Petrified Forest National Park

Giant Logs Trail

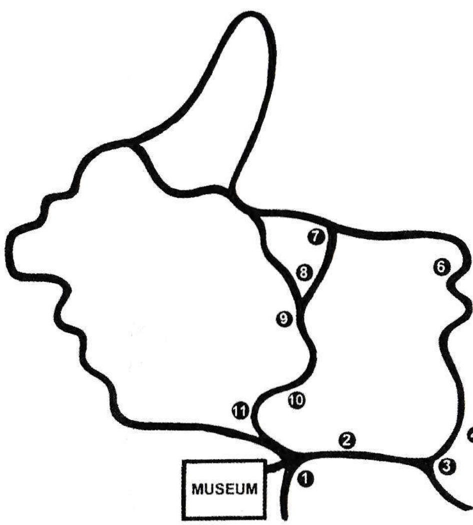
NPS photo

Welcome to the Giant Logs Trail

Trail Facts:

How Long? 0.3 mile (0.5 km) loop
How Much Time? Allow at least 20 minutes
How Difficult? An easy walk with some hills and stairs
Not Handicap Accessible

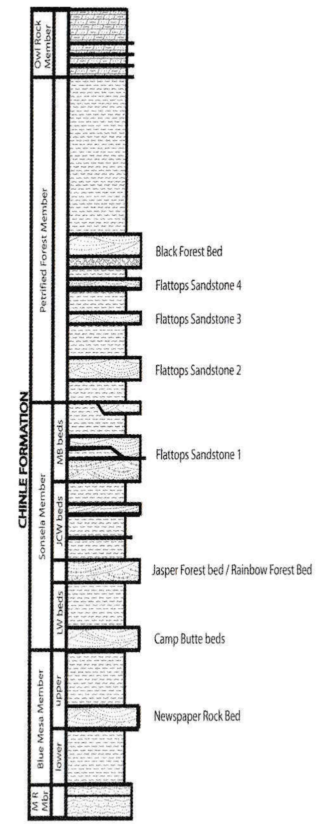
Giant Logs Trail is a self-guided trail through one of the most colorful petrified wood deposits found in the park. The trail is marked with numbered posts that correspond to this booklet. As you walk the trail, please remember that our purpose is to preserve and protect this environment. Every year tons of petrified wood, as well as plants, rocks, fossils, and artifacts are removed illegally from the park. Please stay on designated trails and leave everything where you find it.



Stop #1 Two Parks in One

Take a moment to look at the landscape before you. Today, Petrified Forest National Park is a semi-arid grassland. Temperatures can range from above 100° F (38° C) to well below freezing. About 10 inches (25.4 cm) of moisture comes during infrequent snow in the winter and often violent summer thunder-storms. Animals and plants of today are adapted to extremes in temperature and moisture. It is a dynamic land, but very different from the ancient environment whose story is told by the rocks around you. What can we learn from the rocks?

All NPS images except where indicated



Stop #2 A Sedimentary Journey

What can the rocks tell us? Think of the rock exposures as a storybook written in a foreign language. You may not be able to read the text, but the pictures convey an intriguing learning experience of their own. However, if you learn to read that foreign language, the book provides a more meaningful story. This is like the study of Geology and how it pertains to the world around us.

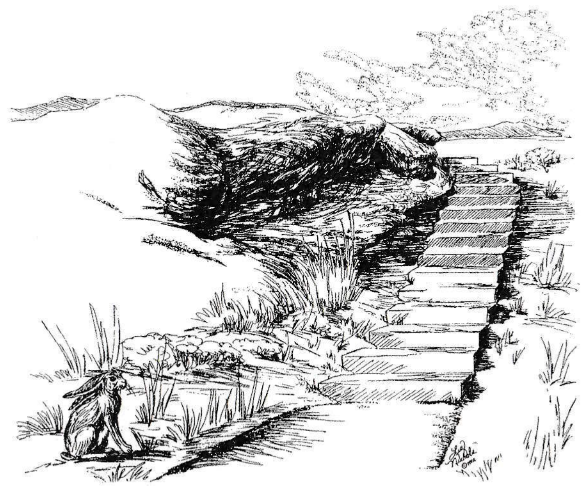
Look at the badlands and sandstone outcrops all around you. The main geological formation in the park is the Chinle Formation, well-known throughout the Southwest, representing the Late Triassic Period. Like chapters in a book, the layers of the Chinle Formation can be divided into *members*: the Blue Mesa Member, Sonsela Member, Petrified Forest Member, and the Owl Rock Member. Each member has its own characteristics. By studying the physical characteristics, researchers can theorize how they were deposited. The sandstone, mudstone, siltstone, claystone, and conglomerates represent *fluvial* (river-related) deposits. Some of the rock layers still possess ripple marks. What do these ripples mean? Where have you seen ripples in sand or mud before? The ripples that can be seen in some of the rocks of the park were made by the moving water of streams, some so detailed that it is still possible to tell which way the water was flowing.

