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Socorro Canyon fault zone, northern section (Class A) No. 2108a

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

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Synopsis	**General:** The Socorro Canyon fault zone is comprised of two sections that bound the Socorro and Lemitar Mountains, west of Socorro. The fault zone dips east, has a normal sense of displacement, and parallels and influences the alluvial margin of the Rio Grande Valley in the Socorro Basin. The northern section of the fault zone forms the eastern margin of the Socorro and northern Lemitar Mountains. In the intervening area between these two uplifted, backtilted ranges, the fault zone juxtaposes Pliocene and Miocene basin-fill sediment along the western margin of the topographically defined Socorro Basin.

	South of Socorro Canyon, the southern section of the fault zone strikes south and southeast across the piedmont, widening southward. The fault zone is mapped at 1:24,000 scale, and a one detailed study has been made of the fault's movement history. At least one strand of the fault appears to be of latest Pleistocene to Holocene age based on the presence of a small (single-event) fault scarp on young alluvial deposits adjacent to Socorro Canyon. **Sections:** This fault has 2 sections. Although Chamberlin referred to segments of the fault, no definitive work has been done to substantiate such a scheme. The fault is herein divided into two sections on the basis of apparent recency of movement and surficial expression of faulting.
Name comments	**General:** Machette and McGimsey (1983 #1024) named this prominent fault zone after scarps exposed near Socorro Canyon, a major yet ephemeral east-trending stream canyon that enters the Rio Grande just south of Socorro, New Mexico. It was previously named the Socorro fault by Kelley (1954 #1222). The Socorro Canyon fault zone extends from San Lorenzo Canyon (on the north) southward to a point just east of U.S. Interstate Highway 25 about 2 km north of the highway exit to San Antonio, New Mexico. The north end of the Socorro Canyon fault is linked to the south end of the Loma Pelada fault [2113] by the south-southeast facing Vivarosa relay ramp (Chamberlin and others, 2001 #7474). **Fault ID:** Fault number 13 of Machette (1982 #1401) and fault number 12 of Machette and McGimsey (1983 #1024).
County(s) and State(s)	SOCORRO COUNTY, NEW MEXICO
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Location of fault from 1:24,000-scale mapping by Chamberlin (1999 #7310) and Chamberlin and others (2001 #7474) combined with accurate placement using photogrammetric methods. Previously compiled using fault map of Machette and McGimsey (1983 #1024) with minor additions from a 1:200,000-scale map of Socorro County (Osburn, 1984 #1238).
Geologic setting	The Socorro Canyon fault zone defines the eastern uplifted margin of the Socorro and northern Lemitar Mountains, which lie west of the

	Rio Grande valley. North of Socorro Canyon, east-dipping normal faults bound the Socorro and Lemitar Mountains, which were strongly uplifted and west-titled in late Oligocene to late Miocene time. These mountains are cored by Precambrian and Paleozoic rocks, but the Socorro Mountains are cut by the north wall of the Socorro Caldera, an Oligocene eruptive center that was the source of the 32-Ma Hells Mesa Tuff (Chamberlin and others, 2004 #7309). About 3 km north of Socorro Canyon, the fault splays southward into a distributed but subparallel intrabasin scarps on a variety of ages of piedmont-slope surfaces. Southward bifurcation of the Socorro Canyon fault zone is generally coincident with a transverse tilt-block domain boundary known as the Socorro accommodation zone (SAZ; previously called the Socorro transverse shear zone; Chapin and others, 1978 #1240). The SAZ is coincident with an older crustal flaw that controlled emplacement of the ENE-trending Socorro-Magdalena caldera complex. The pattern of distributed Quaternary faulting may be the surficial expression of "hotter" (more plastic) middle crust associated with the geophysically defined Socorro magma body along the southern section of the Socorro Canyon fault zone. There is about 208 m of cumulative down-to-the-east displacement of a basalt that flowed across the fault zone in Socorro Canyon about 4.0 Ma (Chamberlin and Harrison, 1996 #1225). Total Pliocene through Pleistocene displacement is probably not more than 300 m. Field relations around the 7.8-Ma rhyolitic lava dome (perlite deposit) near Socorro Canyon indicates that the fault zone did not exist prior to about 6 Ma. Larger offsets of Miocene and Oligocene strata (in the Socorro and Lemitar Mountains) predate the Socorro Canyon fault zone.
Length (km)	This section is 23 km of a total fault length of 49 km.
Average strike	N4°W (for section) versus N14°W (for whole fault)
Sense of movement	Normal
Dip	36–68° E *Comments:* Dips from 1:24,000-scale maps of Chamberlin (1999 #7310) and Chamberlin and others (2001 #7474). Shown schematically as a high-angle structure on the cross-section of Chamberlin (1999 #7310).
Paleoseismology studies	
Geomorphic	North of Socorro Canyon, the fault forms discontinuous and obscure

