

LESSON 6 Field Exploration

OBJECTIVES

- Prepare research application for planned activity at Petrified Forest National Park;
- Conduct scientific study at the park using appropriate research methods; and
- Begin developing student research projects.

MAIN IDEA

To gather information, develop scientific research skills, and conduct a paleontological study at Petrified Forest National Park.

ESSENTIAL SKILLS

- | | |
|---------------------------|-------------------------|
| • writing | • summary of data |
| • analysis | • research reporting |
| • cooperating | • observing |
| • gathering research data | • hypothesis generation |
| • decision making | • research skills |

MATHEMATICAL SKILLS

- problem-solving
- scientific method
- data collection
- basic mathematical skills
- data presentation
- mapping

MATERIALS

- student journals

PAGES TO PHOTOCOPY

- *Request to Conduct Research* application page 65
- *Rules, Regulations, and Safety Points* page 67
- *Pre-visit Checklist* page 68
- appropriate Field Guide

The following table aligns this lesson with the Arizona Science (5-24-04) and Mathematics Standards. Most curriculum connections shown are implicit within the lesson. Others are achieved through teacher interaction with the class, including discussion of the background information provided. Teachers are encouraged to expand on the lesson to increase its potential as an educational tool and a fun learning experience.

CURRICULUM CONNECTIONS: PALEONTOLOGY LESSON 6 FIELD EXPLORATION					
Arizona Science Standards (5-24-04)					
	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Strand 1: Inquiry Process	C1-PO3 C2-PO1 C2-PO3 C2-PO4 C2-PO5 C3-PO1 C3-PO2 C3-PO4 C3-PO5 C4-PO1 C4-PO3	C2-PO1* C2-PO3 C2-PO4* C2-PO5* C3-PO2 C3-PO3 C4-PO1* C4-PO3*	C1-PO3 C2-PO1* C2-PO3 C2-PO4 C2-PO5 C3-PO1 C3-PO2 C3-PO3 C3-PO6 C4-PO2 C4-PO5	C1-PO3 C1-PO1* C2-PO3 C2-PO4* C2-PO5* C3-PO1* C3-PO2* C3-PO3 C3-PO5 C3-PO6 C3-PO7 C4-PO2* C4-PO5*	C2-PO1* C2-PO3 C2-PO4* C2-PO5* C3-PO1* C3-PO2* C3-PO5 C3-PO8* C4-PO1 C4-PO3 C4-PO5*
Strand 2: History & Nature of Science	C1-PO2 C2-PO3	C2-PO1 C2-PO2 C2-PO3	C1-PO4 C2-PO1 C2-PO2 C2-PO3	C1-PO4 C2-PO1* C2-PO2* C3-PO3*	C1-PO4 C2-PO1* C2-PO2* C2-PO3
Strand 3: Science in Personal & Social Perspectives		C1-PO2 C2-PO2	C2-PO1	C2-PO1*	C2-PO1*
Strand 4: Life Science	C1-PO2 C3-PO1 C3-PO2	C1-PO1			
Strand 6: Earth & Space Science	C2-PO3 C2-PO4 C2-PO6			C1-PO4	
Arizona Mathematics Standards (Grades 4-8)					
Standard 1: Number Sense			1M-E3 1M-E6		
Standard 2: Data Analysis & Probability			2M-E1		
Standard 4: Geometry			4M-E2 4M-E4		
Standard 5: Measurement & Discrete Mathematics			5M-E1 5M-E2 5M-E3		
* repetition of a performance objective from an earlier grade level					

INTRODUCTION

The field work of a paleontologist is often considered the most enjoyable part of the work, but it also must be the most exact. This is when the facts are collected - the physical evidence of past environments such as fossils and rocks, as well as the evidence supporting the facts, such as maps and photographs of sites.

The facts are interpreted, theories generated, and ideas presented to the scientific community and the general public. A scientist must understand that after all his hard work, others will tear apart his ideas, finding fault wherever they can. This is a crucial point in science, when interpretations and theories are refined and adjusted. The facts don't change - the fossils were found at a specific place, in a specific rock, recorded in the maps and photographs. But the interpretation of these facts can change.

It is very difficult to study the past. Paleontologists are looking at static evidence, such as bones, footprints, and rock layers, that represent dynamic events. Was there a flashflood and the animal bones washed into the area? Did the animal die of old age, starvation, or an injury? Do the footprints move in a regular pattern? Was the animal walking or running? Was it being chased by something else or slowly eating as it ambled along? Because we cannot go back in time, some things we will never know for sure. But as scientists work with evidence and create interpretations, sharing ideas and listening to others becomes as important as the facts themselves.

