Jump to Navigation

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.

Santa Rita fault zone (Class A) No. 934

Last Review Date: 1996-01-02

Compiled in cooperation with the Arizona Geological Survey

citation for this record: **Pearthree, P.A., compiler, 1996, Fault number 934, Santa Rita fault zone, 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 03:11 PM.**

Synopsis	Discontinuous fault scarps trend north to northeast along the western piedmont of the Santa Rita Mountains southeast of Tucson. The scarps are along the east side of a deep Cenozoic basin; seismic reflection data suggests that the northern part of the fault zone dips about 20? to the west at depth. Detailed surficial geologic mapping, fault-scarp analysis, and trenching indicate that two fault rupture events have occurred in the past 200 to 300 k.y. The youngest rupture event likely occurred in the late Pleistocene (ca. 60 to 100 ka). There is no evidence of faulting in the early Pleistocene. A 7-km-long gap in fault scarps near the middle of the fault zone suggests the possibility of separate ruptures on the northern and southern parts of the fault. There is

	no clear difference in the age of youngest movement north and south of the gap, but the available timing data is crude.
Name comments	Part of the fault zone was mapped by Drewes (1971 #2121), whereas the entire fault zone was mapped by Menges and Pearthree (1983 #2073), Pearthree and others (1983 #2083), and Pearthree and Calvo (1987 #1023).
County(s) and State(s)	SANTA CRUZ COUNTY, ARIZONA PIMA COUNTY, ARIZONA
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:250,000 scale. *Comments:* Trace based on detailed mapping at 1:48,000-scale with extensive field-checking by Pearthree and Calvo (1987 #1023); transferred to 1:250,000-scale topographic map.
Geologic setting	Piedmont fault scarps parallel the general north to northeast trend of the Santa Rita Mountains. The fault zone is near east side of the deep (1500-3000 m) upper Cenozoic Santa Cruz sedimentary basin. This basin is fairly narrow (<10 km) along the southern part of the fault, but doubles in width to the north. Seismic reflection data from the northern part of the fault suggests that the fault dips shallowly westward or northwestward beneath the Tucson basin. The fault displaces upper, middle, and lower Pleistocene deposits; total displacement of middle and lower deposits is the same, implying no significant early Pleistocene faulting.
Length (km)	52 km.
Average strike	N26°E
Sense of movement	Normal *Comments:* Based on fault dip and stratigraphic displacements observed in trench (Pearthree and Calvo, 1987 #1023).
Dip	70° to 90° at surface; 20° at depth *Comments:* Near surface dips are from trench exposure of faults in middle and upper Pleistocene alluvium; dips in the subsurface

	are based on interpretation of seismic-reflection data (Johnson and Loy, 1992 #2122)
Paleoseismology studies	Site 934-1. One trench was excavated across the central part of the fault zone, near Madera Canyon (Pearthree and Calvo, 1987 #1023). No datable material was recovered from the trench, but soil-age estimates and offset relations indicate that late Pleistocene alluvium is displaced about 2 m and middle Pleistocene alluvium is displaced about 3.5 m. Latest Pleistocene deposits are not faulted.
Geomorphic expression	Quaternary faulting is expressed as low, subdued, west- to northwest-facing piedmont scarps as much as 3 m high on late Pleistocene alluvial fans and terraces and as much as 5 m high on middle Pleistocene older alluvial fans. Scarp heights on middle and early Pleistocene alluvial fans are the same. The faults are located 3-5 km downslope from the fairly steep, but deeply embayed topographic front of the Santa Rita Mountains. Analysis of scarp morphology indicates a late Pleistocene (ca. 60 to 100 ka) age for the youngest surface rupture (Pearthree and Calvo, 1987 #1023).
Age of faulted surficial deposits	Early (about 1-2 Ma), middle (about 200-750 ka), and late (about 100 ka) Pleistocene. Deposit age estimates are based on soil development and geomorphic surface characteristics (Pearthree and Calvo, 1987 #1023).
Historic earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:* Trenching, surface-age estimates, and fault scarp morphology all indicate that the age of youngest movement is late Pleistocene (ca. 60 to 100 ka).
Recurrence interval	 *Comments:* Recurrence intervals are unknown but are probably long based on evidence for two fault-rupture events in the past 200 to 300 k.y.
Slip-rate category	Less than 0.2 mm/yr *Comments:* A low slip rate is inferred based on about 4 m of

	vertical displacement since the late middle Pleistocene (200 to 300 ka) and about 2 m of vertical displacement in the late Pleistocene (ca. 100 ka).
Date and Compiler(s)	1996 Philip A. Pearthree, Arizona Geological Survey
References	#2121 Drewes, H.D., 1971, Geologic map of the Sahuarita quadrangle, southeast of Tucson, Pima County, Arizona: U.S. Geological Survey Miscellaneous Geologic Investigations I-0613, 1 sheet, scale 1:48.000. #2122 Johnson, R.A., and Loy, K.L., 1992, Seismic reflection evidence for seismogenic low-angle faulting in southeastern Arizona: Geology, v. 20, no. 7, p. 597-600. #2073 Menges, C.M., and Pearthree, P.A., 1983, Map of neotectonic (latest Pliocene-Quaternary) deformation in Arizona: Arizona Geological Survey Open-File Report 83-22, 48 p., scale 1:500,000. #1023 Pearthree, P.A., and Calvo, S.S., 1987, The Santa Rita fault zone—Evidence for large magnitude earthquakes with very long recurrence intervals, Basin and Range province of southeastern Arizona: Bulletin of the Seismological Society of America, v. 77, p. 97-116. #2083 Pearthree, P.A., Menges, C.M., and Mayer, L., 1983, Distribution, recurrence, and possible tectonic implications of late Quaternary faulting in Arizona: Arizona Geological Survey Open-File Report 83-20, 51 p.