Guadalupe Mountains

National Park
National Park Service
U.S. Department of the Interior

Roadside Geology Guide

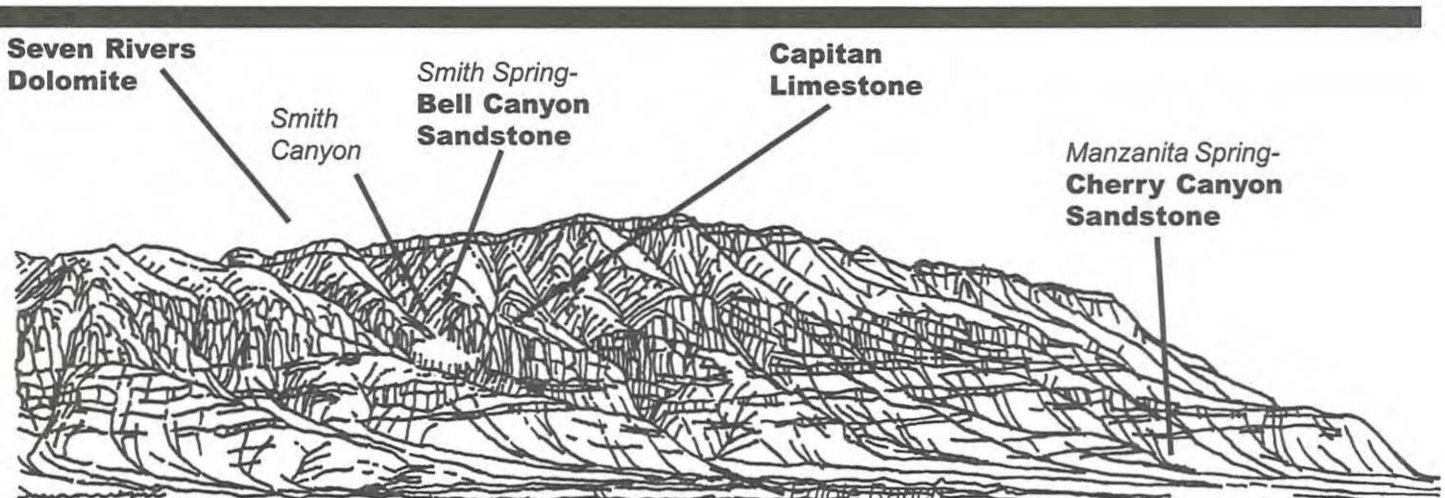
The Guadalupe Mountains are one of the finest examples of an ancient fossil reef. It is largely because of the area's geologic importance that it was designated a National Park in 1972. Geologists from around the world come to study this magnificent Permian-aged reef, which formed about 260-270 million years ago. The Guadalupian Series now appears on the Geological Time Scale and rocks within the park are used as a measuring standard against which rocks the world over are compared. Geologists refer to these representative rocks as the Guadalupian Global Stratotype.

Fossils from the area were first described by geologist Dr. G.G. Shumard in 1855 while he was accompanying an expedition looking for artesian water. However, there was little interest in studying the area more intensely until petroleum was discovered in the Permian Basin in the 1920s. Investigators such as E.R. Lloyd, K.H. Crandall, W.G. Blanchard , and M.J. Davis developed the reef hypothesis. Finally, the Guadalupe Mountains became the focus of detailed study.

Wallace Pratt, an early geologist for what is now Exxon, studied the Guadalupes extensively. Besides contributing to our understanding of the geology, he was instrumental in the creation of Guadalupe Mountains National Park. Mr. Pratt donated more than 5,000 acres of land including McKittrick Canyon, which he had purchased in the 1920s after being overwhelmed by its beauty.

As you look at the rock exposures in the park, there are many clues to tell you about this fossilized reef. Horizontal bands of limestone indicate back-reef materials, those that were deposited in calm waters between the reef and the ancient shore. Some sloping layers on the east side of the mountains are composed of fore-reef materials, or chunks that broke off from the ocean-side of the reef. Looking closely at the non-layered rocks will reveal fossilized evidence of the reef-building organisms.

