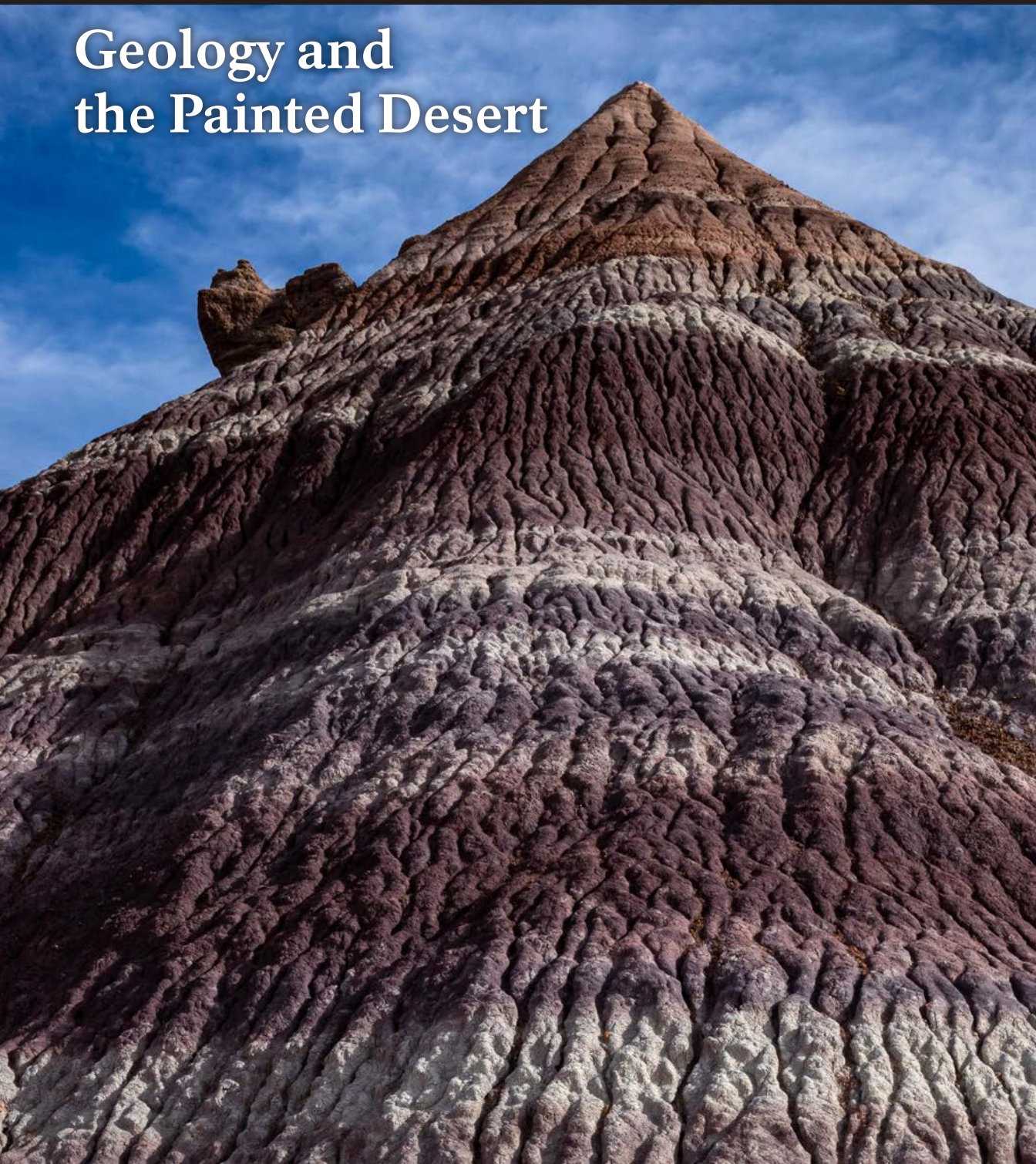
Petrified Forest

National Park Service
U.S. Department of the Interior

Geology and the Painted Desert

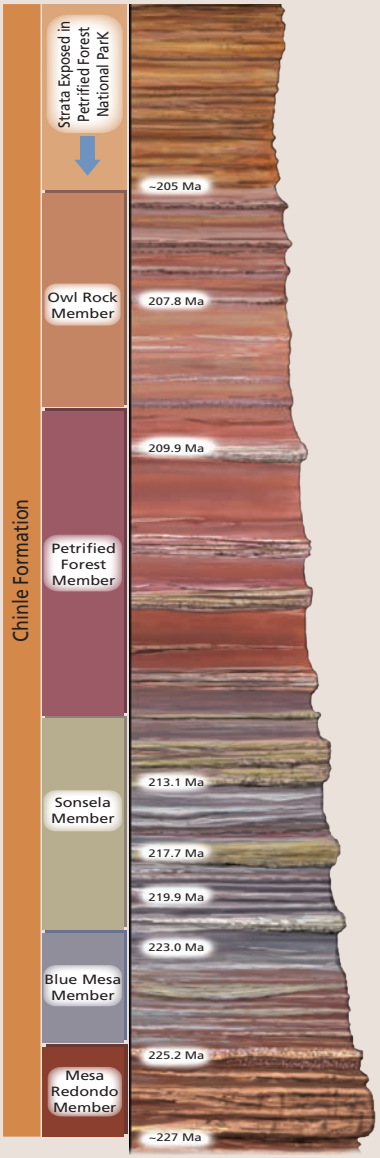


Rocks and Fossils

At Petrified Forest, over 200 million years of Earth's history is recorded in the rock layers that contain fossils, including petrified wood. Most rocks found in the park are sedimentary, formed by the deposition and cementation of sediments.