LESSON FRAMEWORK

1. Activity: *Request to Conduct Research*

A class activity under the direction of the teacher that produces an application to conduct research at Petrified Forest National Park. A form is provided that must be completed by the students and teacher, signed by the principal, and brought to the park on the day of the field exploration.

2. Activity: Field Exploration

A class field trip to Petrified Forest National Park led by a park ranger. Field guides are provided and must be copied, one per student, and brought to the park on the day of the field exploration.

REQUEST TO CONDUCT RESEARCH

TEACHER INSTRUCTIONS

OBJECTIVE

To complete an application to the national park that requests permission for students to conduct research in the form of a field exploration.

MAIN IDEA

Any scientist who wishes to conduct research within the boundaries of any national park area must apply for a research permit. By completing an application to conduct research, students will have a better understanding of the field exploration as a scientific investigation.

MATERIALS

- copy of *Request to Conduct Research* form - one per participating class

PROCEDURE

1. With input from students, fill in the basic information on the form.
2. Ask students to help you write, in particular, the Purpose of Study. This is the heart of the application and provides students with a description of the field exploration written in their own words.
3. The required Lead Teacher signature can be from the class teacher or the teacher who is organizing the field trip for several classes at the school.
4. The required signature of the school principal provides authenticity to the field exploration as a school activity.
5. Bring the completed form to the park on the day of the field exploration and present it to the ranger leading the activity. The ranger will review the form and sign it as approved.
6. You'll keep the form with you during the field exploration. It makes a nice addition to a student journal or final research project!

REQUEST TO CONDUCT RESEARCH

No collection of specimens is allowed under this permit.

School _____

Address _____

Grade/Class _____

Phone _____ Date of Study _____

Title of Study _____

Purpose of Study _____

Location of Study _____

Signature of Lead Educator

Date

On behalf of this educational institution, I approve the research permit application as written above.

Signature of Principal

Date

On behalf of Petrified Forest National Park, I approve this application to conduct research within the park boundaries.

Signature of Park Ranger

Date

FIELD EXPLORATION

TEACHER INSTRUCTIONS

OBJECTIVE

To give students the opportunity to conduct a scientific study at Petrified Forest National Park.

MAIN IDEA

After choosing one of the field explorations in paleontology, students will conduct a scientific study at the park using the knowledge and skills developed during the pre-visit lessons.

MATERIALS

- copies of field guide for chosen activity - one per student and chaperone
- nametags - one per student
- copy of *Rules, Regulations, and Safety Points* - one per participating class
- copy of *Pre-visit Checklist* - one per participating teacher
- all other materials are provided on-site by the national park

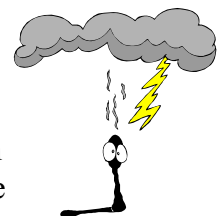
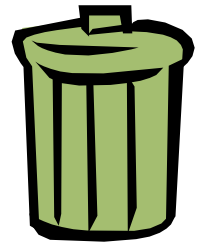
PROCEDURE

1. Go over the *Rules, Regulations, and Safety Points* sheet provided on page 67. You may want to copy this sheet and bring it with you during your visit to the park.
2. Make copies of the appropriate field guide - one per student and one per chaperone. Use legal sized paper (8 1/2" x 14"), copy the pages front to back, and staple each booklet. Stapling the field guide is *essential* due to strong winds!
3. Review the field guide with students so that they become familiar with the layout, the information, and what will be expected of them.
4. Provide a copy of the field guide to each chaperone so they will know what to expect during the field trip. They cannot do the activity themselves, but they will provide assistance when needed for the cooperative group they are assigned to.
5. Use the *Pre-visit Checklist* on page 68 to make sure you have completed all the preparations for your field exploration to the park.