How Old is It?

The Chinle Formation was deposited over 200 million years ago during the Late Triassic Period. This period had one main subdivisions represented in Petrified Forest National Park: the Norian (beginning 226 million years ago). The oldest Chinle Formation rocks in the park, found in the Tepees area, date at about 219 million years ago. The top of nearby Blue Mesa and the mesa north of Rainbow Forest dates at approximately 216 million years ago. In the northern part of the park, the Black Forest Bed of the Upper Chinle is quite a bit younger, at 213 million years old, while even younger Owl Rock Formation on top of Chinde Mesa (the northern boundary of the park) may be about 205 million years old. The Chinle Formation within the park thus represents over 10 million years of deposition!

Stop #3 A Member of the Whole

Notice the sandstone around you. It is part of the Sonsela Member of the Chinle Formation. The Sonsela Member consists of subdivisions, like paragraphs in a chapter of our geological book. Thick layers of sandstone and conglomerate along the Giant Logs trail, called the Rainbow Forest beds, are near the bottom of the Sonsela. Jim Camp Wash beds, mostly consisting of mudstone and shale, form the middle of the Sonsela, while the upper layer is another thick sandstone named the Flattop 1 beds. From the trail, you can see nearly the entire sequence of the Sonsela Member.

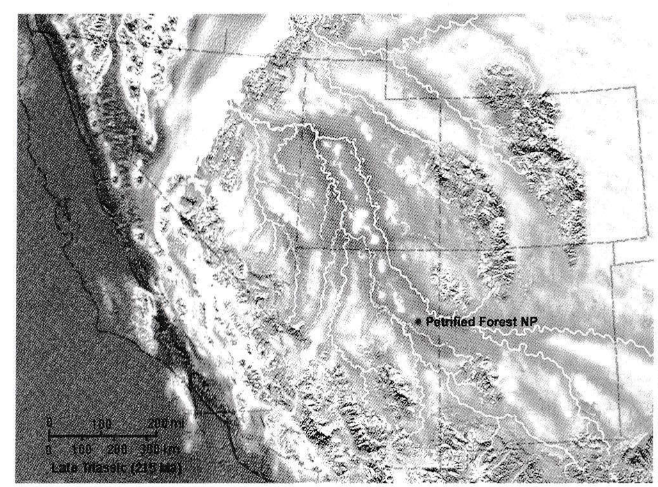


Stop #4 An Ancient Landscape

Step back in time. Instead of hard stone, imagine these sandstone layers as river beds, their water thick with sediment. As the waters subsided after another event of flooding, common during the Late Triassic, silt, mud, and sand were left behind. In your imagined world, pick up one of the pebbles left by the river. There is an even older fossil: a seashell! The gravel is made up of Permian age rocks, featuring marine fossils, such as sea lilies (crinoids) and shells (such as brachiopods), revealing that parts of the Southwest were covered by the sea before the Late Triassic. The region was humid and tropical during the Late Triassic. It isn't difficult to imagine such a landscape. Perhaps you have seen the fertile lands near many modern river systems. This ancient river system is thought to have been equal in size to the modern Amazon or Mississippi Rivers. As these ancient deposits piled up through time, underlying layers were compressed and cemented, forming the rocks we see today. As you walk up the stairs, the ledge of gravelly stone to your left are river cobbles from the ancient streams and rivers. What do some of the other landforms tell us?