To study sedimentary rocks effectively, geologists group rocks with similar properties and characteristics into formations, which can then be broken down into members that share more specific characteristics.

The colorful rocks of the **Chinle Formation** exposed in the park are divided into multiple members. Each layer was a distinct landscapes of the Late Triassic Epoch, between 205-227 million years ago.



PETRIFIED FOREST STRATIGRAPHIC COLUMN

Youngest (top) to oldest (bottom)

Owl Rock Member
These layers mostly tend to have an orange coloration to the rock. We can conclude that here there were once lakes, rivers, and sand dunes that deposited these sediments. We also know that the climate became even more arid.

Exposed at Chinde Mesa
Seen at mile marker 1 at Tiponi Point Overlook

Petrified Forest Member
These sediments tell us that meandering river systems were quite common. We also see a decrease in precipitation. As the level of the water table slowly decreased, this allowed the iron in the soil to oxidize, or rust.

Exposed in Black Forest and Flattops
Seen at mile marker 2 at Kachina Point Overlook and mile marker 22

Sonsela Member
Braided river systems deposited many layers of sandstone. It is in this layer where the majority of petrified wood resides. Climate change is apparent in the layers of these areas, as we can see rainfall becoming more and more seasonal.

Exposed at Rainbow Forest
Seen from Giant Logs trail

Blue Mesa Member
Meandering river systems and swamps dominated this area, depositing thick layers of clay, silt, and mud. The landscape was probably very similar to areas with tropical climates today.

Exposed at the Tepees
Seen at mile marker 13

Mesa Redondo Member
Gravel and sand were deposited in abundance by braided river systems, and multiple flooding sequences carried in larger sediment loads.

Found in Backcountry

The Sonsela Member found in the middle of the park.

Badlands

Much of the Late Triassic Epoch, this region was located near the equator on the northwestern edge of the super-continent Pangea. At that time, northeastern Arizona exhibited subtropical environment with large rivers, floodplains, and swamps.

Sediments deposits range from clay-sized particles and sand-sized grains to cobbles and pebbles. Over time, the deposits were compressed and cemented to form rocks. Today, the rocks reveal a very distinct landscape: badlands.

Primarily composed of soft sedimentary rocks, badlands are a type of terrain that have been heavily eroded by water and wind, with minimal soil development.

Erosion

Water erosion is the major geologic process that removes rock material in the park. While erosion can be relatively fast in the Painted Desert, the actual rate is variable due to the material, the slope, and presence (or lack) of vegetation.

Though this region exhibits a semi-arid climate, heavy rains of summer monsoons remove as much as a quarter inch (0.6 cm) of rock each year. Bentonite clay, one of the main components of the Chinle Formation, swells as it absorbs moisture, then shrinks and cracks as it dries, causing surface movement that discourages plant growth.

The lack of vegetation renders the sediment susceptible to rapid weathering, forming rounded mudstone hills. Other rocks, such as sandstone and basalt, are more resistant to erosion and form mesas (broad, flat-topped hills) and buttes (narrow, flat-topped hills).

A Painted Desert Palette

When each of the multi-colored layers was deposited by the ancient river systems, they were not the color you see today; they were like any ordinary modern river sediments. The change in color occurred long after deposition due to the oxidation (rusting), or reduction of iron and other minerals. Oxidation is determined mostly from the level of the water table at the time of deposition.

The bluish colors in the park suggest that the water table was high during deposition, thus iron was reduced. Whereas, the reddish colors suggest the water table was lower than the sediments as they were being deposited, thus iron was oxidized. In the reddish areas, we find *evaporites* (minerals left over from evaporation), such as selenite (gypsum).

A dryer climate must have existed in order for evaporation to occur. Geologists use nature's color palette can tell us a lot about the ancient landscapes of the Painted Desert and the Late Triassic Epoch.

Questions & Answers

Q: ***Where is the Painted Desert?***

A: It is not just confined to the park! These badlands can be found throughout northern Arizona, but the Chinle Formation can be seen in several forms across the west.

Q: ***What is the black rock by the Painted Desert Inn?***

A: Known as basalt, the rugged black rock is volcanic material from the Bidahochi Formation, around 8 million years old. The missing 200 million years of rock is known as a unconformity.

Since these ancient soils continue to provide new clues to the past, Petrified Forest National Park will remain a significant contributor to unlocking the mysteries of Earth's history, allowing us to better understand and appreciate this beautiful and inspiring planet.

Please join the millions of visitors since this area was first protected in 1906 who have enjoyed the petrified wood here and left it undisturbed for others to enjoy, too.

FIND YOUR PARK

Removal of rocks from the park is illegal under federal law.