Thank you for participating in this field exploration at Petrified Forest National Park! We hope you learned not only how to conduct a scientific study but that you learned something new about *your* national park.

The mission statement of Petrified Forest National Park:

Petrified Forest National Park preserves, protects, and interprets a globally significant examle of a Late Triassic ecosystem and a continuum of human use in a high desert/ short grass prairie environment. It preserves wilderness values for recreation, solitude, natural quiet, long distance views, and night skies. It provides outstanding opportunities for scientific research and education.

The mission statement of the National Park Service:

The National Park Service preserves unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations. The park service cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world.

Rockin' through the Ages: from Fossils to Petroglyphs

Fossil Excavation

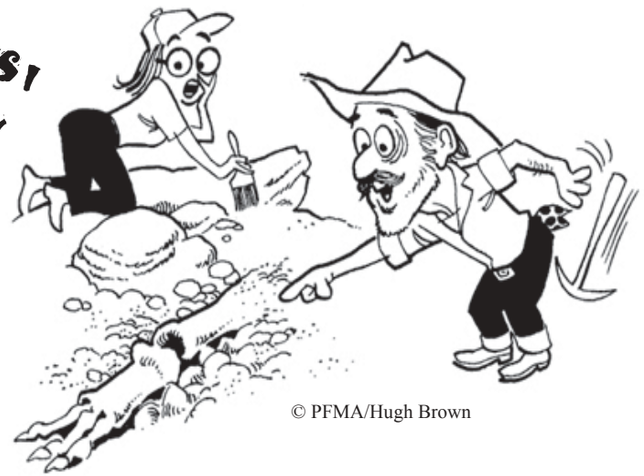
Field Guide

Date_____

Name_____

Petrified Forest National Park

Rules, Regulations, and Safety Points



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- All natural and cultural resources within national parks are protected by federal law. **Collection of park resources is illegal and subject to a $275.00 minimum fine.** This includes petrified wood, archeological artifacts, rocks, plants, and animals. Even the smallest pieces count!

- If you pick up petrified wood, rocks, sticks, or other materials to have a close look at them, be sure to put them back where you found them.

- Even though petrified wood and other fossils are rock, they are still fragile, nonrenewable resources. Do not break, chip, or otherwise damage any fossils, large or small.

- Follow the park ranger in a single file line to the study site to prevent stepping on plants. The plants in this environment grow by the inch and are destroyed by the foot. Don't let it be your foot!

Summary

Geologists describe the ancient environment of the Late Triassic Period as a low lying flood plain. Large, fast moving rivers entered the area from the south and slowed down as they split into smaller rivers and streams. They ended in lakes and swampy areas.

Paleontologists believe that lush plant growth along the rivers allowed for abundant animal life. Fossils of reptiles, amphibians, fish, clams and early dinosaurs are found with plants such as conifers, horsetails, ferns, and cycads. Petrified Forest National Park and the larger Painted Desert region receives worldwide attention for its plant and animal fossils. The fossils found here provide the most complete picture of the Late Triassic in the world.

Fossils are nonrenewable resources that need our protection. Paleontologists use fossils as crime scene detectives use evidence - to recreate a past event or time period. Just as disturbing evidence in a crime investigation may destroy the evidence, removing or relocating fossils may destroy evidence of the ancient past. It is not only the fossils that are important but their *context*. Context is the position of the fossils in the rock and in relation to other fossils and geological features. It can provide as much evidence of the past environment and events as the fossils themselves. Help us protect and preserve our fossil evidence by not disturbing fossils during your visit. This includes removing and relocating petrified wood.

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Additional Notes

Use this space for any additional notes, poems, drawings, thoughts, or feelings you have about today.

Field Exploration Goals

During this field exploration you will:

- learn about the science of paleontology, specifically the excavation and interpretation of fossils;
- develop scientific research skills;
- develop mapping and measuring skills; and
- learn about the National Park Service and how paleontological sites are protected.

