

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](#).

Nacimiento fault, southern section (Class A) No. 2002b

Last Review Date: 2015-12-14

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

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Synopsis

General: The Nacimiento fault is an east-dipping fault bordering the Nacimiento uplift, an 80-km-long, 10- to 16-km-wide uplift related to Laramide deformation. The fault merges with the Gallina fault to the north, and dies out to the south into a broad anticline. The relatively high level of contemporary microseismicity within the Sierra Nacimiento may be related to deformation in the hanging wall of the fault. Detailed mapping along the southern part of the fault shows several short normal faults with both down-to-the-east and down-to-the-west displacements in Quaternary deposits. Down-to-the-east

	<p>displacements may indicate normal reactivation of the Nacimiento reverse fault in the late Quaternary.</p> <p>Sections: This fault has 2 sections. Woodward (1987 #1130) mapped the Nacimiento and Pajarito faults along the western margin of the Sierra Nacimiento. He noted the lack of continuity between these faults in the vicinity of San Miguel Canyon (section boundary), about 3 km southeast of the village of San Miguel. North of San Miguel Canyon, the fault generally has a lower dip and is a thrust fault, whereas south of San Miguel Canyon the fault is a high-angle reverse fault. Wong and others (1995 #1155) considered potential fault-rupture scenarios that included rupture on either a northern section or a southern section, and on both sections together. These sections are considered separately here.</p>
<p>Name comments</p>	<p>General: The Nacimiento fault extends from Red Mesa, 7 km west of San Ysidro on the south, to the northern end of Sierra Nacimiento, 7 km northeast of Regina. The Nacimiento fault forms the western margin of the Laramide Nacimiento uplift. As used herein, the Nacimiento fault includes the Nacimiento and Pajarito faults of Woodward (1987 #1130), to avoid confusion with the Pajarito fault [2008] along the western margin of the Rio Grande rift near Los Alamos.</p> <p>Section: This part of the Nacimiento fault was defined as the southern section by Wong and others (1995 #1155). The southern section extends from U.S. Highway 44 about 7 km west of the village of San Ysidro, northward to San Miguel Canyon about 3 km southeast of the village of San Miguel.</p>
<p>County(s) and State(s)</p>	<p>SANDOVAL COUNTY, NEW MEXICO</p>
<p>Physiographic province(s)</p>	<p>COLORADO PLATEAUS</p>
<p>Reliability of location</p>	<p>Good Compiled at 1:24,000 scale.</p> <p><i>Comments:</i> Detailed geologic maps at a scale of 1:24,000 are available along the entire fault trace; 1:24,000 maps covering the southern section include those of Woodward and Schumacher (1973 #7295) and Woodward and others (1973 #7293; 1977 #1132). These maps are compiled and synthesized by Woodward (1987 #1130). In addition, detailed mapping of Quaternary</p>

	<p>deposits at 1:24,000 scale at the southern end of the fault has been completed by Formento-Trigilio and Pazzaglia (1996 #1295), Formento-Trigilio (1997 #1377), and Formento-Trigilio and others (1998 #7294). The location of the fault was digitized at 1:24,000 scale using photogrammetry to accurately map its trace from these maps. The fault also was mapped by Renick(1931 #1140) at a scale of 1:125,000, by Wood and Northrop (1946 #1143) at a scale of about 1:95,000, and by Baltz (1967 #1167) at a scale of 1:63,360.</p>
Geologic setting	<p>The Nacimiento fault is high-angle and over much of its geologic history a west-vergent reverse fault. The Nacimiento uplift is a north-south elongated structural block that lies west of the Jemez Mountains and forms the eastern margin of the San Juan Basin of the Colorado Plateau. Structural relief of the uplift formed during Laramide deformation, with shortening taking place via folding and reverse movement along the Nacimiento fault. The fault is west of the western margin of the Rio Grande rift. Quaternary normal faulting near Arroyo Peñasco documented by Formento-Trigilio and Pazzaglia (1996 #1295), Formento-Trigilio (1997 #1377), and Formento-Trigilio and Pazzaglia (1998 #2847) may indicate normal reactivation of the Nacimiento reverse fault. The relatively high level of contemporary microseismicity within the Sierra Nacimiento supports the interpretation of Quaternary deformation in the hanging wall of the fault (Wong and others, 1995 #1155; House and Hartse, 1995 #1160).</p>
Length (km)	<p>This section is 45 km of a total fault length of 82 km.</p>
Average strike	<p>N4°W (for section) versus N1°W (for whole fault)</p>
Sense of movement	<p>Normal</p> <p><i>Comments:</i> West-vergent reverse faulting occurred during Laramide deformation on the Nacimiento fault (Woodward, 1987 #1130). Sense of movement associated with contemporary microseismicity is unknown, but down-to-the-east and down-to-the-west Quaternary normal faults have been mapped by Formento-Trigilio and Pazzaglia (1996 #1295), Formento-Trigilio (1997 #1377), and Koning and others (1998 #7375) near Arroyo Peñasco and Cañada de las Milpas at the southern end of the fault. The down-to-the-west normal faults are in the footwall of the Nacimiento reverse fault, but the down-to-the-east Quaternary movement on one fault strand may be interpreted as normal backslip on a splay of the reverse fault (Formento-Trigilio and</p>