What is that plaque?

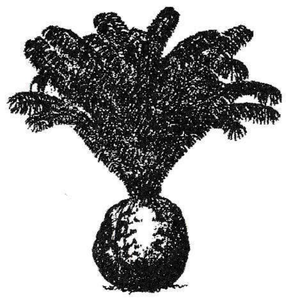
At the turn of the last century, national parks and monuments lacked systematic management. The need for an organization to operate and protect the parks was clear. Among those recognizing this need was Stephen T. Mather, a wealthy Chicago businessman, vigorous outdoorsman, and born promoter. In 1914 Mather complained to Secretary of the Interior, Franklin K. Lane (a fellow alumnus of the University of California at Berkeley), about the mismanagement of the parks. Lane invited Mather to come to Washington D.C. and do something about it. Mather accepted the challenge and arrived in 1915. When President Woodrow Wilson approved the National Park Act on August 25, 1916, creating the National Park Service, Lane appointed Mather as the National Park Service's first director. Stephen T. Mather was one of the first and best advocates of the National Park Service. His life is well summarized on a series of bronze markers which were posthumously cast in his honor and distributed through many parks.



The American West in the Late Triassic.

Map courtesy of Dr. Ron Blakey

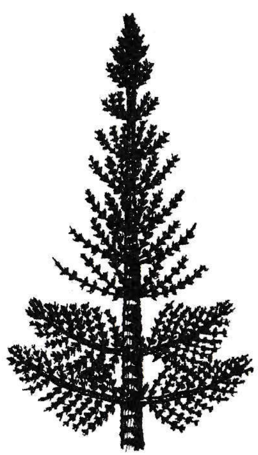
Stop #5—Diversity in the Ancient Ecosystem



Cycadoides

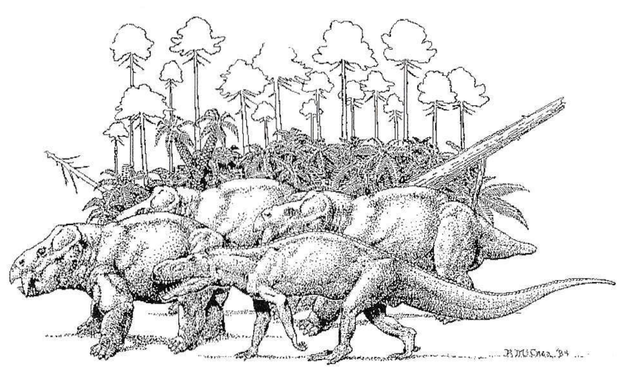
The various landforms of Petrified Forest National Park give clues to the geological past of the area. The trail you follow winds amidst the older Rainbow Forest beds, while the flat cap of the mesa to the north represents the younger Flattop 1 beds. The fossils within the layers also tell the story of the past. The ancient landscape was alive with plants and animals. Fossils of animals that once lived in the lowlands near and within the water include non-marine mollusks, clam-shrimp, insects, amphibians (such as metoposaurs), and phytosaurs. Upland areas were inhabited by aetosaurs, dicynodonts (*Placerias*), carnivorous archosaurs (such as *Postosuchus*), crocodylomorphs, and early dinosaurs, including *Coelophysis* and *Chindesaurus*.

Be sure to see displays about these ancient creatures at the Rainbow Forest Museum.



