

Geology of Western National Parks: Big Bend, TX

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Oblique Google Earth view of the Chisos Mountains, the crown jewel of Big Bend National Park

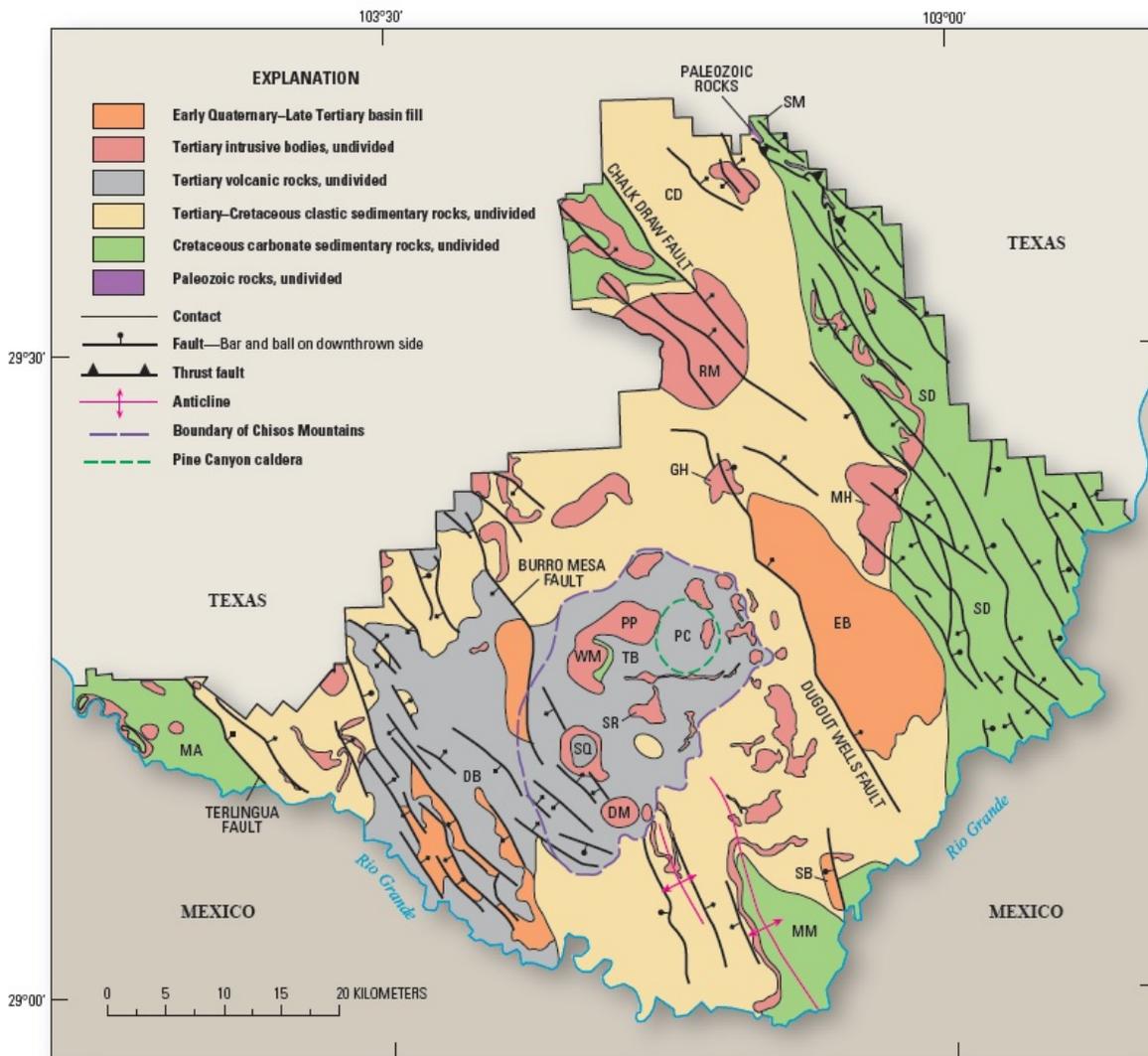
A nice summary of the major geologic events at Big Bend National Park is provided below (text and figures from a publication by W.R. Page, K.J. Turner, and R. Bohannon)

