

Lessons 3–5

Rock Layers

Prepare

In Lesson 3, students analyze a fossil guide that describes the fossils found in Grand Canyon rock layers and then identify patterns in the fossils found in one of the layers. In Lesson 4, students further examine patterns in fossil evidence and use a model to explain how the relative position of rock layers indicates the order in which they were formed. In Lesson 5, students use the evidence they have gathered to answer the Concept 1 Focus Question **What do Earth's rock layers reveal?** In the Conceptual Checkpoint, students consider the rock layers in a location to explain what the past environment may have been like as it changed over time.

Student Learning

Knowledge Statement

Layers of rock and the fossils in those layers provide evidence of changes to Earth's surface over time.

Concept 1: Rock Layers

Focus Question

What do Earth's rock layers reveal?

Phenomenon Question

What do the Grand Canyon's rock layers reveal?

Objectives

- Lesson 3: Use fossil evidence to determine that the Grand Canyon rock layers came from distinct environments.
- Lesson 4: Explain how the relative position of rock layers indicates the order in which they formed.
- Lesson 5: Explain changes in the Grand Canyon landscape by using fossil evidence.

Texas Essential Knowledge and Skills Addressed

- 5.2D **Analyze and interpret information to construct reasonable explanations from direct (observable) and indirect (inferred) evidence.** (Introduced)
- 5.3A **Analyze, evaluate, and critique scientific explanations using evidence,** logical reasoning, and experimental and observational testing. (Introduced)
- 5.3B **Draw or develop a model that represents how something that cannot be seen** such as the Sun, Earth, and Moon system and formation of sedimentary rock **works or looks.** (Addressed)
- 5.9D **Identify fossils as evidence of past living organisms and the nature of the environments at the time using models.** (Introduced)

English Language Proficiency Standards Addressed

- 2E Use visual, contextual, and linguistic support to enhance and confirm understanding of increasingly complex and elaborated spoken language.
- 3E Share information in cooperative learning interactions.
- 5F Write using a variety of grade-appropriate sentence lengths, patterns, and connecting words to combine phrases, clauses, and sentences in increasingly accurate ways as more English is acquired.

Materials

| | | Lesson 3 | Lesson 4 | Lesson 5 |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|
| Student | Science Logbook (Module Question Log) | ● | | |
| | Identify Layers of the Grand Canyon (1 per student pair): printed copy of Present-Day Grand Canyon Figure 5 (Lesson 1 Resource D), heavy-duty sheet protector, 6 different-colored erasable markers | ● | | |
| | Science Logbook (Lesson 3 Activity Guide) | ● | ● | |
| | Create Rock Layer Model (1 per group): 1 roll or brick of modeling clay (a different color for each group), several small objects to be used for imprinting (e.g., cones, ferns, shells, sticks), craft sticks or toothpicks (optional) | ● | | |
| | Science Logbook (Lesson 4 Activity Guide) | | ● | |
| | Clay rock layer created in Lesson 3 | | ● | |
| | Science Logbook (Lesson 5 Activity Guides A and B) | | | ● |
| Teacher | Driving question board | ● | ● | ● |
| | Present-Day Grand Canyon Figure 5 (Lesson 1 Resource D) | ● | | |
| | Grand Canyon Fossil Guide (Lesson 3 Resource A) | ● | ● | |
| | Plastic wrap or airtight container (1 per group) to store clay rock layers and rock layer model | ● | ● | |
| | Layered Cake Photograph (Lesson 4 Resource) | | ● | |
| | 1 roll or brick of modeling clay in a different color than that given to student groups | | ● | |
| | <i>Grand Canyon</i> by Jason Chin (2017) | | | ● |
| | Anchor model | | | ● |
| | Conceptual Checkpoint Diagram (Lesson 5 Resource) | | | ● |
| Preparation | Cue “Over the Rim, Into the Canyon” (NPS 2009) video: http://phdsci.link/1000 . | ● | | |
| | Roll out 1 roll or brick of modeling clay to create Rock Layer F. | | ● | |

Lesson 3


Objective: Use fossil evidence to determine that the Grand Canyon rock layers came from distinct environments.