Materials Needed

- field guide
- pencil
- compass
- metric measuring tape
- graph paper
- fossil identification flip ch
- flags
- clipboard
- trowel
- paint brush

Introduction

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In this field exploration you will conduct an excavation for fossils as a paleontologist. You will be given the tools and materials needed to excavate, measure, and map an area containing real and replica fossils. This field guide and information provided by the park ranger will help you to identify the fossils and develop an *hypothesis* (educated guess) on the lifestyle and death of the LateTriassic animals.

The science of paleontology is the study of ancient life on Earth using fossils. To understand fossils, paleontologists must understand rocks (*geology*), how animals and plants work (*biology*), and how everything is connected within the environment (*ecology*).

How rocks form and how they change over time give paleontologists clues when hunting for fossils. How today's animals and plants are put together, how they survive, and how they behave, help paleontologists understand ancient animals and plants. The environments on Earth today, including how animals and plants live together in them, are not so different from ancient environments. Paleontologists are actually "paleoecologists" as they create images of entire ancient ecosystems.

The following are the most well known fossils found at Petrified Forest National Park. The descriptions are based on current scientific understanding and are subject to change as new discoveries are made.

Reflections

What is the most important thing you learned today?

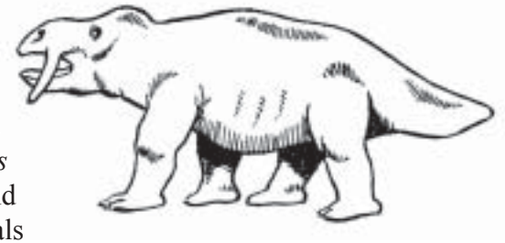
Why do you think fossils in the park should be protected?

Petrified wood is an important fossil within the park. Small pieces of petrified wood are often stolen by visitors who do not think taking one small piece will make a difference. But it does! All the small pieces add up to a very large part of the story about the trees and the Triassic environment. Can you think of ways to prevent petrified wood theft?

Kind of Fossil (tooth, femur, plant, scute,....?)	How Many Found	What was the Animal or Plant? (Rauisuchian, Aetosaur, fern,....?)

Conclusions Write down your *hypothesis* (educated guess) about the lifestyle of the organisms you identified and how they may have died.

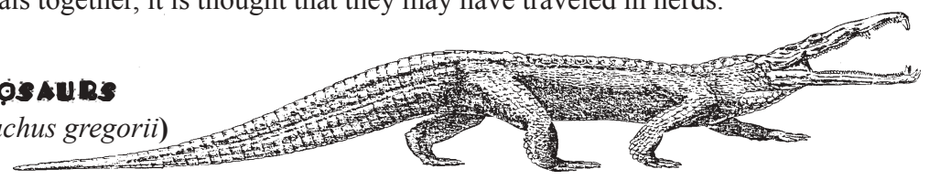
Dicynodonts



(*Placerias hesternus)*

Placerias hesternus and its relative dicynodonts were once the most abundant land dwelling vertebrates on earth. *Placerias hesternus* was over 2 meters (8 feet) long and could weigh as much as 2 tons. These animals might remind you of a rhinoceros with their huge head on a short, heavy neck, barrel-shaped body, and tiny tail. The mouth looked like a turtle's beak and helped to tear tough plants and dig through soil for roots. On the upper jaw was a pair of tusks which were larger on the males. Because fossils of *Placerias hesternus* are often found with many individuals together, it is thought that they may have traveled in herds.

