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Southern Sangre de Cristo fault, Questa section (Class A) No. 2017c

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Synopsis	**General:** The Southern Sangre de Cristo fault is a west-dipping fault that in New Mexico forms the border between the Sangre de Cristo Mountains and the San Luis basin. In Colorado, the fault forms the border between San Pedro Mesa to the east and San Luis Valley to the west. At an embayment in the Sangre de Cristo Range, at the New Mexico/Colorado border, faulting steps eastward to the Northern Sangre de Cristo fault [2321]. The Southern Sangre de Crist fault has subdued geomorphic expression compared to the Northern Sangre de Cristo fault.

	Sections: This fault has 5 sections. The four sections in New Mexico are better exposed and have been studied in more detail than the single section in Colorado. Menges (1988 #1120; 1990 #1116; 1990 #1387) defined 4 geometric segments and 13 subsegments of the Southern Sangre de Cristo fault in New Mexico on the basis of physiographic and geomorphic expression of the fault zone and the morphology of the Sangre de Cristo range front in New Mexico, but did not investigate the part of the fault that extends north into Colorado. The trace of the fault in Colorado is mainly buried by Quaternary landslide debris. On the basis of fault scarp geomorphic expression, morphometric analyses of scarps, and surficial mapping, Ruleman and Machette (2007 #7252) suggest combining the Urraca and Questa sections into the Latir Peaks section of the fault. The original sectioning of the fault is retained in this update because of the lack of robust understanding of the timing of the most recent event, vertical-displacement rates, and recurrence intervals along the fault.
Name comments	**General:** The Sangre de Cristo fault system borders the eastern margin of the San Luis basin, which extends from Poncha Pass, Colorado, to near Taos, New Mexico. This description addresses only the southern part of the fault system, which extends from the north end of San Pedro Mesa Creek south to its intersection with the Embudo fault at TalpaRancho, about 8 km south of Taos. Upson (1939 #1142) first mapped the fault in Colorado and northern New Mexico. The Southern Sangre de Cristo fault, as used by Menges (1988 #1120; 1990 #1116; 1990 #1387) and herein, includes the Sangre de Cristo fault zone of Lipman and Mehnert (1975 #1955), the Taos fault of Dungan and others (1984 #1181), and the Cedros Canyon, Urraca Ranch, Taos Pueblo, and Cañon faults of Machette and Personius (1984 #1113) and Personius and Machette (1984 #1124). Ruleman and Machette (2007 #7252) suggest the Sangre de Cristo fault system (including the Northern Sangre de Cristo [2321] and the Southern Sangre de Cristo, herein) is more appropriately divided into northern, central, and southern based on tectonic activity that has shifted from the southern and northern parts of the fault system to the central part during the late Quaternary. The southern fault zone of Ruleman and Machette (2007 #7252) coincides with what we call the Southern Sangre de Cristo fault. **Section:** This section corresponds to segment 2 of Menges (1988 #1120; 1990 #1116; 1990 #1387), but a new name is used to avoid numerical section designations. The northern termination of