	Pazzaglia, 1996 #1295; Formento-Trigilio, 1997 #1377).
Dip	<p>75°–90° E.</p> <p><i>Comments:</i> Bedrock exposures of the fault noted by Woodward (1987 #1130) provide near-surface data on fault dip. Although exposures of the main trace of the Laramide Nacimiento fault clearly show steep east dips, west dipping synthetic and antithetic faults are locally present (Woodward, 1987 #1130). Formento-Trigilio and Pazzaglia (1996 #1295) and Formento-Trigilio (1997 #1377) mapped several normal faults in Quaternary deposits with both east and west dips near Arroyo Peñasco at the southern end of the Nacimiento fault. Woodward (1987 #1130) speculated that the fault steepens with depth, although no published subsurface structural data are available to confirm this interpretation.</p>
Paleoseismology studies	<p>Formento-Trigilio and Pazzaglia (1996 #1295), Formento-Trigilio (1997 #1377), and Formento-Trigilio and others (1998 #7294) mapped Quaternary deposits and faults in detail near Arroyo Peñasco at the southern end of the Nacimiento fault. Most of the Quaternary faults mapped by these workers dip west, opposite to the dip of the bedrock fault mapped by Woodward (1987 #1130) in the area. These faults are as much as 2 km long and are marked by scarps up to 17 m high, although some of this apparent displacement may be related to landsliding in the underlying Triassic shale bedrock. Down-to-the-east Quaternary displacement of 4.2 m of travertine-cemented alluvium on one fault strand on the north rim of Arroyo Peñasco may either represent normal reactivation on a trace of the Nacimiento reverse fault mapped by Woodward (1987 #1130), or is an antithetic splay to the down-to-the-west faults mapped further east by Formento-Trigilio and Pazzaglia (1996 #1295) and Formento-Trigilio (1997 #1377).</p>
Geomorphic expression	<p>The prominent west-facing range front of the Sierra Nacimiento is coincident with the Nacimiento fault. Baltz (1967 #1167) did not identify geomorphic evidence of late Quaternary activity, but Formento-Trigilio and Pazzaglia (1996 #1295) and Formento-Trigilio (1997 #1377) discuss evidence of multiple fault strands with Quaternary displacement along the southern end of the Sierra Nacimiento near Arroyo Peñasco. Scarps on middle to late Pleistocene terrace and pediment-fan surfaces in this area are up to 4.2 m high (Formento-Trigilio and Pazzaglia, 1998 #2847).</p>

Age of faulted surficial deposits	<p>Although the youngest faulted bedrock mapped along the Nacimiento fault is Cretaceous in age (Woodward, 1987 #1130), Formento-Trigilio and Pazzaglia (1996 #1295) and Formento-Trigilio (1997 #1377) map fault scarps and infer displacements from geomorphic data in late Pleistocene alluvial deposits near Arroyo Peñasco at the southern end of the Nacimiento fault. Uranium-series ages on faulted, travertine-cemented alluvium indicate the faulted alluvium was deposited between about 270 ka and about 60 ka (Formento-Trigilio, 1997 #1377).</p>
Historic earthquake	
Most recent prehistoric deformation	<p>middle and late Quaternary (<750 ka)</p> <p><i>Comments:</i> Timing of most-recent event is from uranium-series dating of faulted travertine-cemented alluvium by Formento-Trigilio (1997 #1377) that bracket the age of the offset alluvium between about 270 ka and 60 ka.</p>
Recurrence interval	
Slip-rate category	<p>Less than 0.2 mm/yr</p> <p><i>Comments:</i> Wong and others (1995 #1155) conservatively estimated a range in slip rate of 0.01 to 0.23 mm/yr for the Nacimiento fault, with a preferred value of 0.02 mm/yr, based on analysis of slip rates on analogous faults in the Rio Grande rift (Formento-Trigilio and Pazzaglia, 1996 #1295; Formento-Trigilio, 1997 #1377). A rate of up to 0.07 mm/yr may be permissible depending on the age of displaced travertine-cemented alluvium (Personius and others, 1999 #6930).</p>
Date and Compiler(s)	<p>2015</p> <p>Keith I. Kelson, William Lettis & Associates, Inc. Andrew P. Jochems, New Mexico Bureau of Geology & Mineral Resources Stephen F. Personius, U.S. Geological Survey</p>
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