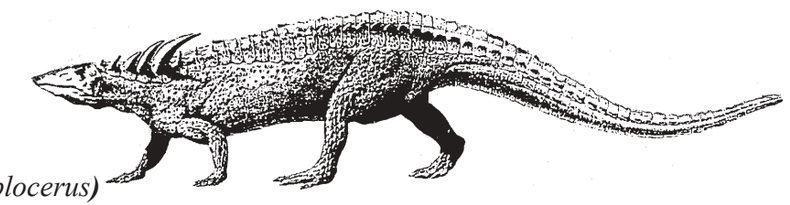
Phytosaurs



(*Leptosuchus gregorii*)

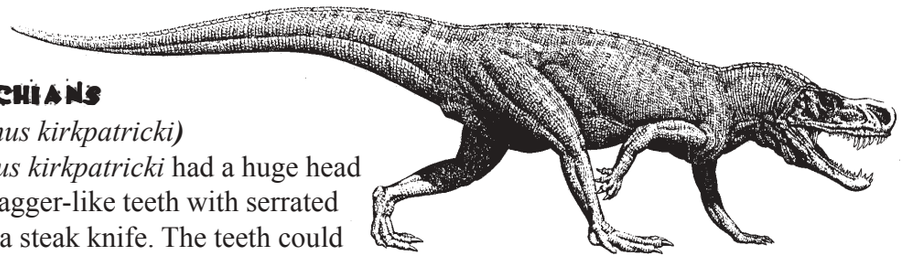
Phytosaurs lived along rivers and streams. Even though they resembled modern day crocodiles, they are only very distant relatives. Nostrils on a phytosaur were high up on its head near its eyes, but the nostrils on a crocodile are at the end of its long nose. Phytosaurs were the largest of all the Triassic reptiles. An average sized animal was about 5 meters (17 feet) long, but some fossils are from animals 9 meters (30 feet) long! The body and tail were protected by bony plates. These plates are commonly found in the park. The long, slim jaws had an awesome set of sharp teeth made for catching prey.

Aetosaurs



(Desmatosuchus haplocerus)

Aetosaurs looked like an armadillo with a long, pig-like snout. They dug in the soil for roots and tender new plants to eat. Aetosaurs can be identified by their *scutes* (bony plates). *Desmatosuchus haplocerus* had shoulder spikes up to 61 cm (2 feet) long. From its nose to the tip of its tail, it could reach over 6 meters (20 feet) in length.



Rauisuchians

(Postosuchus kirkpatricki)

Postosuchus kirkpatricki had a huge head and with dagger-like teeth with serrated edges like a steak knife. The teeth could grow up to 8 cm (3 inch) long! Teeth like these were used for tearing large chunks of flesh from prey. *Postosuchus kirkpatricki* moved like a dinosaur with its back legs tucked under its body so that it walked on its toes rather than flat-footed like most other reptiles. Each hand had a large, curved claw - an efficient and deadly weapon. An average sized *Postosuchus kirkpatricki* was about 4 meters (13 feet) long.

Clams

(Antediplodon thomasi)

Paleontologists discovered a bed of clams 61 cm (2 feet) deep and over 305 meters (1000 feet) long in Petrified Forest National Park. Individual clams averaged about 8 cm (3 inches) long. The clams probably spent their time half-buried in the sand at the bottom of lakes and ponds, filtering food from the water around them. Paleontologists believe that many of the Triassic creatures must have eaten these clams for breakfast, lunch, and dinner.

Petrified Wood

(Araucarioxylon arizonicum)

Araucarioxylon arizonicum was a large cone-bearing tree that grew near this area during the Triassic Period and is what you will find petrified as you travel through the park. Scientists debate about whether these trees grew in great forests or in less concentrated groups. Some *Araucarioxylon arizonicum* grew to almost 61 meters (200 feet) in height. Two other cone-bearing trees, *Woodworthia* and *Schilderia,* can be found in small amounts in the Painted Desert.

Field Report

Introduction Why did you do this scientific study?

Observations Describe the area where you have been working.

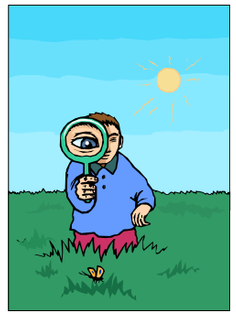
Procedure How did you do this scientific study?

Data Complete the table below and on the next page. The map you make is also part of your data, so you will take it back to school with you.