Remember, the reef is preserved for you and others to enjoy. **Removing any material from the park is prohibited.**



View from Frijole Ranch

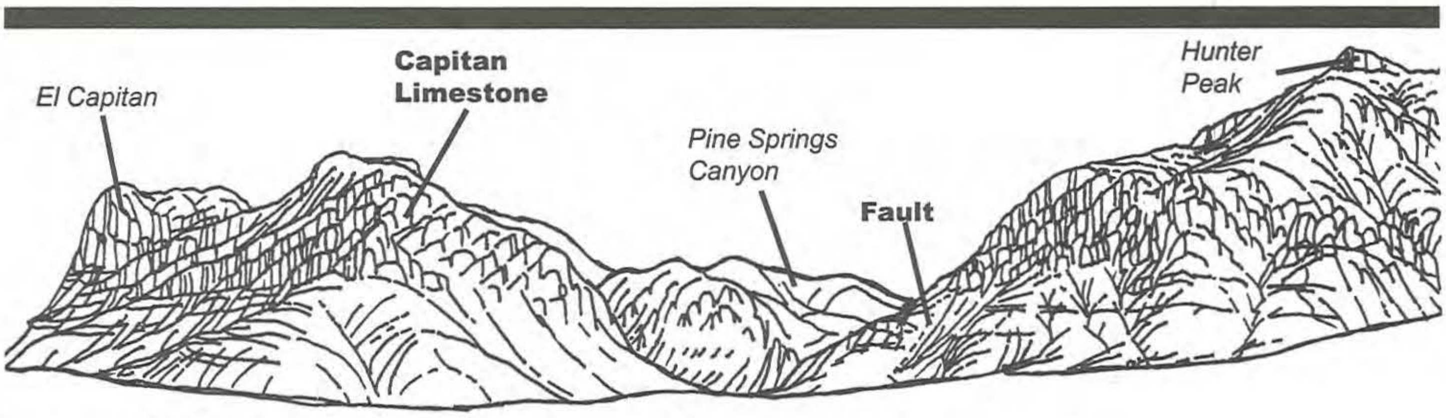
In and near the Guadalupe Mountains, very small to medium springs flow from the Permian sandstones and gravel at the foot of the mountains. Springs are spillways through which overflow or surplus groundwater passes. Near Frijole Ranch, which at one time was called Spring Hill Ranch, are five of the park's major springs.

One is Smith Spring, located in Smith Canyon. Smith Spring is among the highest springs in Texas and flows from the Bell Canyon sandstone at 5,955 feet above sea level. This spring water collects in the higher elevations to the northwest where rainfall is greater. The water then percolates down through a complex system of joints in the limestone and sandstone layers.

The Cherry Canyon sandstone is the major water-bearing sandstone layer from which most springs in the park flow. Smith Spring flows from the Bell Canyon sandstone because it is higher in elevation than the other springs in the park.

Water from Smith Spring disappears underground then reemerges from the gravel below to form Manzanita Spring which is 0.3 miles east of Frijole Ranch. The Smith Spring Trail (2.3 miles) gives an excellent view of both Smith Spring and Manzanita Spring.

This area is named for Pine Springs, a spring that was

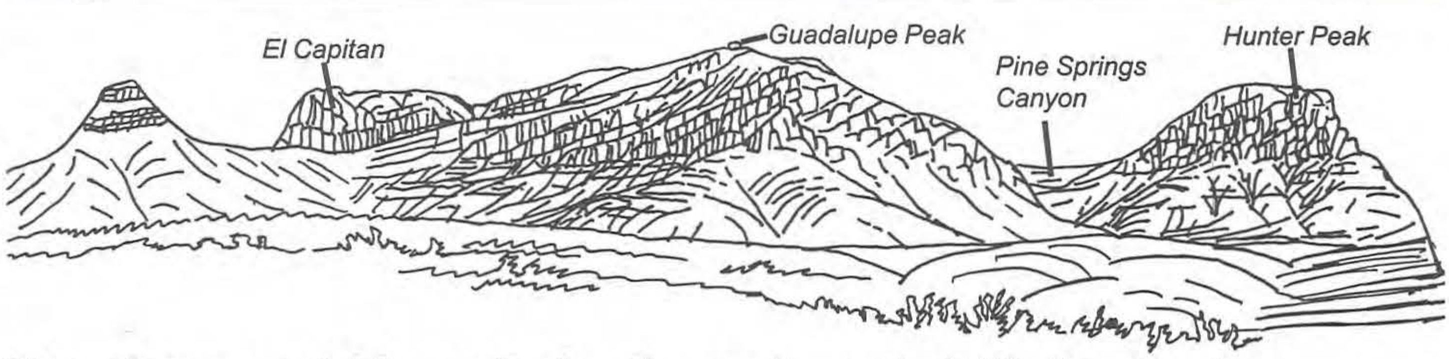


View of Pine Springs from The Pinery Parking Area

historically used by Indians, then served as a stop for the Butterfield Overland Mail Line.