Geologic features in Big Bend National Park (BBNP) formed from repetitive cycles of rifting, mountain building, basin development, faulting and folding, and volcanism and plutonism. The oldest tectonic episode recorded in the park is mountain building associated with the Marathon orogeny, which deformed the rocks in the park region from Middle Mississippian to Early Permian time (about 330–285 Ma). During this episode, deep ocean basin rocks originally deposited south of BBNP were thrust northwestward onto the edge of the North American continent by collision between the North and South American plates.

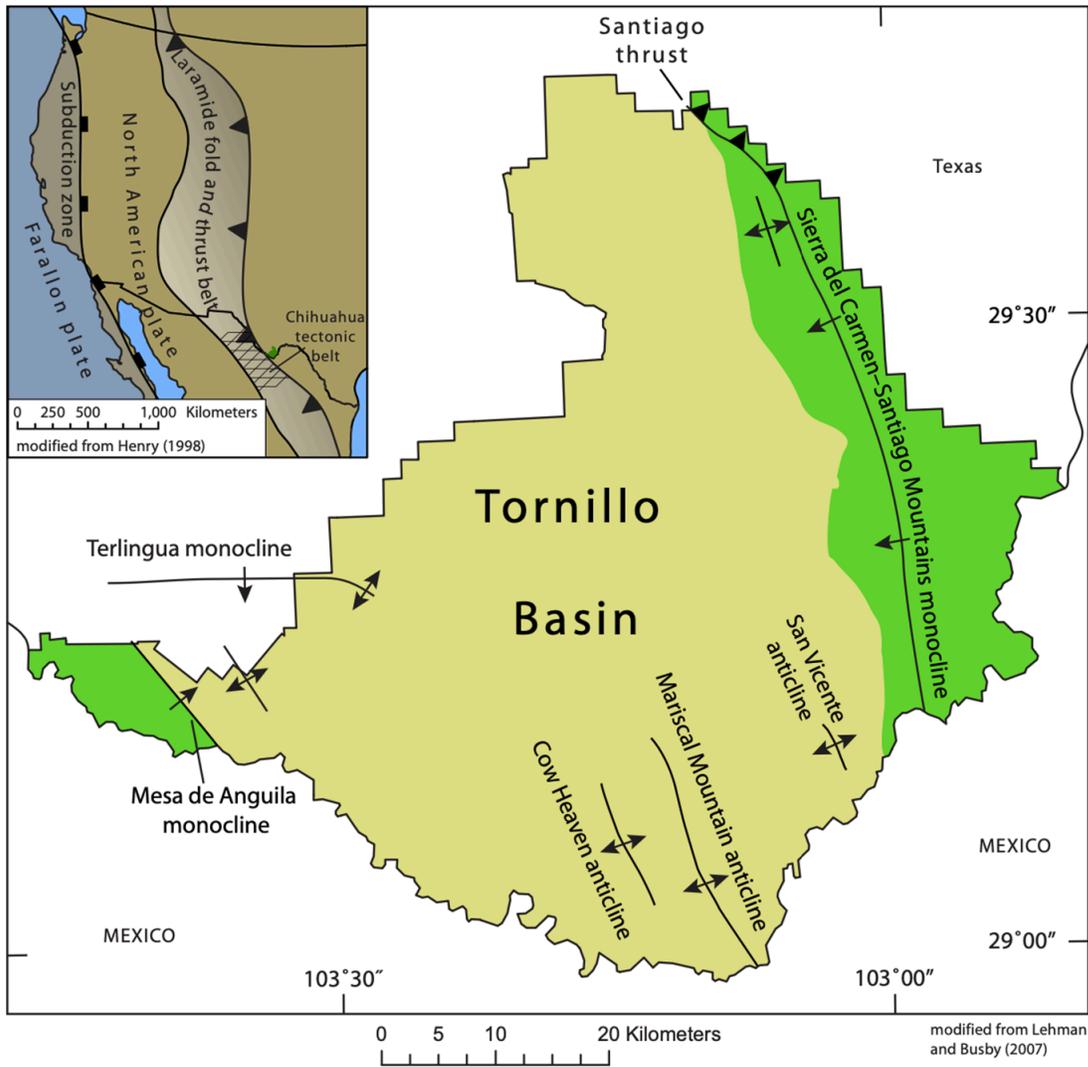
From the Late Triassic into the Late Cretaceous (about 200–85 Ma), the BBNP area experienced subtle effects of rifting between the North and South American continents; this rifting largely controlled the opening of the Gulf of Mexico. During rifting, BBNP was part of the Diablo Platform, a carbonate platform where the sediments that would become Lower and Upper Cretaceous limestone and shale units were deposited in shallow, open-marine water.

