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Organ Mountains fault, Cox Ranch section (Class A) No. 2052a

Last Review Date: 2015-12-15

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

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Synopsis	**General:** This north-trending major piedmont fault bounds the eastern margin of the Organ Mountains, although in most places the fault is within Quaternary piedmont-slope deposits. This fault is characterized by prominent, high scarps on middle to late Quaternary deposits and appears to be one of the most recently active faults in this part of the Rio Grande rift. Detailed studies of soils on alluvial-fan deposits that are offset by the fault yielded information on slip rates and the most recent time of movement. A single deep trench across the fault failed to yield conclusive

	paleoseismic information owing to lack of penetration of fault colluvium on the downdropped block. **Sections:** This fault has 2 sections. It is divided into two sections on the basis of apparent differences in recency of movement and geomorphic expression. The southern 6.5 km of the fault [2052b] appears to be older and has a substantially lower slip rate than the Cox Ranch section [2052a].
Name comments	**General:** Seager (1981 #968) first applied the name Organ Mountains to this fault, although Reiche (1938 #972) appears to have been the first to describe the feature and to note its youthfulness. However, Reiche (1938 #972) only recognized about 6 km of the fault south of the Cox Ranch headquarters. Gile referred to this part of the fault as the Cox Ranch segment, although segment was used in a geometric rather than seismologic sense. As defined here, the Organ Mountains fault extends from a prominent counter-clockwise bend in the fault just south of U.S Highway 70 and Antelope Hill to its intersection with the Artillery Range fault [2051] on the southeast margin of the Organ Mountains. Seager (1981 #968) extended the fault north of U.S Highway 70 to the latitude of Bear Mountain, but his northern limit was not defined by structural or paleoseismic information. Therefore, the name and limits of the fault are herein restricted to correspond with its namesake, the Organ Mountains. **Section:** Named herein for prominent, well-studied fault scarps that are within the J.M. Cox Ranch, due west of White Sands, New Mexico. Seager (1981 #968) referred to the entire fault as the Organ Mountains fault, but did not suggest either sections or segments. Gile (1986 #967) referred to this part of the fault as the Cox Ranch segment, although segment was used in a geometric rather than seismologic sense. Similarly, Beehner (1990 #971) referred to these as the Cox Ranch scarps. Therefore, it seems appropriate to apply the name Cox Ranch to this northern section of the fault, which extends from south of Antelope Hill to a point about 6.5 km north of the fault's southern intersection with the Artillery Range fault [2051a]. It includes a single basinward splay near the southern end of the section. **Fault ID:** Referred to as fault 4 on figure 1 and table 2 of Machette (1987 #847).
County(s) and State(s)	DONA ANA COUNTY, NEW MEXICO

Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Location based on 1:31,250-scale mapping of Seager (1981 #968), which was later compiled at 1:125,000 scale (Seager and others, 1987 #627). Gile (1986 #967) studied small portions of the fault and showed its relation to soils on large-scale aerial photographs, whereas Machette (1987 #847) included a 1:24,000-scale map of the fault scarps near Cox Ranch. The location of the fault was digitized at 1:24,000 scale using photogrammetry to accurately map its trace from these maps.
Geologic setting	The fault is part of a longer system that extends from the latitude of Capital Peak in the northern White Sands Proving Grounds south to Juarez, Mexico. It joins the latest Pleistocene-age San Andres Mountains fault [2053] on the north and the late Pleistocene age Artillery Range fault [2051] on the south. The trace of the Organ Mountains fault is entirely within Quaternary deposits, although Precambrian bedrock of the Organ Mountains is generally either in close proximity to the fault or at shallow depth on the upthrown fault block.
Length (km)	This section is 18 km of a total fault length of 25 km.
Average strike	N4°W (for section) versus N3°W (for whole fault)
Sense of movement	Normal *Comments:* Inferred from drilling and gravity measurements in the Tularosa Basin. Seager (1981 #968) estimated there may be as much as 4–5 km of throw across the Organ Mountains fault and similar buried faults on the west side of the Tularosa Basin.
Dip	60°–75° E. *Comments:* Seager (1981 #968) reported near-surface dips of 60°–75° E. based on a natural exposure of the southern section of the San Andres Mountains fault [2053c] along U.S. Highway 70.
Paleoseismology studies	There have been detailed studies at two closely spaced sites along this section of the fault.

