



Geologic Resources Inventory Fact Sheet

Fact Sheet Compiled in October 2023

The Geologic Resources Inventory provides geologic map data, a written report, a map poster, and pertinent information to support resource management and science-informed decision making.

Scan QR code for access to the full report, map, and GIS data



<https://irma.nps.gov/DataStore/Reference/Profile/2124884>

Geologic Issues

Paleontological Research and Protection

Petrified Forest National Park preserves a renowned assemblage of Triassic Period paleontological (fossil) resources, including one of the largest, most colorful concentrations of petrified wood on Earth and some of the earliest dinosaurs. Geologic issues at the park include resource damage and theft, ongoing paleontological inventories, and addressing on-site research and collection needs. *Pages 5–8.*

Revisions to Stratigraphy

The stratigraphic nomenclature within the park has undergone revisions since the early 1990s. The current geologic map data incorporate revised stratigraphy of the Chinle Formation. Mapping was completed in 2012, and the geologic map data were updated in 2020. *Pages 8–9.*

Bentonite

The colorful, picturesque mudstone beds of the Chinle Formation contain altered volcanic ash called bentonite. Bentonite clay deposits swell when wet and shrink when dry, creating hazardous conditions and unstable foundations along roads, trails, and buildings. *Pages 9–10.*

Mass Wasting

Mass wasting hazards in the park include slumping, cliff retreat, and subsidence. Mass wasting is caused by shrink/swell bentonite clays within the Chinle Formation. During wet periods, bentonite turns into a sticky mud that moves downslope under gravity. *Page 10.*

Geologic History

The following is a brief history of the geologic events that formed the present landscape. Pages 15–33.

Triassic Period (about 252 million to 201 million years ago)

The Triassic Chinle Formation is a sequence of fossiliferous, nonmarine strata that preserves a suite of lowland terrestrial environments, including fluvial (river) channels, floodplains, swamps, and small lakes. The formation contains altered volcanic ash beds originally deposited during the breakup of the supercontinent Pangea. In the park, the Chinle Formation is subdivided into several members (in order from oldest to youngest):

- Mesa Redondo Member—a combination of fluvial environments
- Blue Mesa Member—a vast muddy tropical floodplain
- Sonsela Member—large, gravelly rivers in a wide fluvial plain
- Petrified Forest Member—a broad muddy floodplain
- Owl Rock Member—an ancient lake system

NOTE: Since the GRI report was published, the Colorado Plateau Coring Project

(<https://www.nps.gov/pefo/learn/nature/coring.htm>) has collected rock cores within the park detailing the underlying bedrock.

Subsidence

Subsidence is controlled by both natural (e.g., removal of underground fluids, natural consolidation, or dissolution of subsurface minerals) and artificial (e.g., underground mining) processes. *Page 10.*

Potash

Potash is an in-demand commodity used in manufacturing fertilizer, pottery, glass, and soap. Potash is a mining-related, resource management issue because of the Holbrook Basin—a salt-rich basin known for its economic potash deposits—underlies a significant portion (about 50%) of the park. *Pages 10–11.*

Liquefied Petroleum Gas Storage

Extensive salt deposits of the Permian Supai Formation occur west of the park and are used by energy companies to store liquefied petroleum gas (LPG). Salt caverns that host LPG do not underlie the park and pose no significant potential for subsidence. *Pages 11–12.*

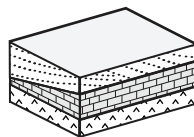
Uranium

Although sandstone beds of the Chinle Formation often contain uranium, the park contains no specific occurrences. Due to threats from uranium mine tailings entering the upstream Puerco River, the NPS monitors groundwater quality in the park. *Page 12.*

Adjacent Development

Following the 2004 park expansion, external development may have a negative impact on the integrity of fossil preservation and lead to the loss of biodiversity, increased erosion, and accelerated eolian processes (dust storms). *Pages 12–13.*

Projectile point made from petrified wood



The geology in and around Petrified Forest National Park spans more than 200 million years.

Petrified Forest National Park

Arizona

National Park Service
U.S. Department of the Interior

Geologic Resources Inventory
Natural Resource Stewardship and Science



Geologic History (cont.)

