TEXAS PARKS & WILDLIFE

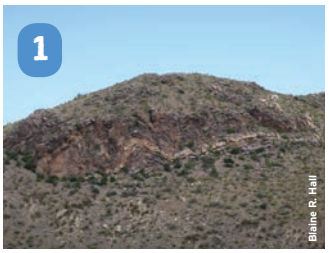
BIG BEND RANCH STATE PARK

Geology at the Crossroads

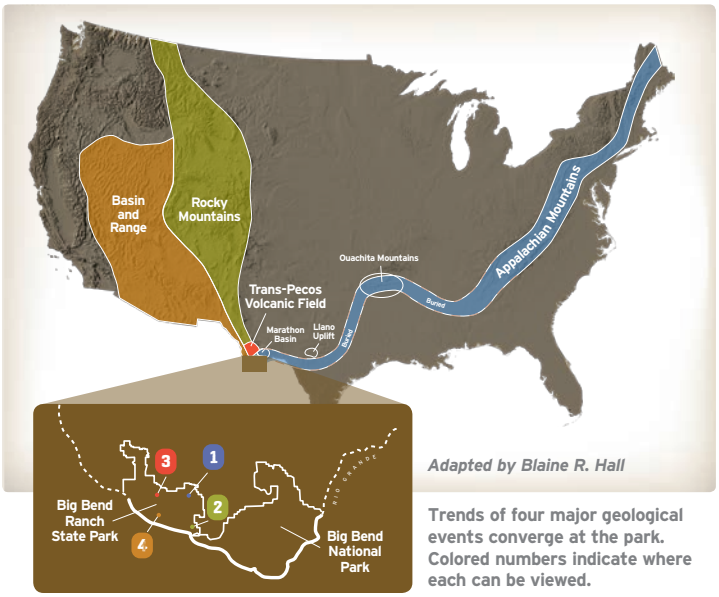
By Blaine R. Hall

Crossroads: Intersection, Junction, Gathering Place. Big Bend Ranch State Park (BBRSP) has been all of these for at least the last 11,000 years as Native Americans, ranchers, miners, freighters, travelers, and now park visitors have lived and traveled here. The scenery is magnificent and the landscape varies from river lowlands, through deep canyons, across high plateaus, and up steep mountains. Ultimately all of this is controlled by the character and variety of the underlying geology and the processes that created it over millions of years.

But why a crossroads of geology? A look at the geological map above can answer that question just by following the variously colored areas to their convergence in the Big Bend region. The trends illustrated here represent the four major events that have shaped North America over the past 500+ million years, and all of them are represented in the park. So, get in your car, mount up your horse, hop on your bike or strike up a hike and visit the Crossroads of Geology!



1 Appalachian/Ouachita/ Marathon/Solitario Trend. Around 520 Ma. (million years ago) sandstone, conglomerate, limestone, shale, and chert formed in an ocean basin offshore from ancient North America. By 300 Ma. this old ocean was closed up and the rocks were strongly deformed and uplifted as what is now Africa collided with eastern North America to form the Appalachian Mountains. Concurrently, South America crashed into the southern edge of North America to form the Ouachita Mountains. This same event closed the old ocean further to the south, extending the mountain trend into West Texas. The strongly deformed rocks that are present today in the Marathon Basin can also be seen at BBRSP. Photo 1 documents this mountain-building event, where highly folded and faulted rocks are exposed in the interior walls of the Solitario. The strong deformation is particularly evident in the white band of rocks that bends and contorts along the hillside and across the saddle.



Trends of four major geological events converge at the park. Colored numbers indicate where each can be viewed.

2 Rocky Mountain Trend. About 200 million years later, the park area was again covered by an ocean basin, but this time the rocks were deposited in a shallow, near-shore environment and consisted mostly of thick-bedded limestone, shale, and sandstone. The second major geological event, building the Rocky Mountains, was completed about 50 Ma. here in West Texas. This time the folding, faulting, and uplift was driven by compression originating at the western margin of North America. Photo 2 shows how this event caused once-horizontal reddish and grey rocks to bend and fold from left to right. This one-sided fold marks what is known as the Fresno-Terlingua Monocline, located along the southeastern edge of the park in the Contrabando area.

3 Trans-Pecos Volcanic Field. Undoubtedly the most dramatic geological event affecting the area was strong volcanism that occurred between 47 Ma. and 18 Ma. throughout western North America. The large Trans-Pecos Volcanic Field was created at this time by the eruption of molten rock, called magma, which originated from a slab of oceanic crust driven from the west deep underground and then melted. This volcanism had the most direct and profound effect of the four events at BBRSP and is the most completely represented. The Bofecillos Mountains make up the high, central part of the park and were formed at 27 Ma. by the eruption of very extensive lava flows and abundant volcanic ash that forms rock called tuff. The interior of the Bofecillos Mountains is characterized by high rugged peaks marking old eruption sites and level plateaus where lava flows accumulated, while the edges of the mountains are incised by deep canyon drainages. Photo 3 provides a view of the central Bofecillos vent area, a source for most of the lavas and tuffs comprising the mountains. On the left is Oso Mountain, the highest peak in the Park at 5135 feet. The vent area is readily accessible from the Main Park

Road, and the Oso Loop passes directly through it.

4 Basin and Range Trend. The fourth geological event is marked by development of the Basin and Range Province. The map illustrates how the Basin and Range is characterized by north-trending mountains and intervening sediment-filled valleys or basins, which began forming about 25 Ma. These uplifted ranges and down-dropped basins are separated by parallel faults. This deformation is due to the west-to-east stretching of the earth's crust that may have been caused by relaxation of the compressive force that had built the Rocky Mountains. In the park, the Basin and Range trend is evident along the Rio Grande, where the river flows through a series of elongated basins bounded by long, continuous faults. Photo 4 shows one of the best-developed examples along the north edge of Colorado Mesa, where the bounding fault extends from right to left beyond the photo margin. The shot was taken just west of Closed Canyon. Here the road parallels the fault for about 2.5 miles east–one of the longest straight stretches of F.M. 170 in the park.

As you travel through BBRSP, watch for evidence of all four geological events–for folds and faults, lavas and tuffs. Take with you a fuller appreciation for the geological enormity of time and scale and the resulting variety of landscape and scenic beauty here at the Crossroads.

Additional Information. For a general geological map and trail side geology of the Park pick up a copy of *Down to Earth at Big Bend Ranch State Park, Texas*, and for a more complete and detailed report try *Geology of Big Bend Ranch State Park, Texas*. Both are available at any of our visitor centers.