Tonto

National Park Service
U.S. Department of the Interior

Tonto National Monument

GEOLOGY OF TONTO NATIONAL MONUMENT

In the rugged Mazatzal range of east-central Arizona lies Tonto National Monument, established in 1907 to preserve several 700-year-old cliff dwellings and the surrounding Sonoran Desert. The fragile buildings could not have survived for so many centuries outside of the sheltering caves. The caves, in turn, would not be here were it not for the nature of the rocks that formed them.

Around 2 billion years ago, Arizona lay along the southwestern edge of a large landmass. About 1.7 billion years ago, layers of rock were lifted into a great mountain range which stretched along the edge of the continent. After many cycles of deposition, uplifting, and erosion, most of what is now North America was a broad, flat plain.

For nearly a half-billion years the continent was alternately elevated and submerged. Marine sedimentary rocks alternated with continental deposits that accumulated in rivers and deltas, or as sand dunes. At times, widespread erosion removed previous deposits or prevented deposition altogether, so the record is by no means complete.

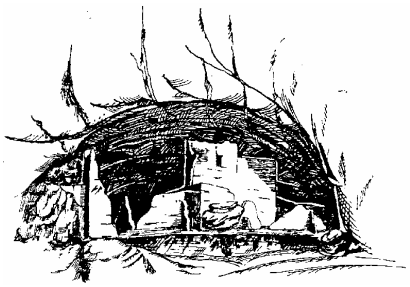
During the time of the dinosaurs, there was an increase in geologic uplift. What is now the southwestern United States became a vast desert. Seas rolled across the land, coming from the northeast. However, these advances were short-lived, and most deposits indicate an environment similar to that of northern Africa today, with its desert dunes and the great floodplain and delta of the Nile.

Around 15 million years ago faulting brought more mountain building, including the present central Arizona ranges. As soon as uplift began, streams began cutting and carrying debris to the surrounding lowlands. The coarsest materials were dropped close to the mountains, while finer sediments were carried out into the center of the basins. Hardened gradually by minerals carried in groundwater, the margins of the formation became tightly cemented.

The final chapter in the geologic history of the Tonto Basin is one of erosion spurred partly by continuing uplift, partly by downcutting. Gradually the Salt River cut a deep channel that enabled it to carry its deposits out to the deserts of the Phoenix area and points west. By approximately 10,000 years ago, the landscape looked much as we know it today.

The rocks in the monument are mostly sedimentary, and the oldest are a little more than a billion years old. Natural processes formed the caves, probably starting between 50,000 - 400,000 years ago. Water dissolved the minerals binding the rocks together; eventually pieces of the hillside fell away, and caves were formed.

Although the Lower and Upper Cliff Dwellings



are at different altitudes, they are both in the same layer of Dripping Spring Quartzite. A fault line between the two dwellings offsets them by nearly 300'.

Many rocks along the trail appear to be stuck together. This is caused by caliche, the natural cement of the Southwest. As groundwater evaporates, it leaves behind a tiny amount of lime which gradually cements the stones together.

Look closely at the rocks along the ½-mile trail from the visitor center to the Lower Cliff Dwelling. Many of them display features that reveal the environment in which they were deposited. Mud cracks formed when sediments dried out during low tide. Some rocks display ripples or crossbedding, which also form in shallow water. Fossils are rare because the rocks are too old or were deposited in an unfavorable environment.

During your visit to Tonto National Monument, remember that these areas belong to all of us. Please stay on the trail. Do not lean on, touch, or climb on the walls. Do not remove any rocks or plants, and enjoy the animals from a distance.