Horsetail

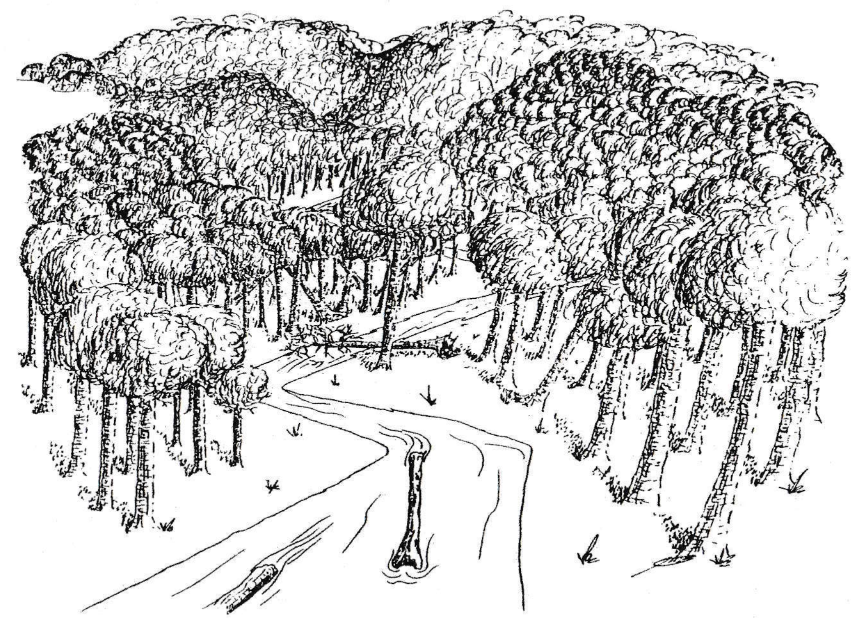
The Chinle Formation contains many plant fossils. Over 200 plant taxa are known from leaves, pollen, and other structures found in the Chinle Formation, including lycopods, ferns, horsetails, cycads, conifers, bennettitaleans, and several types that are currently unclassified. Some of the fossil plants actually show internal anatomical structure, including the famous petrified logs, the main species of trees represented in the park. Turn around: how many logs do you see? How did the logs get here?



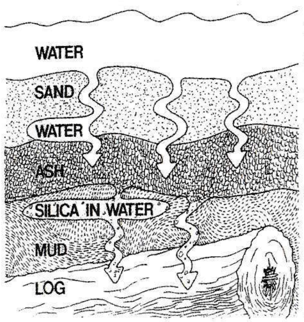
Placerias and *Postosuchus*

Stop #6—A River Journey

Have you noticed during your walk that there are no branches or bark on the fossilized logs? Researchers believe they may have been broken off during the logs' journey downstream. The logs were driftwood! Like all unmodified modern river systems, this drainage was subject to periodic flooding during seasonal runoff and high precipitation. Trees, their roots dislodged from banks farther upstream, toppled into the water and were carried by the swollen rivers. Notice the knot on the log before you. Their branchesand roots were broken. Water rising up out of the river beds spread over the floodplain, depositing both dead animals and plants and covering them with sediment. How did the wood turn to stone?



Stop #7—Trees to Stone



The colorful logs of Rainbow Forest underwent a fascinating change. Buried beneath layers of silt, mud, sand, and volcanic ash, the logs were protected from decay. Mineral-laden ground water percolating down through the layers of sediments carried silica, from the volcanic ash, and other trace minerals, saturating the absorbent dead wood.

Silica crystals (quartz) grew within the porous cell walls, continuing to form on the inner surface of the walls, and finally filling the central cavity (lumen) of the cells. If the process of petrification stopped, perhaps due to lack of water, the organic cell walls remained intact, thoroughly embedded with silica. This type of preservation is called *permineralization*. Permineralized petrified logs are tan and brown and tend to resemble modern wood. Touch the surface, however, and you will discover that they are indeed stone. Permineralized logs are most often found at Crystal Forest and Blue Mesa.

Most of the logs at Rainbow Forest, including along the Giant Logs Trail, are colorful agatized wood. If the petrification process continued, the remaining organic material degraded and was replaced by more silica crystals. Eventually, this results in the complete mineral replacement of the wood by silica. This creates a pseudomorph: a copy of wood. Where does the rainbow of colors come from?