RULES, REGULATIONS, AND SAFETY POINTS

In order to make your trip as enjoyable and successful as possible, the following rules, regulations, and safety points must be followed by all members of your group:

- 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 not only petrified wood and archeological artifacts, but also rocks, plants, and animals. The park has a *zero loss* policy, so even the smallest pieces count!
- If you pick up petrified wood, rocks, sticks, etc., to have a close look at them, be sure to put them back where you found them.
- Dispose of trash properly. Most viewpoints have receptacles for your use. Please make sure all trash is within the receptacle and the lid is closed. Ravens can pull out an entire garbage bag if any of it is exposed!
- Don't feed the wildlife. Wild animals can become dependent on humans for food and forget how to forage for themselves. When humans are not around, they may starve! Wild animals can also bite and may carry diseases. A deep puncture wound means a visit to the doctor for a tetanus shot to prevent infection.
- Stay on designated trails or follow the park ranger's instructions when off-trail at field study sites. The plants in our high plateau short grass prairie environment grow by the inch and are destroyed by the foot. Don't let it be your foot!
- Watch your step. Don't go beyond protective fencing or guardrails. Falling accidents occur when people get too close to the edge of steep slopes and cliffs. Please don't throw rocks over the edge of cliffs. Hikers or animals may be below.
- Stay with your group. It's a big place in which to get lost.
- Be respectful of other visitors. Try to keep noise levels down, and don't yell to each other across large areas.
- Be safe. Average elevation within the park is 1,700 meters (5,600 feet), so protect yourself from sunburn, even in the winter months. Drink water, eat lunch, and use sunscreen. Bring appropriate clothing for sudden weather changes.
- Lightning can be an electrifying experience. Avoid high observation sights, open areas, and rocky overhangs. Vehicles and buildings (avoid shade shelters) are the safest refuge during thunderstorms.



PRE-VISIT CHECKLIST

- Booked a field trip date with the park’s education technician several weeks in advance.

- Education Fee Waiver* request sent to the park and the approved form received. A copy must be provided for each vehicle entering the park.

- What You Know BEFORE* questions have been completed by each student. These can be mailed to the park or brought with you on the day of your visit.

- Classroom lessons and activities are completed.

- Request to Conduct Research* application is completed and ready to present to the park ranger at the park.

- Rules, Regulations, and Safety Points* are understood by students.

- Field guides have been duplicated and stapled, one per student.

- Students understand what they need to wear/bring:
 - Comfortable clothes that can get dirty
 - Closed-toe shoes
 - Bad weather gear
 - Water (at least 1 quart per person)
 - Hat and sunscreen
 - Field guide and pencil

- Students divided into no more than 6 field groups (maximum of 30 students).

- Chaperones, at least one for each student field group, recruited and confirmed.

- Transportation arrangements made.

- Lunch arrangements made.

- Nametags made and ready for distribution the morning of departure.

- Questions? Concerns? Call the Education Technician at (928) 524-6228 ext 264.

PETRIFIED TREE ORIENTATION

TEACHER INSTRUCTIONS

ACTIVITY OBJECTIVE

Students will map and measure petrified trees along the Giant Logs Trail in the Rainbow Forest to determine directional orientation and interpret the depositional environment of the trees prior to fossilization.

MAIN IDEA

Students will:

- take compass readings and measure marked petrified trees along the Giant Logs Trail, using mathematical skills and scientific techniques;
- place marked trees onto a map of the Giant Logs Trail;
- identify sediment type to determine depositional environment of the trees prior to fossilization;
- discuss ideas to help protect paleontological resources, sharing this information with the National Park Service; and
- share the results of each cooperative group with the other groups, noting overall directional orientation of trees and sediment type.

STUDENT GOALS

During this field exploration students will:

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

STUDENT OBJECTIVES

At the end of this field exploration students will be able to:

- describe at least one skill of a paleontologist;
- define petrified tree;
- map and measure with some accuracy; and
- describe at least one way to help preserve paleontological resources.

LOGISTICS

Allow at least 2 hours for the field exploration.

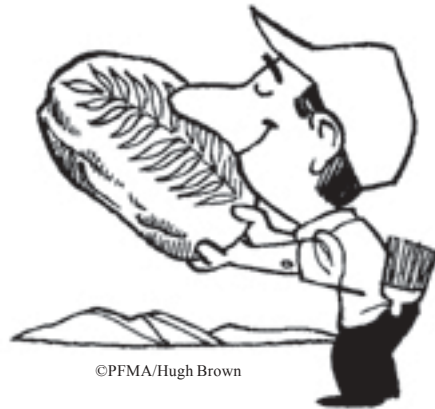
Entrance fees for an educational group are waived. You must submit an Educational Fee Waiver Application *prior* to your visit.

Make enough copies of the enclosed field guide for each student and chaperone. Use legal sized paper (8 1/2" x 14"), copy the pages front to back, and staple each booklet. Stapling the field guide is *essential* due to strong winds! The National Park Service will supply all other materials needed.

Allow students and teachers/chaperones to read through the field guide before coming to the park. This gives them a chance to become familiar with the information and the procedures they will be following.