Jurassic and Cretaceous Periods (about 201 million to 66 million years ago)

Following the deposition of Triassic rocks, tectonic forces uplifted the area of the park and eroded any Jurassic and Cretaceous rocks that may have been present.

Miocene–Pliocene Epochs and Quaternary Period (about 23 million years ago to present)

The Miocene–Pliocene Bidahochi Formation was deposited in a freshwater lake setting that experienced volcanic activity sourced from nearby vents of the Hopi Buttes volcanic field. Quaternary deposits consist of fluvial sediments and eolian (wind-driven) sands that cover older rocks throughout much of the park.

Geologic Features and Processes



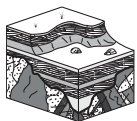
Paleontological Resources

Best known for its petrified trees, the park contains a rich assemblage of Upper Triassic plant, animal, and trace fossils that record an interval of Earth's history known as the “dawn of the dinosaurs.” Paleontological resources include some of the earliest plant- and meat-eating dinosaurs, giant amphibians, flying lizards, fish, clams, snails, early mammalian ancestors, and plants such as cycads, ferns, ginkgoes, horsetails, and conifers! Indigenous Peoples have incorporated the petrified wood into their legends, building materials, and stone tools. *Page 17.*



Chinle Formation and Badlands Topography

The colorful badlands topography of the park consists of the Chinle and overlying Bidahochi Formations. Hills, mesas, plateaus, buttes, monuments, spires, arroyos, cuevas, escarpments, and hoodoos, which are the result of differential erosion of various rock types, decorate the rugged landscape. *Pages 17–18.*



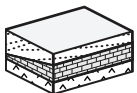
Unconformities

The contact between the Chinle and Bidahochi formations is an unconformity representing a time gap in the geologic record of about 200 million years. A comparison between other rocks in the region suggests more than 305 m (1,000 ft) of strata were removed along this surface. *Pages 18–19.*



Structural Geology and Features

Rocks in the region of the park are relatively undeformed (few folds or faults) and gently tilt to the northeast. Folded strata within the park were likely deformed by mobile subsurface salts of the Holbrook Basin. *Page 19.*



Sedimentary Structures

Sedimentary structures reflect environmental conditions that prevailed at or shortly after rocks were deposited. The most common sedimentary structures in the park are cross-bedding features indicative of an ancient fluvial environment. Other structures include lenticular (lens-shaped) bedding, cut-and-fill (eroded then filled) deposits, mudstone rip-ups (flakes removed by currents), mud cracks, and raindrop or hailstone impressions. *Page 19.*



Eolian Features and Processes

Eolian features include three forms of sand dunes (barchan, transverse, and longitudinal) that record a long history of development that began in the Pleistocene Epoch. Additional small eolian features include desert pavement and ventifacts (rocks shaped by wind-driven sand or ice crystals). *Pages 19–20.*



Volcanic Features

The Miocene–Pliocene Bidahochi Formation contains small volcanic structures and lava flows that form erosion-resistant caps protecting softer underlying rocks. Regional volcanic ash deposits are responsible for the preservation of the park's paleontological resources. *Pages 20–21.*



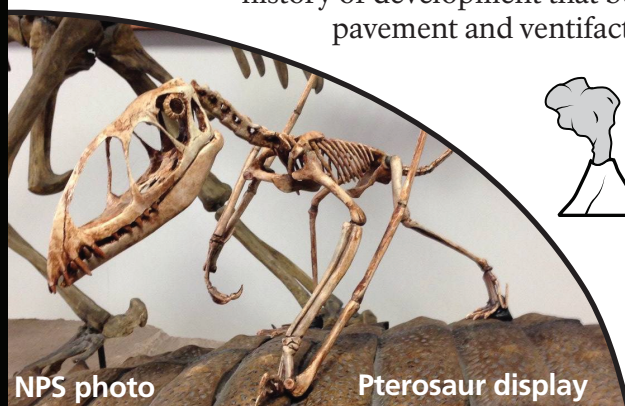
Additional Features and Processes

Additional geologic features and processes in the park include (1) stream terraces—*Page 21*, (2) tinajas—*Page 21*, (3) desert varnish—*Pages 21–22*, and (4) caliche—*Page 22.*

NPS photo



Fossilized log and colorful banded mudstone at Twin Buttes



NPS photo

Pterosaur display