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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.

unnamed faults of the Valles caldera, Toledo caldera section (Class B) No. 1986c

Last Review Date: 2016-06-27

citation for this record: **Jochems, A.P., compiler, 2016, Fault number 1986c, unnamed faults of the Valles caldera, Toledo caldera section, 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 02:25 PM.**

Synopsis	**General:** The unnamed faults of the Valles caldera include the caldera ring-fracture system, possible collapse features (gravitationally driven slumps) that are on the margins of the calderas and intracaldera faults that are associated with volcanic domes constructed during resurgence of the caldera floors. No detailed paleoseismic studies have been conducted on any of these faults, although much detailed research has concentrated on the timing, petrography, geochemistry, and volcanic processes involved in the caldera eruptions. **Sections:** This fault has 3 sections. This fault has 3 sections for ease of description. Faults of the first section [1986a] are associated with the Valles caldera ring-fracture system, faults of the second section [1986b] are associated with volcanic domes constructed during resurgence of the floor the Valles caldera, and

	faults of the third section [1986c] are found on the caldera margins and within the adjacent (and older) Toledo caldera.
Name comments	**General:** This system of faults was originally mapped by Smith and others (1970 #1125) during a regional geologic reconnaissance of the Jemez Mountains. Although the faults are unnamed, they are closely associated with two Quaternary-age calderas (explosive volcanic edifices) that form the core of the Jemez Mountains. The most easterly of the faults is located about 6–10 km northwest of Los Alamos, New Mexico. **Section:** These faults form linear to semicircular patterns with general down-to-the-center movement suggestive of partial collapse of the walls of the Valles and Toledo calderas.
County(s) and State(s)	LOS ALAMOS COUNTY, NEW MEXICO RIO ARRIBA COUNTY, NEW MEXICO SANDOVAL COUNTY, NEW MEXICO
Physiographic province(s)	SOUTHERN ROCKY MOUNTAINS
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Fault traces from 1:24,000-scale maps of Kelley and others (2004 #7574), Lawrence and others (2004 #7573), Gardner and others (2006 #7571), and Goff and others (2006 #7572).
Geologic setting	These faults are assigned Class B because their origin is due to volcanic activity of the Valles caldera. Much of the geologic setting briefly described herein is abstracted from a classic article on the Bandelier Tuff (Smith and Bailey, 1966 #2069) and an excellent geologic map of the Jemez Mountains (Smith and others, 1970 #1125). Two calderas, the Valles and Toledo, form the central core of the Jemez Mountains. The calderas are roughly circular and have a ring-fracture zone that is largely buried by moat (intracaldera) sediment and intruded by post-eruptive volcanic domes related to resurgence of the calderas. Eruption of the Toledo caldera created the Otowi member of the Bandelier Tuff (Smith and others, 1970 #1125) at about 1.6 Ma (Izett and Obradovich, 1994 #1305). This is the more easterly of the two calderas and only the northeastern half is preserved. It is about 9 km in diameter, and its eastern margin is located only about 6–10 km from Los Alamos, New Mexico. Eruption of the younger Valles caldera created the Tshirege member of the Bandelier Tuff

	(Smith and others, 1970 #1125) at about 1.2–1.3 Ma (Izett and Obradovich, 1994 #1305; Phillips and others, 2007 #7431). It is a larger caldera, being roughly 13–17 km in diameter and overlapping the older Toledo caldera on the east. The outflow facies of these two massive eruptions formed welded to unwelded ash-flow tuffs in and around the calderas, but the more distant airfall ash component is found in fluvial and lacustrine beds throughout New Mexico and farther downwind in western Texas and adjacent states.
Length (km)	This section is 15 km of a total fault length of km.
Average strike	N19°E
Sense of movement	Normal *Comments:* These faults are mostly associated with minor collapse along the margins of both of the calderas. Kelley and others (2004 #7574), Lawrence and others (2004 #7573 Gardner and others (2006 #7571), and Goff and others (2006 #7572) showed them as all having a normal sense of displacement.
Dip Direction	Unknown *Comments:* These faults dip in most directions of the compass, with northern to northeasterly orientations being the most common. Common curvilinear forms and association with ring-fracture faults of the calderas suggest that some fault traces may be of moderate to low angle. More linear traces have dips of up to 70° (Goff and others, 2006 #7572).
Paleoseismology studies	
Geomorphic expression	These faults from scarps of unknown height and displacement on consolidated sediment and rock (the Bandelier Tuff and underlying late Tertiary volcanic rock). No studies have been made of the size or morphology of the scarps.
Age of faulted surficial deposits	These faults displace both members of the Bandelier Tuff (1.2–1.6 Ma) and older volcanic rocks (late Tertiary or early Quaternary) of the Jemez Mountains.
Historic earthquake	

Most recent prehistoric deformation	undifferentiated Quaternary (<1.6 Ma) *Comments:* Movement probably is mainly at 1.2–1.6 Ma during eruptions of the Valles and Toledo calderas (Smith and others, 1970 #1125).
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr
Date and Compiler(s)	2016 Andrew P. Jochems, New Mexico Bureau of Geology & Mineral Resources
References	#7571 Gardner, J.N., Goff, F., Reneau, S.L., Sandoval, M.M., Drakos, P.G., and Goff, C.J., 2006, Geologic map of the Valle Toledo quadrangle, Sandoval and Los Alamos Counties, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 133, scale 1:24,000. #7572 Goff, F., Reneau, S.L., Goff, C.J., Gardner, J.N., Drakos, P.G., and Katzman, D., 2006, Geologic map of the Valle San Antonio quadrangle, Sandoval and Rio Arriba Counties, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 132, scale 1:24,000. #1305 Izett, G.A., and Obradovich, J.D., 1994, $^{40}Ar/^{39}Ar$ age constraints for the Jaramillo Normal Subchron and Matuyama-Brunhes geomagnetic boundary: Journal of Geophysical Research, v. 99, no. B2, p. 2925-2934. #7574 Kelley, S.A., Osburn, G.R., Ferguson, C.A., Kempter, K., and Osburn, M., 2004, Geologic map of the Seven Springs quadrangle, Sandoval County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 88, scale 1:24,000. #7573 Lawrence, J.R., Kelley, S., and Rampey, M., 2004, Geologic map of the Cerro del Grant quadrangle, Rio Arriba and Sandoval Counties, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 87, scale 1:24,000.

	#7431 Phillips, E.H., Goff, F., Kyle, R., McIntosh, W.C., Dunbar, N.W., and Gardner, J.N., 2007, The $^{40}Ar/^{39}Ar$ age constraints on the duration of resurgence at the Valles caldera, New Mexico: Journal of Geophysical Research, v. 112, B08201. #2069 Smith, R.L., and Bailey, R.A., 1966, The Bandelier Tuff; a study of ash-flow eruption cycles from zoned magma chambers: Bulletin Volcanologique, v. 29, p. 83-104. #1125 Smith, R.L., Bailey, R.A., and Ross, C.S., 1970, Geologic map of the Jemez Mountains, New Mexico: U.S. Geological Survey Miscellaneous Investigations Map I-571, 1 sheet, scale 1:125,000.