The springs are reported to have failed on August 16, 1931 during an earthquake. There was probably some movement in the fault in the Cherry Canyon sandstone from which the water flowed causing blockage of flow. A fault is a fracture in the earth's crust along which rocks on one side have been displaced relative to rocks on the other side. The fault can be seen below the top exposures of the Capitan Limestone where the limestone beds have been offset; the right side of this fault has been moved up and the left has moved down. This is one of numerous faults that cut this area causing the rock layers to be displaced by a few to several hundred feet.

This is an excellent place to view the role of erosion on the Guadalupe Mountains from the formation of the reef until

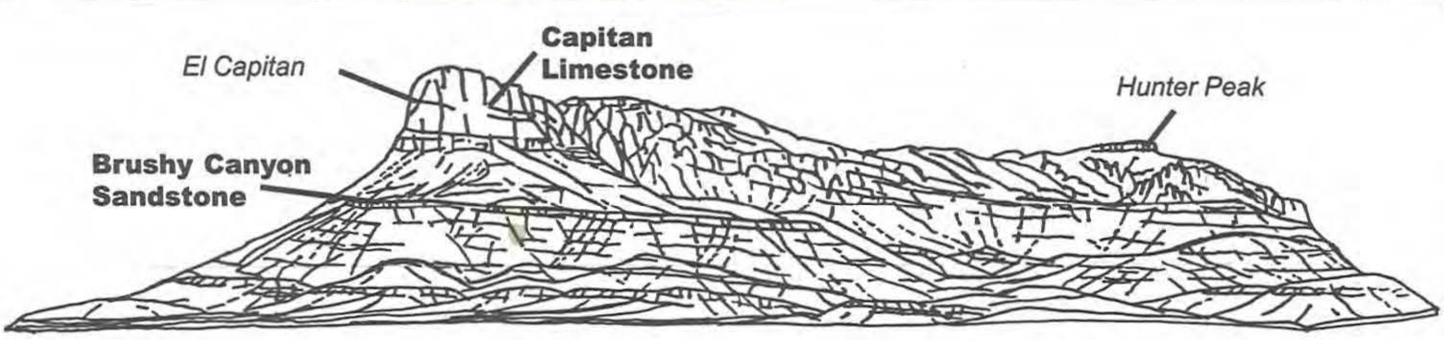


View from roadside park, 1 mile southwest of Visitor Center

present time. Looking to the far left at El Capitan, this now erosion-resistant cliff was in Permian time eroded by wave action on the seaward-facing side. This caused blocks of the reef to roll down into the sea basin forming a slope of debris at the base of the reef which now makes up some of the lower limestone layers.

Now look to the far right at Hunter Peak, with its fractured and rugged cliffs that have layers that look almost vertical compared to El Capitan's horizontal layering of rock. Hunter Peak looks so much different due to the faulting that occurred in that area in late Mesozoic time. The rock layers were pushed up by the fault which caused the layers to fracture allowing them to erode more easily. In more recent time, stream erosion and groundwater erosion have removed softer sediment forming calcium-rich soils in which vegetation has grown.

The most striking feature of Guadalupe Mountains National Park is the thousand-foot high El Capitan, which can be seen from miles around. Early settlers used it as a landmark on the route through Guadalupe Pass.



View from roadside park, 4 miles southwest of Visitor Center

El Capitan is composed of the Capitan Limestone, which is the Permian-aged limestone reef deposit. A reef is a submerged resistant mound or ridge formed by the accumulation of plant and animal skeletons. The Capitan Limestone is a massive, fine-grained fossiliferous limestone that formed by growth and accumulation of invertebrate skeletons of algae, sponges, and tiny colonial animals called bryozoans. These skeletons were stabilized by encrusting organisms that grew over and cemented the solid reef rock, unlike modern reefs built by mainly a rigid framework of corals.

Below this massive cliff of Capitan Limestone you can see a prominent sandstone ledge of the Brushy Canyon sandstone which formed when the off-shore basin began to slowly subside.

Because of the Capitan's greater resistance to erosion, it forms this cliff which looms majestically above the horizon for us all to see.