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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.

Hot Springs fault (Class A) No. 2100

Last Review Date: 2016-04-05

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 2100, Hot 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	This northeast-trending, down-to-the-west normal fault bounds Paleozoic and Cretaceous rocks in the north-trending, east-tilted Caballo block and further northeast forms part of the southeastern margin of the Engle basin. Of special concern is the fault's proximity to Elephant Butte Dam. Although the fault is known to have Quaternary motion, detailed studies have not been able to decipher the fault's history in any significant detail. The northern half of the fault now lies submerged beneath Elephant Butte Reservoir.
Name comments	First mapped in detail and named by Kelley and Silver (1952 #1072) for the town of Hot Springs, New Mexico, which is now

	known as Truth or Consequences. The fault extends from about 6 km north of Kettle Top Butte (Lozinsky, 1986 #1073) south to the northern Red Hills (Kelley and Silver, 1952 #1072), about 6 km south of Truth or Consequences. **Fault ID:** Referred to as fault 8 on fig. 1 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:* Trace of the central part of the fault is from detailed (1:25,000-scale) geologic mapping by Lozinsky (1986 #1073). The southern end is from 1:24,000-scale geologic mapping by Jochems and Koning (2015 #7348) and Seager (unpub. mapping of Palomas Gap 7.5-minute quadrangle). Kelley and Silver (1952 #1072), whereas the northern end is from 1:24,000-scale geologic mapping by Warren (1978 #1079) and Cikoski and Koning (unpub. mapping of Black Bluffs 7.5-minute quadrangle) combined with accurate placement using photogrammetric methods.
Geologic setting	This northeast trending, down-to-the-west primarily normal fault bounds Paleozoic and Cretaceous rocks that are uplifted in the north-trending, east-tilted Caballo block. Northeast of Truth or Consequences, the fault forms part of the southeastern margin of the Engle basin, an eastward-tilted sediment-filled half graben (Lozinsky, 1986 #1073). Of special concern is the fault's location 1.5 km northwest of the left abutment of the embankment dike of Elephant Butte Dam (Foley and others, 1988 #991). The Hot Springs fault forks into two splays at both its north and south ends. On the north, the Hot Springs fault (the western splay) ends in sediment of the Santa Fe Group whereas the eastern splay continues north as the Walnut Springs fault [2102] of Warren (1978 #1079). On the south end, the Hot Springs fault (the western splay) separates Precambrian and Paleozoic rock from Santa Fe Group sediment and terminates against the Williamsburg section of the Caballo fault [2088a]. The eastern splay (south of the Rio Grande) represents the northern, range-bounding portion

	of the Caballo fault [2088], which displays no evidence of Quaternary movement. These two southern splays form an intermediate-level structural element of the Caballo block. Collectively, the Caballo, Hot Springs [2100], and Walnut Springs [2102] faults form the western, tectonically active margins of the Caballo Mountains, Palomas and Engle basins, and Fra Cristobal Range (respectively). At least half of the trace of the Hot Springs fault lies buried beneath Elephant Butte Reservoir, east and northeast of Truth or Consequences.
Length (km)	28 km.
Average strike	N24°E
Sense of movement	Normal, Right lateral *Comments:* Late Cenozoic motion was predominately normal and Lozinsky (1986 #1073) suggested that some of the apparent lateral offset across the fault zone noticed by Kelley and Silver (1952 #1072) may be the result of right-lateral strike slip motion related to Laramide compression rather than Cenozoic extension. Further work by Harrison and Cather (2004 #7489) synthesizes geophysical evidence and field relations to demonstrate a potentially significant dextral component of offset on the Hot Springs fault, though most of this lateral motion occurred prior to the Quaternary.
Dip	78° NW *Comments:* Lozinsky (1986 #1073) showed the fault as having a 78° NW dip and characterizes it as relatively high dip (70–80°) in his text and on his cross sections B and D.
Paleoseismology studies	
Geomorphic expression	No fault scarps were found by Lozinsky (1986 #1073) on Quaternary surficial deposits younger than the Palomas Formation along the fault. However, the fault forms bedrock-cored escarpments along the southernmost and northernmost parts of the fault. Along the northwest flank of the Caballo Mountains, these scarps are 50–150 m high where the fault juxtaposes Precambrian or Paleozoic rock with sediment of the Palomas Formation.
Age of faulted	Lozinsky (1986 #1073) mapped the fault as cutting the piedmont

surficial deposits	facies of the Palomas Formation (Pliocene to early or middle Pleistocene). In addition, the fault seems to have controlled the eastward margin of the ancestral Rio Grande during aggradation of the Engle basin. Along the southern part of the fault, south of Lozinsky's map area, Hawley and Seager (1978) mentioned that the fault offsets sediment of the upper part of the Santa Fe Group (Palomas Formation). Conversely, there appears to be no significant offset of 2.5 Ma basalts exposed on Rattlesnake Island in Elephant Butte Reservoir, but Machette (1987 #960) cited evidence from Warren (1978 #1079) that there is as much as 90 m offset in Quaternary basalts (probably late Pliocene, 2–3 Ma) farther north near Black Bluffs. Thus, it appears that a significant portion of the fault probably has stratigraphic evidence of at least early Pleistocene offset.
Historic earthquake	
Most recent prehistoric deformation	undifferentiated Quaternary (<1.6 Ma) *Comments:* Early Pleistocene offset is suggested by offset of the piedmont facies of the Palomas Formation (Pliocene to early Pleistocene). Middle Pleistocene movement cannot be ruled out because deposits of this age are not preserved along the trace of the fault; however Lozinsky (1986 #1073) found no offset of late Quaternary terrace deposits along the fault. Foley and others (1988 #991) came to the same conclusion concerning a lack of late Quaternary movement on the fault.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* Machette (1987 #960) cited evidence that 2–3 Ma basalts are offset as much as 90 m along the northern trace of the fault. These data yield a low long-term vertical displacement rate.
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.

#7489 Harrison, R.W., and Cather, S.M., 2004, The Hot Springs fault system of south-central New Mexico—Evidence for the northward translation of the Colorado Plateau during the Laramide orogeny: New Mexico Bureau of Geology and Mineral Resources Bulletin 160, p. 161-179.

#7348 Jochems, A.P., and Koning, D.J., 2015, Geologic map of the Williamsburg 7.5-minute quadrangle, Sierra County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 250, 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.

#1073 Lozinsky, R.R., 1986, Geology and late Cenozoic history of the Elephant Butte area, Sierra County, New Mexico: New Mexico Bureau of Mines and Mineral Resources Circular 187, 40 p., 2 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.

#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.