Jump to Navigation

Quaternary Fault and Fold Database of the United States

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Red Hills fault, northern section (Class A) No. 2087a

Last Review Date: 2016-01-13

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 2087a, Red Hills fault, northern 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 02:22 PM.**

Synopsis	**General:** This normal fault bounds Precambrian, Paleozoic, and Tertiary rocks that are uplifted in a north-trending horst, southwest of the Caballo Mountains block. The fault forms part of the eastern margin of the Palomas Basin, an eastward-tilted, sediment-filled half-graben. The Red Hills fault joins the Caballo fault [2088] on the north and appears to abut or project to the Derry fault [2086] on the south. These three faults form the western, tectonically active margin of the Caballo uplift (Caballo Mountains, Red Hills, Derry Hills, Round Mountain, and Red House Mountain). Quaternary deposits of the Camp Rice

	Formation and middle to late Pleistocene piedmont-slope deposits are offset along almost the entire length of the Red Hills fault. However, no detailed studies have addressed the fault's Quaternary history. **Sections:** This fault has 2 sections. These sections are based on the aforementioned character of the fault. Section boundary placed in southwest corner of Sec. 4, T. 17 S., R. 4 W. (Garfield 7.5-minute quadrangle).
Name comments	**General:** Named by Kelley and Silver (1952 #1072) for the Red Hills, a horst block southeast of Caballo Dam and southwest of the Caballo Mountains. The fault extends from Caballo Creek (about 3 km east of Caballo Dam) where it joins the Caballo fault [2088], southwest and south to a point about 4 km east of Derry, New Mexico, where it projects to or abuts the Derry fault [2086]. **Section:** The section extends from Caballo Creek (about 3 km east of Caballo Dam) where it joins the Caballo fault [2088], southwest and south to a point about 2.5 km north of the mouth of Green Canyon (southwest corner of Sec. 4, T. 17 S., R. 4 W., Garfield 7.5-minute quadrangle). The southern boundary of the section is based on the geology of hanging-wall deposits and footwall structure. Seager and others (1982 #626) and Seager and Mack (1991 #1263; 2005 #1257) showed primarily young piedmont-slope deposits with subordinate undifferentiated facies of the Palomas Formation (Pliocene-Pleistocene) against bedrock along this section. **Fault ID:** Referred to as fault 10 in Machette (1987 #960).
County(s) and State(s)	SIERRA COUNTY, NEW MEXICO
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Fault trace from 1:24,000-scale maps of Seager and Mack (1991 #1263; 2005 #1257) combined with accurate placement using photogrammetric methods. Older geologic maps do not show the Red Hills and Caballo faults joining to the north, although Kelley and Silver (1952 #1072) alluded to the possibility of such a connection.

Geologic setting	This down-to-the-west normal fault bounds Precambrian, Paleozoic, and Tertiary rocks that are uplifted in a north-trending horst southeast of the Caballo Mountains block. The fault forms part of the eastern margin of the Palomas Basin, an eastward-tilted, sediment-filled half-graben. The fault was probably initiated in the Miocene; it cuts Tertiary and Quaternary deposits of the Santa Fe Group, sediment of the Palomas Formation (largely equivalent to the Pliocene to Pleistocene Camp Rice Formation to the south), and locally derived piedmont-slope deposits of middle to late Quaternary age. The fault changes character at its approximate mid-point: to the north, it places piedmont-slope deposits against bedrock and to the south the hanging wall is comprised mainly of sediment of the Palomas Formation. Also, this point marks a prominent southward bifurcation in the fault, with some strands trending southeast into Paleozoic bedrock. The point at which this change in character occurs may reflect long-term differences in slip rate, and may prove to be a fault segment boundary. However, no detailed studies have been made of the fault's scarp morphology or its Quaternary history to warrant such a segmentation model.
Length (km)	This section is 9 km of a total fault length of 14 km.
Average strike	N5°E (for section) versus N7°W (for whole fault)
Sense of movement	Normal *Comments:* Kelley and Silver (1952 #1072) considered the fault to be normal dip slip.
Dip	67° W *Comments:* Kelley and Silver (1952 #1072) showed the fault as high-angle on their cross sections E and F, whereas Seager and others (1982 #626) showed a single dip measurement of 67° near the south end of the section. Seager and Mack (1991 #1263, 2005 #1257) showed dip measurements of 50–60° along the northern section of the fault.
Paleoseismology studies	
Geomorphic expression	The Red Hills fault forms a prominent topographic escarpment, most of which is a fault-line escarpment formed on Precambrian

