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Quaternary Fault and Fold Database of the United States

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San Felipe fault zone, Algodones section (Class A) No. 2030b

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

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Synopsis	**General:** The San Felipe fault zone is a broad zone of normal faults that offset basalts of the San Felipe volcanic field and underlying Santa Fe Group sedimentary rocks. The fault zone is best expressed where individual fault strands offset the volcanic tablelands of Santa Ana Mesa. The fault zone is primarily a graben, centered on the westernmost of two north-trending eruptive centers in the volcanic field. This structure, the San Felipe graben, is bound on the west by the down-to-the-east Luce and Santa Ana faults, and on the east by the down-to-the-west Algodones fault. Most of these faults offset the 2.4–2.6 Ma basalt

	flows of the San Felipe volcanic field. Average displacements on most faults are 15–30 m, although some of the larger structures, such as the Luce fault, have as much as 90–120 m of vertical displacement. **Sections:** This fault has 2 sections. Wong and others (1995 #1155) used the polarity of faults in the San Felipe fault zone to delineate two sections: down-to-the-east faults that form the western margin of the San Felipe graben (Santa Ana and Luce faults) are included in the Santa Ana section, and down-to-the-west faults that form the eastern margin of the graben (Algodones fault) are include in the Algodones section. They assumed that one of these sections is a "master fault" that controls both sections, but they did not have enough subsurface data to support either scenario.
Name comments	**General:** This complex of numerous, generally north-trending normal faults near Santa Ana Mesa was first mapped in detail by Soister (1952 #1418). Kelley (1954 #1222) followed Soister's mapping closely in his compilation, and applied the name San Felipe fault zone to these structures. Later maps by Smith and others (1970 #1125), Kelley (1977 #1106), and Kelley and Kudo (1978 #1307) show similar fault patterns. Kelley (1977 #1106) named many of the more prominent structures in the zone, such as the Santa Ana, Luce, Cocida, and Algodones faults and the San Felipe graben. In their compilation, Wong and others (1995 #1155) used the name "San Felipe fault zone". **Section:** The Algodones section includes the Algodones fault of Kelley (1977 #1106) and numerous smaller displacement down-to-the-west faults that form the east flank of the San Felipe graben. Some strands of the Algodones section of the San Felipe fault zone have been projected southward across the Rio Grande and connected with parts of the Valley View fault (Kelley, 1977 #1106; Wong and others, 1995 #1155), but detailed mapping by Connell (1995 #1291), Connell and others (1995 #1764), and Cather and Connell (1998 #7435) shows that strands of the Valley View fault trend northeasterly at their northern ends and probably do not connect with the San Felipe fault zone.
County(s) and State(s)	SANDOVAL COUNTY, NEW MEXICO
Physiographic province(s)	BASIN AND RANGE

Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Fault locations are good where faults cut volcanic rocks, but locations are poor in the less resistant Santa Fe Group rocks. Fault traces are from 1:24,000-scale maps of Cather and Connell (1998 #7435), Connell (1998 #7502), Smith and Kuhle (1998 #1771), Chamberlin and others (1999 #7524), and Personius (2002 #7526). A.P. Jochems used photogrammetric methods to accurately place fault traces in some locations.
Geologic setting	The San Felipe fault zone is located in the western part of the Santo Domingo basin of the Rio Grande rift as defined by Smith and others (2001 #7438). The Santo Domingo basin links the en echelon Albuquerque and Española basins, and kinematic and paleostress evidence suggests that the basin functions as a relay that began to narrow in Plio-Pleistocene time (Minor and others, 2013 #7437). The fault zone forms a north-trending graben within the San Felipe volcanic field. Although Wong and others (1995 #1155) conclude that this graben is a minor sub-basin within the Rio Grande rift, the narrowing of the fault zone within the volcanic field indicates that the geometry of the fault zone may be in part controlled by volcanic activity (for example, van Wyk de Vries and Merle, 1996 #1422).
Length (km)	This section is 45 km of a total fault length of 48 km.
Average strike	N7°W (for section) versus N1°E (for whole fault)
Sense of movement	Normal
Dip	64–74° W *Comments:* Dips of 64–74° are reported for west-dipping faults belonging to the Algodones section of the San Felipe fault zone (Connell, 1998 #7502; Personius, 2002 #7526). In addition, Connell (1998 #7502) reported a dip of 77° toward the east along one of the few east-dipping strands in the Algodones section 1.5 km northwest of Canjilon Hill in the Bernalillo 7.5-minute quadrangle
Paleoseismology studies	

Geomorphic expression	The Algodones fault and other faults that cut the basalt flows of the San Felipe volcanic field are well preserved as escarpments covered by basalt talus. Where these structures are located in Santa Fe Group rocks, fault expression is poor. Soister (1952 #1418) and Kelley (1977 #1106) measured average displacements of 15–30 m in basalts on most structures in the San Felipe fault zone, and as much as 90–120 m on larger structures such as the Luce fault in the Santa Ana section.
Age of faulted surficial deposits	Faults in the Algodones section offset the 2.4-2.6 Ma (Bachman and Mehnert, 1978 #1265; Smith and Kuhle, 1998 #1771) basalts of the San Felipe volcanic field and underlying Santa Fe Group sedimentary rocks. Soister (1952 #1418) describes offset of his early Pleistocene Mesita Alta gravel and surface, which overlies San Felipe basalt flows in several places.
Historic earthquake	
Most recent prehistoric deformation	undifferentiated Quaternary (<1.6 Ma) *Comments:* No detailed studies of the age of most recent movement have been conducted. However, early Pleistocene gravels are offset locally and 90–120 m of post-San Felipe basalt (2.4-2.6 Ma) displacement has occurred.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* Wong and others (1995 #1155) calculated long-term slip rates of 0.01–0.04 mm/yr based on 90–120 m of displacement that has occurred on the Luce fault since deposition of the San Felipe basalt (2.4-2.6 Ma) and similar data. They also concluded that it is likely that some of the major faults within the San Felipe fault zone act as independent rupture segments, but could not rule out the possibility that some faults rupture together.
Date and Compiler(s)	2016 Stephen F. Personius, U.S. Geological Survey Keith I. Kelson, William Lettis & Associates, Inc. Andrew P. Jochems, New Mexico Bureau of Geology & Mineral Resources

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