10.1, an ERDAS extension, version 11.0.6). Previous aerial photography-based mapping and field studies by Machette (1987 #847) aided this effort.
Geologic setting	The Alamogordo fault is a west-down, range-front normal fault forming the structural boundary between the west side of the Sacramento Mountains and the Tularosa Basin. The eastern Tularosa Basin corresponds to a half-graben tilted eastward towards the Alamogordo fault (Healy and others, 1978 #7329; Orr and Myers, 1986 #7338; Seager and others, 1987 #627; Johnson and others, 1989 #7331; Lozinsky and Bauer, 1991 #7336). The Alamogordo fault juxtaposes Quaternary basin fill against Paleozoic bedrock at the foot of the Sacramento Mountains. Due to variable northward and southward components of dip in the mountain block, the particular Paleozoic lithologic unit exposed at the ranges from Ordovician through Permian (Pray, 1961 #984). Sufficient throw occurred 25 km south of Alamogordo to expose local Proterozoic rock at the base of the mountains (Pray, 1961 #984). North of La Luz, a broad pediment surface has formed largely in erodible strata of the Abo Formation (Otte, 1959 #983). In the Three Rivers area, relatively low hills, including the Phillips Hills, are found on the immediate footwall of the fault. Aside from the Godfrey Hills, relatively low relief and shallow Quaternary deposits characterizes the 18- to 23-km-wide area between the northern Alamogordo fault (i.e., the Three Rivers section) east to the imposing western face of Sierra Blanca. South of Bug Scuffle Canyon, the fault forms small scarps across the piedmont slope and along low-relief bedrock hills. Depth to basement in the eastern Tularosa Basin is 200–1,200 m based on geophysical and well data (Hood, 1959 #7330; McLean, 1970 #7337; Healy and others, 1978 #7329 Orr and Myers, 1986 #7338; Lanka, 1995 #7335; gravity and aeromagnetic data from R. Keller, pers. comm., 1998; Koning, 1999 #5535).
Length (km)	This section is 15 km of a total fault length of 130 km.
Average strike	N21°E (for section) versus N10°W (for whole fault)
Sense of	

Sense of movement	Normal
Dip Direction	W *Comments:* Suspected to be a high-angle normal dip-slip fault from regional geologic studies and from other faults associated with downdropping of the Tularosa basin.
Paleoseismology studies	
Geomorphic expression	The scarps along this section depart from the Sacramento Mountain front at Bug Scuffle Canyon, and extend south across a west-sloping piedmont. The scarps are west-facing and as much as 25 m high on dissected Quaternary Camp Rice Formation, piedmont facies (?). The scarps are clearly the product of multiple faulting events, whereas the smaller scarps on late (?) Quaternary piedmont-deposits may be the result of only one or two faulting events. Initial reconnaissance of these scarps suggested an age as young as late Pleistocene, but not of latest Pleistocene age (Machette, 1996, unpub. data). However, more recent comparison of scarp morphology, using aerial photography, between this section and the Deadman section (2054c) suggest enough similarity to assign a latest Pleistocene most-recent rupture event. The fault forms prominent and conspicuous scarps as far south as Otero County Road 506; no conspicuous scarps were found south of the road.
Age of faulted surficial deposits	There have been no detailed studies of the Quaternary deposits or scarps along this section of the fault. The high scarps are probably on early to late Pleistocene alluvium.
Historic earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:* Timing poorly controlled but based on presence of small, yet clear scarps on piedmont slope deposits of suspected late Quaternary age; however, the most recent surface rupture may be latest Pleistocene (15–10 ka) in age.
Recurrence interval	

Slip-rate category	Less than 0.2 mm/yr *Comments:* Low slip-rate category assigned is based on lower rate of activity (smaller scarps) than along the Deadman section of the Alamogordo fault.
Date and Compiler(s)	2016 Daniel J. Koning, New Mexico Bureau of Geology & Mineral Resources Michael N. Machette, U.S. Geological Survey, Retired Keith I. Kelson, William Lettis & Associates, Inc.
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