	and Paleozoic rocks exposed in the footwall block. However, according to Seager (oral commun., 1996) the fault forms small but prominent local scarps on late Pleistocene alluvium (unit Qvo of Seager and others, 1982 #626). Along the northern part of the section, the fault turns northeast and trends subparallel to drainages that it appears to control (Foley and others, 1988 #991). Detailed mapping by Seager and Mack (1991 #1263) and by Machette (unpubl. mapping used in Machette, 1987 #960) shows discontinuous fault scarps between Flordillo Canyon (also known as Cable Canyon; north end of section) and Apache Creek, at the north end of the Red Hills. The fault forms a 5–10 m high bedrock scarp south of Apache Canyon (Foley and others, 1988 #991). No detailed studies have been made of the fault's scarp morphology or its Quaternary history
Age of faulted surficial deposits	Most facies of the Camp Rice Formation (Pliocene to early or middle (?) Pleistocene) are faulted against bedrock. Detailed mapping by Seager and Mack (1991 #1263, 2005 #1257) indicated that their unit Qvo (late Pleistocene piedmont-slope deposits) is displaced by the fault at a number of sites along this section of the fault.
Historic earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:* Timing based on offset of unit Qvo of Seager and others (1982 #626) and presence of fresh-appearing scarps on bedrock at the northern end of the section. Seager and Mack (2003 #7347) note that the youngest units offset by the fault correlate to Picacho alluvium (~50–150 ka), and that the fault could have Holocene offset based on its continuity with the central Caballo and Williamsburg faults.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* Unit Qvo appears to have a scarp that is about 3–5 m high. The amount of offset in older sediment of the Camp Rice Formation cannot be determined because these deposits are only present on the hanging-wall block of the fault. However, based on comparisons with the Caballo fault [2088] and other associated

	faults in the region, this section of the Red Hills fault probably has a low slip rate (<0.2 mm/yr).
Date and Compiler(s)	2016 Michael N. Machette, U.S. Geological Survey, Retired Andrew P. Jochems, New Mexico Bureau of Geology & Mineral Resources
References	#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. #1072 Kelley, V.C., and Silver, C., 1952, Geology of the Caballo Mountains: University of New Mexico Publications in Geology 4, 286 p., 9 pls. #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. #1263 Seager, W.R., and Mack, G.H., 1991, Geology of Garfield quadrangle, Sierra and Doña Ana Counties, New Mexico: New Mexico Bureau of Mines and Mineral Resources Bulletin 128, 2 pls., scale 1:24,000. #7347 Seager, W.R., and Mack, G.H., 2003, Geology of the Caballo Mountains, New Mexico: New Mexico Bureau of Geology and Mineral Resources Memoir 49, 136 p. #1257 Seager, W.R., and Mack, G.H., 2005, Geology of Caballo and Apache Gap quadrangles, Sierra County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Geologic Map 74, 1 sheet, scale 1:24,000. #626 Seager, W.R., Clemons, R.E., Hawley, J.W., and Kelley, R.E., 1982, Geology of northwest part of Las Cruces 1° x 2° sheet, New Mexico: New Mexico Bureau of Mines and Mineral Resources Geologic Map 53, 3 sheets, scale 1:125,000.

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