expression	east-facing scarps that are largely buried by colluvium shed from the mountains and by possible landslide debris. Near Nogal Canyon, the fault trends and steps basinward and forms several anastomosing scarps. Each of these is relatively small, but no scarp profiles have been measured along this part of the fault section. There are as many as four additional synthetic and antithetic scarps preserved downslope (east) about 2–3 km. This broad zone of preserved scarps probably indicates the true width of the fault zone in the subsurface. Recognizable scarps of the Socorro Canyon fault end at Corkscrew Canyon (Cañoncito del Puertocito del Lemitar) on the north, but the fault steps over to the northwest to form the relatively inactive eastern margin of the Lemitar Mountains. At the north end of these mountains, the through-going fault juxtaposes Plio-Pleistocene sediment of the Sierra Ladrones Formation with the Miocene Popotosa Formation.
Age of faulted surficial deposits	The fault zone cuts middle to early Quaternary surficial deposits. The only prominent scarps along this section are preserved on high-level piedmont slopes between Nogal Canyon and Cañoncito del Puertocito del Lemitar, and no scarps are known to be formed on deposits or surfaces as young as late Pleistocene age. Along the Lemitar Mountains, the fault juxtaposes Plio-Pleistocene sediment of the Sierra Ladrones Formation with the Miocene Popotosa Formation (both comprising the Santa Fe Group). However, deposits along the fault are not dated.
Historic earthquake	
Most recent prehistoric deformation	middle and late Quaternary (<750 ka) *Comments:* Machette and McGimsey's (1983 #1024) comments about the time of movement apply to the southern section of the fault, not the northern one. They did not study any of the scarps on this section of the fault. Thus, the timing of movement is only controlled by the age of deposits on which the scarps are preserved.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* Little offset/age data exist for these faults. However, as mapped by Chamberlin (1999 #7310), the scarps near Nogal Canyon barely affect the gradient of the faulted piedmont slope (20-ft, 6-m contour interval). Thus, there is probably less than 5–7 m of offset

	across single strands of the fault. These high-level surfaces are at least middle or possibly early (?) Quaternary in age, thereby suggesting a very low average slip rate.
Date and Compiler(s)	2016 Michael N. Machette, U.S. Geological Survey, Retired Andrew P. Jochems, New Mexico Bureau of Geology & Mineral Resources Richard M. Chamberlin, New Mexico Bureau of Geology & Mineral Resources
References	#1224 Chamberlin, R., Eggleston, T., and McIntosh, W.C., 2002, Geologic map of the Luis Lopez quadrangle, Socorro County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 53, scale 1:24,000, https://geoinfo.nmt.edu/publications/maps/geologic/ofgm/details.cfml?Volume=53. #7310 Chamberlin, R.M., 1999, Geologic map of the Socorro 7.5-minute quadrangle, Socorro County: New Mexico Bureau of Mines and Mineral Resources Open-File Geologic Map 34, scale 1:24,000, https://geoinfo.nmt.edu/publications/maps/geologic/ofgm/details.cfml?Volume=34. #1225 Chamberlin, R.M., and Harrison, B., 1996, Pliocene and Pleistocene displacement history of the Socorro Canyon fault, central Rio Grande rift, New Mexico [abs.]: New Mexico Geology, v. 18, p. 45. #7474 Chamberlin, R.M., Cather, S.M., Nyman, M., W., and McLemore, V.T., 2001, Geologic map of the Lemitar 7.5-minute quadrangle, Socorro County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 38, scale 1:24,000. #1240 Chapin, C.E., Chamberlin, R.M., Osburn, G.R., White, D.W., and Sanford, A.R., 1978, Exploration framework of the Socorro geothermal area, New Mexico, *in* Chapin, C.E., Elston, W.E., and James, H.L., eds., Field guide to selected cauldrons and mining districts of the Datil-Mogollon volcanic field New Mexico: New Mexico Geological Society Special Publication 7, p. 114-129. #1222 Kelley, V.C., 1954, Tectonic map of a part of the upper Rio Grande area, New Mexico: U.S. Geological Survey Oil and Gas Investigations Map OM-157, 1 sheet, scale 1:190,080.

#1401 Machette, M.N., 1982, Quaternary and Pliocene faults in the La Jencia and southern part of the Albuquerque-Belen basins, New Mexico—Evidence of fault history from fault-scarp morphology and Quaternary geology, *in* Grambling, J.A., and Wells, S.G., eds., Albuquerque Country II: New Mexico Geological Society, 33rd Field Conference, November 4-6, 1982, Guidebook, p. 161-169.

#1024 Machette, M.N., and McGimsey, R.G., 1983, Map of Quaternary and Pliocene faults in the Socorro and western part of the Fort Sumner 1° x 2° quadrangles, central New Mexico: U.S. Geological Survey Miscellaneous Field Studies Map MF-1465-A, 12 p. pamphlet, 1 sheet, scale 1:250,000.

#1238 Osburn, G.R., compiler, 1984, Geology of Socorro County: New Mexico Bureau of Mines and Mineral Resources Open-File Report 238, 13 p. pamphlet, 1 sheet, scale 1:200,000.