Meet the park ranger at Rainbow Forest Museum at the scheduled time. Please allow 15-20 minutes prior to the meeting time for students to use the restroom and tour the museum. Do not let your students run wild through the museum - keep them under supervision.

Please review with students *Rules, Regulations, and Safety Points* from page 67. The field guide contains several rules which the park ranger will review before beginning the field exploration.



FOSSIL EXCAVATION

TEACHER INSTRUCTIONS

ACTIVITY OBJECTIVE

Students will excavate, map, measure, and identify fossilized remains of animals and plants using the skills and techniques of a paleontologist.

MAIN IDEA

Students will:

- excavate buried fossil animal and plant parts;
- map and measure excavated fossils using mathematical skills and scientific techniques;
- identify the type of animal from which the fossilized remains came from;
- discuss ideas to help protect paleontological resources, sharing this information with the National Park Service; and
- share the results of each cooperative group with the other groups, describing the fossils found and how the type of animal and its habits were determined.

STUDENT GOALS

During this field exploration students 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.

STUDENT OBJECTIVES

At the end of this field exploration students will be able to:

- describe at least one skill of a paleontologist;
- define fossil;
- map and measure accurately; and
- describe at least one way to help preserve paleontological resources.

LOGISTICS

Allow at least 2 hours for the field exploration.

Entrance fees for an educational group are waived. You must submit an Educational Fee Waiver Application *prior* to your visit.

Make enough copies of the enclosed field guide for each student. Use legal sized paper (8 1/2" x 14"), copy the pages front to back, and staple each booklet. Stapling the field guide is *essential* due

to strong winds! The National Park Service will supply all other materials needed. Allow students and teachers/chaperones to read through the field guide before coming to the park. This gives them a chance to become familiar with the information and the procedures they will be following.

Meet the park ranger at Painted Desert Visitor Center at the scheduled time. Please allow 15-20 minutes prior to the meeting time for students to use the restroom and tour the Visitor Center. An additional 20 minutes should be included if you are scheduled to watch the orientation movie, *Timeless Impressions*. Do not let your students run wild through the Visitor Center - keep them under supervision.

Please review with students *Rules, Regulations, and Safety Points* from page 67. The field guide contains several rules which the park ranger will review before beginning the field exploration.



STUDYING FOSSILS IN THE LABORATORY

TEACHER INSTRUCTIONS

ACTIVITY OBJECTIVE

Students will analyze, label, and catalog fossils in a laboratory setting, designing an exhibit in which to display and interpret them in the context of their ancient environment.

LESSON FRAMEWORK

Students will:

- clean and analyze fossil animal and plant parts,
- label and catalog fossils using museum curation techniques,
- identify the type of animal from which the fossilized remains came from,
- design an exhibit in which to display and interpret the fossils in the context of their ancient environment,
- discuss ideas to help protect paleontological resources, sharing this information with the National Park Service, and
- share the results of each cooperative group with other groups, describing the designed exhibits.

STUDENT GOALS

During this field exploration students will:

- learn about the science of paleontology, specifically laboratory preparation and museum curation techniques,
- develop scientific research skills,
- use their creativity to design an interpretive exhibit, and
- learn about the National Park Service and how paleontological resources are protected.

STUDENT OBJECTIVES

At the end of this field exploration students will be able to:

- describe at least one skill of a paleontologist,
- define fossil,
- describe how paleontology specimens are prepared and curated, and
- describe at least one way to help preserve paleontological resources.

LOGISTICS

Allow at least 2 hours for the field exploration.

Entrance fees for an educational group are waived. You must submit an Educational Fee Waiver Application *prior* to your visit.

Make enough copies of the enclosed field guide for each student. Use legal sized paper (8 1/2" x 14"), copy the pages front to back, and staple each booklet. Stapling the field guide is *essential* due to strong winds! The National Park Service will supply all other materials needed. Allow students and teachers/chaperones to read through the field guide before coming to the park. This gives them a chance to become familiar with the information and the procedures they will be following.

Meet the park ranger at Painted Desert Visitor Center at the scheduled time. Please allow 15-20 minutes prior to the meeting time for students to use the restroom and tour the Visitor Center. An additional 20 minutes should be included if you are scheduled to watch the orientation movie, *Timeless Impressions*. Do not let your students run wild through the Visitor Center - keep them under supervision.

Please review with students *Rules, Regulations, and Safety Points* from page 67. The field guide contains several rules which the park ranger will review before beginning the field exploration.



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