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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, ring-fractures (Class B) No. 1986a

**Last Review Date: 2016-06-27**

***citation for this record:*** **Jochems, A.P., compiler, 2016, Fault number 1986a, unnamed faults of the Valles caldera, ring-fractures, 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.**

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| **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.<br><br>**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 |

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| | 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.<br><br>**Section:** These faults form the ring-fracture zone of the Valles caldera. |
| **County(s) and State(s)** | SANDOVAL COUNTY, NEW MEXICO |
| **Physiographic province(s)** | SOUTHERN ROCKY MOUNTAINS |
| **Reliability of location** | Good<br>Compiled at 1:100,000 scale.<br><br>*Comments:* Digitized trace from 1:24,000-scale maps of Gardner and others (2006 #7571) and Goff and others (2006 #7427,2006 #7572, 2006 #7428) generalized to 1:100,000 scale (S. Kelley, pers. comm., 2016). Although depicted as a single concealed (dotted) fault on the map, the structure is more realistically shown as a 1–2 km wide zone of parallel circular faults on cross section B of Smith and others (1970 #1125). |
| **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 |

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| | 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 13 km of a total fault length of km. |
| **Average strike** | N3°W |
| **Sense of movement** | Normal |
| **Dip Direction** | Unknown<br><br>*Comments:* Shown somewhat schematically by Smith and others (1970 #1125) as dipping about 75° on cross-section B. These faults dip toward the center of the Valles caldera and form a circular (ring-like) pattern. As such, they dip in all directions of the compass. |
| **Paleoseismology studies** | |
| **Geomorphic expression** | These faults form the structural wall of a collapsed volcanic edifice (the Valles caldera). The resultant escarpments are formed on the Bandelier Tuff and underlying late Tertiary volcanic rocks. There are no scarps mapped in the post-eruptive sedimentary moat fill, although collapse of the caldera margins may have continued later into the Quaternary. |
| **Age of faulted surficial deposits** | These faults displace the Bandelier Tuff, specifically the Tshirege member of the Bandelier Tuff (Smith and others, 1970 #1125), which has been dated at about 1.2–1.3 Ma (Izett and Obradovich, 1994 #1305; Phillips and others, 2007 #7431). Volcanic domes (Quaternary Valles Rhyolite) have been emplaced along the ring-fracture zone after the eruption, but they do not appear to be disturbed by later movement on the faults comprising the ring-fracture zone. |

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| **Historic earthquake** | |
| **Most recent prehistoric deformation** | undifferentiated Quaternary (<1.6 Ma)<br><br>*Comments:* Movement probably is mainly at 1.2–1.3 Ma during eruption of the Tshirege member of the Bandelier Tuff (Smith and others, 1970 #1125; (Izett and Obradovich, 1994 #1305; Phillips and others, 2007 #7431). |
| **Recurrence interval** | |
| **Slip-rate category** | Less than 0.2 mm/yr |
| **Date and Compiler(s)** | 2016<br>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.<br><br>#7427 Goff, F., Gardner, J.N., Reneau, S.L., and Goff, C.J., 2006, Geologic map of the Redondo Peak quadrangle, Sandoval County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 111, scale 1:24,000.<br><br>#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.<br><br>#7428 Goff, F., Reneau, S.L., Lynch, S., Goff, C.J., Gardner, J.N., Drakos, P., and Katzman, D., 2006, Geologic map of the Bland quadrangle, Los Alamos and Sandoval Counties, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 112, scale 1:24,000.<br><br>#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 |

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| | Research, v. 99, no. B2, p. 2925-2934.<br><br>#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.<br><br>#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.<br><br>#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. |