Excavated Area Dimensions

Length (meters)	Width (meters)	Area (square meters = length x width)

Observations



Scientists write field observations before beginning work. This records *variables* (things that can change) which might change the results of a study.

How do you feel today?

Describe the weather today. Is it hot, cold, windy, cloudy, sunny?

Look around you at the environment. What do you see? Rocks, sand, plants, animals or signs of animals like burrows or tracks?

Definitions

Chinle Formation - rock formation within Petrified Forest National Park and the entire Painted Desert that has several different rock layers, dating to the Late Triassic Period, over 200 million years ago

context - where and how fossils are found and explained; the context provides evidence as important as the fossils themselves

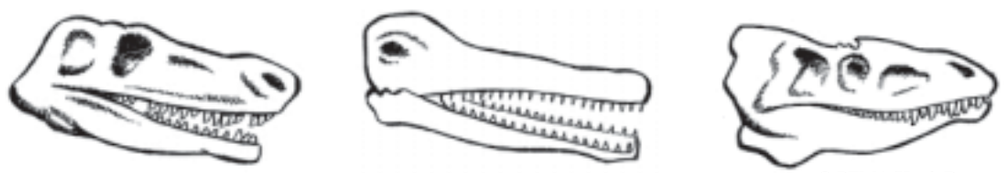
excavation - careful digging for fossils of ancient plants and animals to use for scientific study

fossilization - a process by which plant and animal remains or their impressions are preserved in rock; often rock replicas of the original plant or animal material

paleontology - science that investigates ancient life on earth through the study of fossils

sedimentary - rock formed from the deposition, accumulation, and cementation of sediments, usually forming layers and often including fossils

Triassic Period - the first geologic timespan within the Mesozoic Era, dating from 248-206 million years ago; the Late Triassic Period is well represented at Petrified Forest National Park



Field Exploration Procedures

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1. Meet a park ranger at the Painted Desert Visitor Center. Your bus will follow the ranger to Chinde Point.

2. Listen to the park ranger's introduction and review of your field guide.

3. **Answer the Observations questions on page 10.**

4. Divide into your groups and follow the ranger to where you will be working.

5. Listen to the park ranger describe how you will be doing the excavation, then collect the materials provided.

6. Using the compass, **find where north is at your site**. Mark north, south, east, and west on your graph paper. You will use these directions when you draw your map.

7. **Measure the length and width of your site** using the tape measure. **Complete the table on page 11.**

8. To **draw the site onto your graph paper, determine the *scale* first.** Count the squares across the graph paper. How many squares do you need to map the length and width of the site? Write the scale you used onto the map, for example 1 square = 5 centimeters.

9. **Begin your excavation** *systematically*: start at one side and work your way across to the other side. Mark each fossil found with a flag. The number of flags you have is the number of fossils you should find. Some fossils are large and some are small, so search carefully!

10. Use your trowel, paintbrush, and fingers to carefully **remove the *sediment* (dirt) from around the fossils**. DO NOT PICK UP THE FOSSILS! You will be able to pick them up after you find them all and make your map.

11. **Map the location of fossils** onto your graph paper. You can divide the study site into smaller squares to make it easier.

12. Show your work to the park ranger when all the fossils are found and the map is made. Only now can you carefully pick up the fossils for closer examination and identification. Replace the fossils where you found them.

13. Use the information provided by the park ranger and on pages 5 and 6 to identify the fossils you discovered. **Complete the table on page 12**.

14. Discuss with your group what you found. Do you think all the fossils are from the same animal? Can you tell what the animal ate? What clues do they give you about the ancient environment?

15. **Develop an *hypothesis*** (educated guess) about the lifestyle of the organisms you identified and how they may have died. Read the information on pages 5 and 6 to learn more about the animals.

16. **Complete the Field Report on pages 11 and 12**.

17. **Present your findings** to the rest of the class.

18. **Complete the Reflections questions on page 13**.

19. Use the results of this field study to develop a final project to be presented at school.