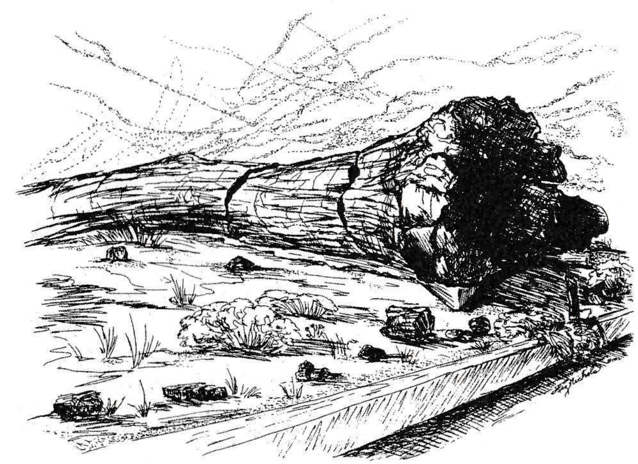
The Rainbow Forest

The colors of the Rainbow Forest's brilliant petrified logs are due to trace minerals that soaked into the wood along with the silica. Iron minerals provide bright mustard, orange, rich reds, ochre, and black. Blue, purple, brown, and black, including graceful fern-like patterns, are caused by manganese minerals. Other minerals may be present in small amounts, differing from log to log. The colors are best seen in broken sections of petrified wood. Who cut up the logs?

Stop #8—Triassic Lumberjacks?

There weren't any prehistoric lumberjacks and the National Park Service doesn't break up the logs. The logs were broken naturally! Since petrified logs are composed of quartz, they are hard and brittle, breaking easily when subjected to stress. The hard logs are surrounded by softer sedimentary layers. During earth movement and as the sediments shifted and settled, stress on the rigid logs caused fractures. As erosion exposes the logs, weathering widens the cracks, particularly from ice wedging in the winter. Gravity helps the sections roll or fall away from their original orientation, however many of the logs in the area remain aligned.

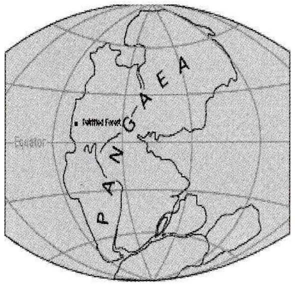
Old Faithful



Changing Views

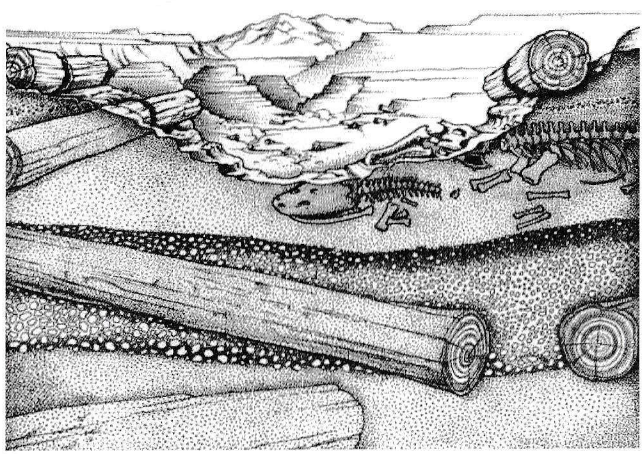
One of the largest in the park, this log was affectionately christened "Old Faithful" by the wife of the park's first Superintendent. As you look at the large end of the log, you can see the base of the main root. The rest of the root system was broken off either during the log's journey downstream or after fossilization and exposure. The remaining 35-foot (10.6-meters) section of the log is estimated to weigh approximately 44 tons (39,000 kilograms). Take a close look: you might notice that some fragments of the log's base seemed to be mortared to the main log with cement. In July of 1962, lightning struck Old Faithful, fracturing the favorite tourist attraction. At that time, the National Park Service repaired the damage, something that would not be done today. It shows that attitudes about the resources of our national parks have changed over the years.

Stop #9—The Journey to the Present



How did Petrified Forest move from near the equator? At one time, all the continents were massed together into a supercontinent called Pangaea. *Paleomagnetic** and fossil data reveals that during the Late Triassic this region was situated only a few degrees north of the equator, just east of the southwestern shores of Pangaea. Due to the movement of the earth's crust, Pangaea gradually began to move northwest, as the modern Atlantic Ocean began to open and form. Pangaea began to break apart into smaller continents, including North America. Not only did this region move north and west, the Colorado Plateau began to uplift about sixty to seventy million years ago. Wind and water gradually removed layers of rock to expose Late Triassic fossils, including the petrified logs. These same erosional forces are still at work today.

*The fixed orientation of a rock's crystals, based on the Earth's *magnetic field* at the time of the rock's formation, that remains constant even when the magnetic field changes.



