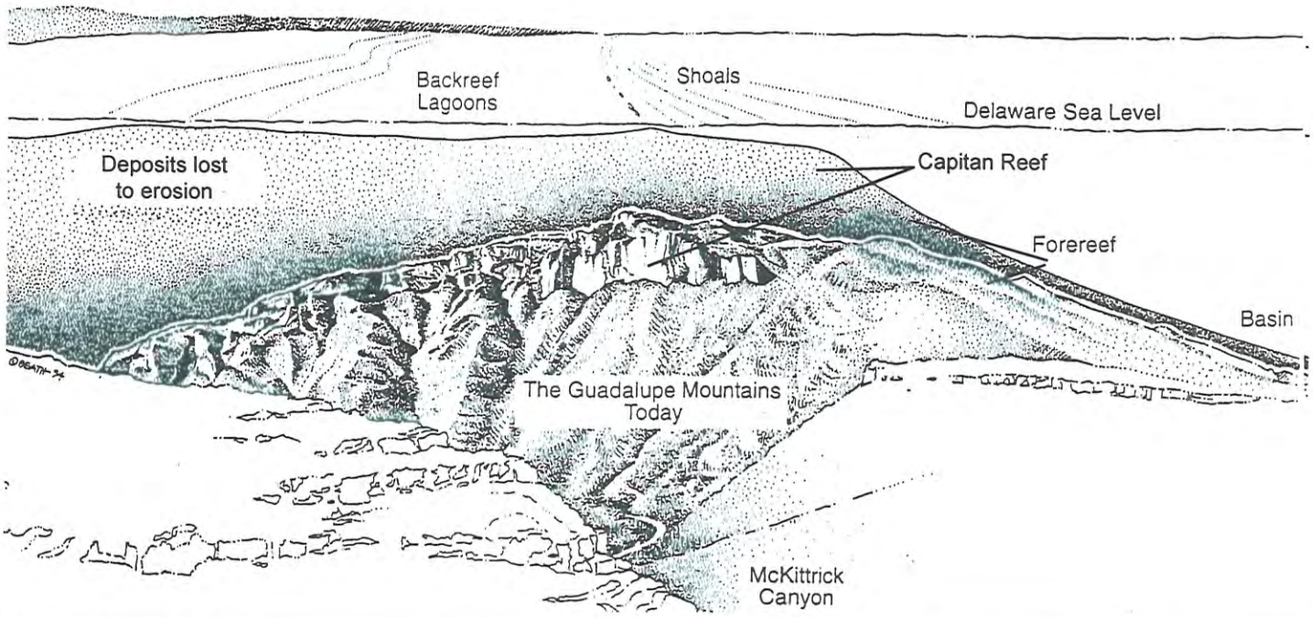
McKittrick Canyon Geology



The Rise and Fall of a Marine Empire

The massive cliff at the top of the northeast wall of McKittrick Canyon is part of a fossil reef that formed approximately 260-270 million years ago. The Capitan Reef grew from the remains of billions of marine animals and plants cemented together by lime (calcium carbonate). The reef builders thrived in shallow, sunlit, tropical waters around the edge of the Delaware Sea, a deep, nearly land-locked arm of the vast Permian Ocean. While corals form most reefs today, the Capitan Reef was built by algae and sponges and during the Permian Period prior to the development of modern, colonial reef-building corals. McKittrick Canyon is unique because its walls reveal a grand cross-section of several million years of reef growth history. The fossil reef now overlooks the dry sea floor, a silent testimony to the changing face of West Texas

Limy sands and muds were deposited in warm, quiet lagoons behind the reef. These "backreef" layers form horizontal rock beds visible to the left of the reef cliff. A narrow shoal, perhaps consisting of a line of small islands when sea level was low, restricted water circulation between the shallow lagoons and the waters above and oceanward of the reef.

Fragments of the growing reef edge often broke off and rolled down the slope into deep water, mixing with shells, sand, and other sediments to create thick "forereef" deposits. Generations of reef creatures then built the reef seaward, using the remains of the old as a foundation.

Water at the base of the forereef deposits was over 1500 feet deep. Fine windblown sand and floating organic debris sometimes crossed the shoal and reef barrier into the deep, cold water of the Delaware Basin. These slowly settled to the quiet basin floor to form the fine-grained siltstone at the mouth of McKittrick Canyon.

The reef stopped growing when the Delaware Sea was eventually cut off from the ocean. As seawater evaporated, thick salt deposits filled the subsiding basin. Erosion of the surrounding highlands slowly buried the reef over a period of millions of years. As the Guadalupe Mountains began to be uplifted 20-30 million years ago, the softer overlying rock has quickly eroded away to expose the reef and the basin once again.

The World During Permian Times

The land was quite different 290-250 million years ago. Two large landmasses collided and formed one supercontinent called Pangea. The Delaware Sea was situated near the equator and the land surrounding it had an arid to semi-arid climate. Numerous sea level changes occurred during the Permian. The Permian Period ended with the worst mass extinction in the history of the Earth. Close to 90 percent of species became extinct. There is disagreement over what caused the extinction.

Permian Diversity

Sponges

Sponges were the primary reef builders. Sponges are the most simple of the multi-cellular animals. Sponges fed on nutrients and plankton in the water.

Bryozoans

Bryozoans were major contributors to the structure of the reef. These tiny creatures (1 mm across) are sometimes called "moss animals". A colony of bryozoans 2 ft. in diameter could house tens of millions of individuals.

Crinoids

The disc-like segments of crinoid stems are easily recognized. Crinoids are called "sea lilies" because of their resembled flowers blanketing the ocean floor.

Ammonoid

Ammonoids were squidlike creatures that lived inside an external shell. Ammonoids were important predators in the ancient oceans, eating fish, crabs, and other shellfish.

Brachiopod

Brachiopods are soft-bodied creatures that secrete a two-valved shell. The bilateral symmetry distinguishes them from clam-like pelecypods. Brachiopods were common on the reef.

Trilobite

Trilobites became extinct at the end of the Permian (250 Million years ago). They were probably scavengers and predators that lived on the seafloor. Trilobite fossils are rare in Guadalupe Mountains National Park.

Nautiloid

Nautiloids displayed greater diversity during the Paleozoic Era. Today there is only one type of nautilus in existence, the pearly nautilus. Nautiloids have heads, well-developed eyes, and grasping tentacles. They propel themselves by forcing water out of the body cavity.