	the section is located at Rito Primero, which marks the northern edge of a moderate salient of the Sangre de Cristo Mountains. The southern end of the section is at San Cristobal Creek, about 3 km northeast of the village of San Cristobal, which coincides with a large salient in the range front. This southern section boundary coincides with the boundary between segments 2 and 3 of Menges (1988 #1120; 1990 #1116; 1990 #1387). Ruleman and others. (2013 #7252) group the Urraca and Questa sections into the Latir Peaks section. **Fault ID:** Segment 3 of Menges (1988 #1120; 1990 #1116; 1990 #1387).
County(s) and State(s)	TAOS COUNTY, NEW MEXICO
Physiographic province(s)	SOUTHERN ROCKY MOUNTAINS
Reliability of location	Good Compiled at 1:250,000 scale. *Comments:* Menges (1988 #1120) mapped fault traces from aerial photography at scales of 1:15,780 to 1:70,000, and presents mapping at a scale of about 1:400,000. Machette and Personius (1984 #1113) mapped fault traces at a scale of 1:250,000.
Geologic setting	The Southern Sangre de Cristo fault is part of a major rift-margin structure of Neogene age that borders the eastern margin of the Rio Grande rift in south-central Colorado and north-central New Mexico. The entire Sangre de Cristo fault system generally forms the boundary between the San Luis basin to the west, a narrow (10–25 km wide), east-tilted, asymmetrical half-graben on the west, and the Sangre de Cristo Mountains to the east. There is 7–8 km of structural relief on Precambrian basement rock across the Sangre de Cristo fault zone (Lipman and Mehnert, 1975 #1955). The western margin of the San Luis basin has comparatively little displacement, and no evidence of late Quaternary displacement. The southern end of the fault merges with or intersects the north-down, sinistral Pilar section of the Embudo fault [2007a] near the village of Talpa, New Mexico; geologic mapping shows there is not a distinct boundary between the Embudo and the Southern Sangre de Cristo faults (Bauer and Kelson, 2004 #7250). Wong and others (1995 #1155) note that a few well-located earthquakes appear to have occurred near the fault in New Mexico.

Length (km)	This section is 18 km of a total fault length of 96 km.
Average strike	N1°E (for section) versus N6°W (for whole fault)
Sense of movement	Normal
Dip	60° W *Comments:* Deep seismic reflection data and two-dimensional modeling of gravity data near Alamosa, Colorado, suggest that the most likely dip of the Northern Sangre de Cristo fault [2321] is 60° (Kluth and Schaftenaar, 1994 #1183). Tandon (1992 #1390; cited in Chapin and Cather, 1994 #1180) interprets the same data set processed for deeper resolution, and concludes that the fault dips about 60° to at least 26 to 28 km, which is probably below the brittle-ductile transition zone.
Paleoseismology studies	
Geomorphic expression	Prominent west-facing fault scarps are present on late Pleistocene and possibly Holocene alluvial fans derived from the Sangre de Cristo Mountains. Menges (1988 #1120; 1990 #1116; 1990 #1387) documents the presence of truncated ridge spurs and triangular facets along the Sangre de Cristo range front, and interprets these as products of long-term displacement.
Age of faulted surficial deposits	Pazzaglia (1989 #1170) mapped late Quaternary deposits and some fault strands along this section, and shows faulted late Pleistocene alluvial-fan deposits. Menges (1990 #1116; 1990 #1387) did not map surficial deposits along the fault, but suggests that this fault section has experienced middle to early Holocene movement.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* The exact timing of the most-recent surface rupture on this section is unknown. Menges (1988 #1120; 1990 #1116; 1990 #1387) conducted a study of fault-related landforms, and suggests the possibility of middle to early Holocene movement along the northern and southern parts of the Questa section. Fault scarps are not observed at Cedro Canyon on middle Quaternary

	(120—170 ka) deposits; however at Jaroso Canyon, scarps up to 7 m high are reported on undifferentiated Quaternary alluvium that may be as old as 620 ka (Ruleman and others, 2013 #7253).
Recurrence interval	10 to 50 k.y. *Comments:* Menges (1988 #1120; 1990 #1116; 1990 #1387) estimated recurrence at a given site along the southern Sangre de Cristo fault as 10,000 years and stated that this is compatible with data from the northern part of the Sangre de Cristo fault system (l10 to 50 k.y.) given by McCalpin (1982 #791). No data exist that are specific to this section.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Menges (1988 #1120; 1990 #1116; 1990 #1387) estimated two separate vertical-displacement rates for the southern Sangre de Cristo fault on the basis of fault scarp data: (1) a post-late Pleistocene (post-Bull Lake) rate of 0.03–0.06 mm/yr, and (2) a post-Pliocene (post-4 Ma) rate of 0.12–0.23 mm/yr. Ruleman and others (2013 #7253) conclude that tectonic activity along their Latir Peaks section has waned during the middle to late Pleistocene -- citing 7.8 m of vertical surface offset of deposits older than 200 ka. All available field evidence supports assigning the lowest slip-rate category.
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