The Late Cretaceous to early Tertiary Laramide orogeny (about 70–50 Ma) had significant influence on the tectonic evolution of BBNP. This period of contractional deformation produced major uplifts, basins, and faults and folds that formed from northeast-directed compression related to collision between the North American continent and the Pacific/ Farallon plate at the western edge of the continent. Major Laramide features in BBNP include the northeast-facing Mesa de Anguila, an uplifted monocline on the southwest margin of the park, and the southwest-facing Sierra del Carmen–Santiago Mountains, an uplifted and thrust monocline bounding the east part of the park. The Tornillo Basin developed between these uplifted basin margins.

Major episodes of volcanism and plutonism occurred in the park area from about 46 to 28 Ma. Principal features formed in this time period include numerous volcanic flows extruded from a complex system of volcanic vents and lava domes in the western part of the park and adjacent areas of Mexico, and the Pine Canyon caldera complex, which constitutes the high Chisos Mountains. It was during this time that major laccolithic complexes developed and intruded Cretaceous and Tertiary sedimentary rocks to form the Rosillos Mountains, McKinney Hills, and Grapevine Hills. The last major tectonic episode to affect BBNP was Basin and Range faulting from about 25 to 2 Ma. Features formed in BBNP during this time period include mostly high-angle normal faults that cut the entire stratigraphic sequence through Pliocene basin-fill deposits. Movement on some of the major faults has formed local depositional basins, such as the Estufa and Delaho bolsos on the flanks of the high Chisos Mountains. Basin and Range faults predated integration of the late Tertiary basins with the Rio Grande, which began about 2 Ma, and they were the last structures to modify the landscape into its present-day configuration.



Map of BBNP showing Basin and Range faults (last major tectonic episode in BBNP), volcanic and plutonic features, and present-day distribution of generalized rock units (colors). Geologic features are designated by upper case letters and include: SM, Santiago Mountains; CD, Chalk Draw graben; NP, Nine Point Mesa; RM, Rosillos Mountains; SD, Sierra del Carmen; GH, Grapevine Hills; MH, McKinney Hills; EB, Estufa bolson; MM, Mariscal Mountain; PC, Pine Canyon caldera; B, The Basin; PP, Pulliam Peak; WM, Ward Mountain; SR, South Rim; SQ, Sierra Quemada; DB, Delaho bolson; and MA, Mesa de Anguila. Thick black dashed line in central part of figure is outline of Chisos Mountains; green dashed line is Pine Canyon caldera. Solid black lines with bar and ball are late Tertiary Basin and Range faults.



Generalized map of the major structures that formed in BBNP during the Laramide orogeny. Inset map shows location of Laramide fold and thrust belt in western North America and Chihuahua tectonic belt in the BBNP area.