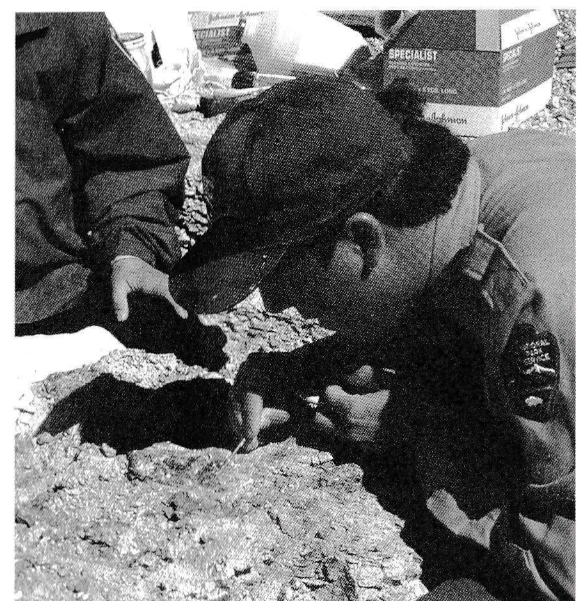
Beneath the badlands of the Painted Desert is a treasure trove of Triassic fossils.

Stop #10—It's All in the Details

The detail preserved in the petrified logs can be remarkable. Some of the logs feature knots where branches were broken away. Even the passage of insects and other arthropods left marks, such as the galleries carved beneath the bark by prehistoric beetles. Examine the surface of the petrified log to your right to find these burrows that are about as wide as a finger. While traveling through Arizona, you might see conifers with brown needles in the nearby mountains, damage caused by bark beetles today. Ancient nests, tracks, and borings are called trace fossils, clues that help researchers understand animal behavior of the Late Triassic ecosystem.

Thus layers of the Chinle Formation, and the fossils therein, tell a rich and fascinating story. Researchers put together clues such as these to reconstruct the past environment of the Late Triassic.

As you walk along the trails of Petrified Forest, imagine your feet sinking into the rich organic mud of the ancient floodplain. Nearby, the river flows swift between corridors of tall conifers. What is that sound? Could it be the grunt of feeding aetosaurs?

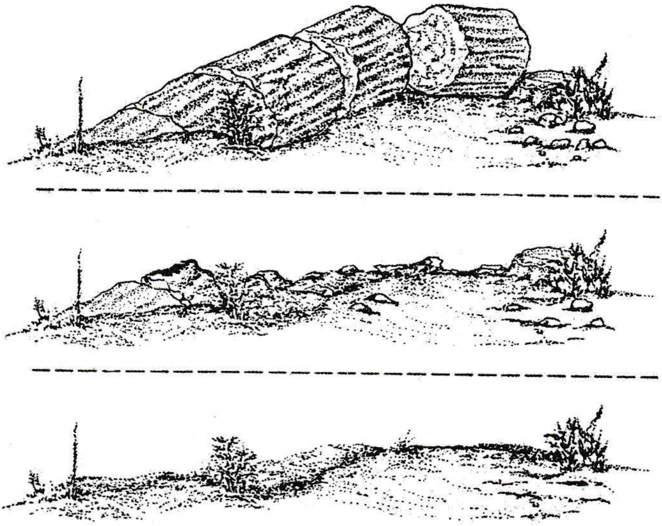


NPS photo

Paleontologist at work in Petrified Forest National Park.

Stop #11—A Message for the Future

National parks were established to preserve and protect our American heritage. The parks provide unlimited opportunities to explore and learn. The petrified wood along this trail is only one of the resources protected at Petrified Forest National Park. Archeological and historic sites, rock formations, fossils, and the modern environment all contribute to the significance of this national park. Nature continues to alter the landscape, but, unfortunately, humans have accelerated the process. Although only 10% of the entire petrified wood deposit found in Northern Arizona is protected and preserved within the boundaries of Petrified Forest National Park, tons continue to be removed from the park every year. We ask your help in protecting and preserving Petrified Forest National Park by staying on designated trails and leaving all resources where you see them. Please help us protect this internationally important site for future generations.



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