Launch 5 minutes

Display the driving question board and review the Concept 1 Focus Question: **What do Earth's rock layers reveal?** Tell students they are going to take a journey through the Grand Canyon to observe the rock in the canyon. Play the “Over the Rim, Into the Canyon” (NPS 2009) video (<http://phdsci.link/1000>). Ask students to Think–Pair–Share about what they notice about the rock they see in the video.

Sample student responses:

- *The rock walls of the canyon have stripes on them.*
- *Some of the rock looks really jagged.*
- *There are a lot of rocks. Some are small, and some are really big.*
- *I saw bands in the rock wall.*

Draw attention to student responses that talk about stripes or bands on the rock wall. Explain that in this lesson students will learn more about these stripes or bands as they investigate the Phenomenon Question **What do the Grand Canyon's rock layers reveal?** Tell students to record this Phenomenon Question in their Module Question Log. 

Agenda

Launch (5 minutes)

Learn (37 minutes)

- Identify Layers of the Grand Canyon (12 minutes)
- Interpret Patterns in Fossil Evidence (17 minutes)
- Create Rock Layer Model (8 minutes)

Land (3 minutes)



Teacher Note

In subsequent lessons, continue directing students to record new Phenomenon Questions in their Module Question Log.


Learn

37 minutes

Identify Layers of the Grand Canyon


12 minutes

Display the photograph depicting the major rock layers of the Grand Canyon (Figure 5 from Lesson 1 Resource D).

- Point out where you see different stripes on the photograph, and describe what the stripes look like. 
 - *There are big stripes of different colors. At the bottom it's light tan, in the middle it's reddish, and some parts are white.*
 - *Some of the wider stripes have smaller stripes inside. The reddish part has white stripes mixed in.*

Call attention to student responses that describe the major layers. Explain that scientists who study Earth's surface, called geologists, refer to the big stripes in Earth's surface as **rock layers**. To investigate further, students will first identify the different layers.

Instruct students to work with a partner to trace at least four distinct layers of the Grand Canyon on a printed copy of the rock layer photograph (Figure 5 from Lesson 1 Resource D) placed in a sheet protector. If possible, students should use a different-colored erasable marker for each layer.

After students trace the layers, lead a class discussion that reveals the six layers shown in the annotated photograph below.  To guide this discussion, project the rock layer photograph (Figure 5 from Lesson 1 Resource D), and ask questions such as these: How would you describe this layer? Do you see any differences in this layer? As the class identifies each layer, trace it on the projected photograph. Once the class has identified all six layers, label the layers A through F from top to bottom. Instruct students to record these layers on the photograph in their Science Logbooks (Lesson 3 Activity Guide).



Differentiation

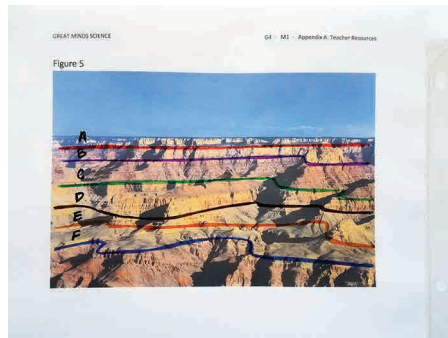
Instruct students to look for changes in the rock to identify the layers. This could be different colors in the rock. Later in the lesson, help students find these color changes when they trace the layers.



Teacher Note


The bottom portion of the photograph shows the foreground, not an additional rock layer.

Sample annotated photograph:



Interpret Patterns in Fossil Evidence 17 minutes

Tell students that scientists have studied the rock layers of the Grand Canyon and have found fossils. Students will now read about some of the discovered fossils to learn more about the rock layers. Display a copy of the Grand Canyon Fossil Guide (Lesson 3 Resource A), and explain that students will work in groups to respond to the following prompts about one of the layers.


- ▶ What type of environment do you think the fossilized organisms lived in? 
- ▶ Provide evidence to support your thinking.



English Language Development

The words *fossil*, *pattern*, *environment*, and *evidence* are used repeatedly in this module. Introduce these terms explicitly. The Spanish cognates for *fossil* (*fósil*), *pattern* (*patrón*), and *evidence* (*evidencia*) may be useful.

Discuss Layer F as a class since it is the only layer in which no fossils were found. Have students record responses to the prompts about Layer F in the table provided in their Science Logbooks (Lesson 3 Activity Guide).