	Gile conducted extensive studies of soil geomorphic relations on scarps south of the Cox Ranch. Trench excavations (site 2052-1) were used to characterize soil texture and development, to place limits on the timing of most recent movement (Gile, 1986 #967, 1987 #970) and to estimate the time of previous movement (Gile, 1994 #966). No radiocarbon ages were obtained to limit or date the most recent faulting event. At a second site (2052-2), Beehner (1990 #971) made similar geomorphic observations and excavated a single deep trench along an arroyo that crosses a scarp on Organ I/II alluvium (Holocene); unfortunately, the basinward end of the trench only intercepted the uppermost part or strand of the Organ fault and yielded no new paleoseismic information.
Geomorphic expression	Scarps along this section of the fault are nearly continuous, the exceptions being in areas of late Holocene alluvial deposition. Reiche (1938 #972) reported scarp heights of 5–30 m and scarp slope angles of 29–35°. These perceptive observations led him to speculate that faulting occurred in recent times. Machette (1987 #847) made 11 detailed topographic profiles of the scarps in this same area and recorded scarp heights that range from 1.6–6.3 m on Holocene deposits to as much as 26 m on middle Pleistocene alluvial fans. Most of the scarps greater than 5 m high have slope angles steeper than 25° (Machette, 1987 #847); faulted deposits are coarse grained.
Age of faulted surficial deposits	In the vicinity of Cox Ranch, Holocene and older alluvial deposits are offset by the fault (Gile, 1986 #967; Machette, 1987 #847; Gile, 1987 #970; Gile, 1994 #966). The Organ II alluvium (1,100-2,100 yr B.P.) is offset as much as 5 m, but the younger Organ II alluvium (<1,100 yr B.P.) is not offset (Gile, 1986 #967, 1987 #970). Deposits that form older surfaces (Holocene to late Pleistocene) are offset by two faulting events, whereas the higher landscapes (Jornada I surface) have scarps approaching 25 m in height, and reflect many faulting events (Machette, 1987 #847; Gile, 1994 #966). In as much as the fault usually lies at the base of the larger scarps, their heights may only represent one-half of the total offset for that age deposit. The Jornada I surface is not well dated but is generally considered to have stabilized in the middle Pleistocene (250–400 ka) (table 1 in Gile, 1987 #970).
Historic earthquake	

Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Gile (1986 #967; 1987 #970) argued that the most recent faulting in the vicinity of Cox Ranch occurred about 1,000 years ago. This estimate was based on displacement of the Organ II alluvium (1,100–2,100 yr B.P.) and the degree of soil development on colluvium derived from this faulting event. Machette (1987 #847) estimated that the most recent movement was middle Holocene, but this was based on the morphology of scarps that are probably the result of multiple (2) faulting events. Even though the scarps have been studied in some detail, neither the most recent nor penultimate event have been dated directly using analytical methods.
Recurrence interval	4–15 k.y. (<15 ka) *Comments:* Machette (1987 #847) estimated a recurrence interval of 4–5 k.y. for this section of the fault on the basis of two different heights of scarps (1.6–2.0 m versus 4.1–6.3 m) on fan deposits correlated with the Organ alluvium. Gile (1994 #966) speculated that the penultimate event on this section of the fault might be latest Pleistocene in age, which would allow the most recent recurrence interval to be as much as 10–15 k.y. However, since neither the most recent or penultimate events are directly dated, the recurrence interval is poorly constrained.
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Inferred slip rate based on Machette's (1987 #847) detailed measurements of scarp heights indicating that 1.6–2.0 m of vertical displacement (at about 1,000 years ago) was released after 4–5 k.y. of fault quiescence. Earlier work by Seager (1981 #968), however, suggests about 10 m of displacement in the past 5 k.y., which yields a much larger vertical displacement rate. In terms of longer-term slip rates, the bounds are defined by 25–50 m of displacement of the 250–400 ka Jornada I surface, which yields a vertical displacement rate of less than half of that for the most recent event.
Date and Compiler(s)	2015 Michael N. Machette, U.S. Geological Survey, Retired Andrew P. Jochems, New Mexico Bureau of Geology & Mineral Resources
References	#971 Beehner, T.S., 1990, Burial of fault scarps along the Organ Mountains fault, south-central New Mexico: Bulletin of the

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#627 Seager, W.R., Hawley, J.W., Kottlowski, F.E., and Kelley, S.A., 1987, Geology of east half of Las Cruces and northeast El Paso 1° x 2° sheets, New Mexico: New Mexico Bureau of Mines and Mineral Resources Geologic Map 57, 3 sheets, scale 1:125,000.