After discussing Layer F, use a Jigsaw routine to organize students into five expert groups, one for each of the remaining layers. Distribute the remaining sections of the Grand Canyon Fossil Guide to the group assigned to each section. 




Teacher Note

Students may need to be reminded of what the term *environment* means as they respond to this question. Environment was previously defined as the area surrounding an organism that includes what the organism needs to survive.



Differentiation

When forming groups, consider the needs of each student to develop groups with a variety of abilities and interests. For example, it may be helpful to group students with varied English language ability to support students as they develop interpersonal and academic language (3E) (5F).

Ask students to read their assigned section (either as a group or individually) and complete the corresponding row of the table in their Science Logbooks (Lesson 3 Activity Guide).  In the next lesson, students will share information about the fossils in their assigned rock layer with their home group and complete the rest of the table.

Sample table:

| Layer | Fossils Present | What type of environment do you think the fossilized organisms lived in? | Provide evidence to support your thinking. |
|-------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| F | None | Unknown, maybe active volcanoes? | There are no fossils in this layer. Volcanic activity formed the rocks. |
| E | Trilobites, brachiopods, and worm burrow fossils | Ocean water | Worms lived on the ocean floor. Trilobites and brachiopods lived in the deep ocean or sometimes ocean water near the shore. |
| D | Brachiopods, bryozoans, corals, mollusks | Tropical water | All the organisms lived in different parts of the ocean. Bryozoans and corals lived in shallow, tropical water. |
| C | Cone-bearing plants, ferns, winged insects, fossilized tracks of mammal-like reptiles and millipedes | Land with some moist areas and some dry areas | All the organisms lived on land. Some lived on moist land, like the winged insects and ferns, and some lived on very dry land, like the cone-bearing plants and the mammal-like reptiles. |
| B | Brachiopods, bryozoans, corals, crinoids, sponges | Ocean/tropical water | All the organisms lived in different parts of the ocean. Bryozoans and corals lived in tropical water. |
| A | Conifers, dicynodonts, calamites, hybodont sharks, lungfish | Land with rivers, lakes, and swamps | Some of the organisms lived on land, like the conifers and dicynodonts. Calamites usually lived in swamps. Hybodont sharks and lungfish lived in fresh water like that found in rivers and lakes. |



Differentiation

Support advanced students by encouraging them to identify adaptations in the organisms that would indicate whether they are land- or water-dwelling animals. For example, the hybodont sharks and lungfish have fins instead of legs, which would indicate they are water-dwelling animals (2E).



Content Area Connection: English

As students read the Grand Canyon Fossil Guide, they can apply strategies for understanding complex informational texts. It may be helpful to paraphrase, or state in their own words, key details about each fossil. Once they understand the key details, they can annotate details that relate to the type of environment the fossilized organisms lived in.

**Check for Understanding**

Read student responses to the prompts in the table in their Science Logbooks (Lesson 3 Activity Guide) and their supporting evidence to assess their inferences about past environments based on patterns in fossil evidence.

Evidence

Look for evidence that all students

- correctly identify the environment of the fossilized organisms they read about, and
- cite evidence that organisms fossilized in the layer lived in that environment.

Next Steps

If students do not correctly infer the environment, ensure that students understand the relationship between fossils and past environments. Help students connect the fossils to animals living today and make inferences on the environments of the fossilized animals. Prompt students with questions about the fossils such as these: Do they look like anything we see today? Where does that modern animal (or plant) live? In which kind of environment do you think the animal (or plant) lived? Why do you think it lived there?

Create Rock Layer Model 8 minutes

As students complete their row of the table, give each group a different-colored roll or brick of modeling clay. Ask students in each group to roll out the clay to form a flat layer and make imprints in the clay to represent fossils of the organisms found in their layer or traces of their activities. Students may use a toothpick or craft stick to draw fossils found in their layer if cones, ferns, shells, sticks, or other objects representative of the fossils are not available for imprinting.

**Teacher Note**

To prevent the modeling clay from drying overnight, place the clay rock layers in plastic wrap or airtight containers. They will be used again in the next lesson.

Land

3 minutes

Have students review the Phenomenon Question **What do the Grand Canyon's rock layers reveal?** Ask students to record what they learned about this Phenomenon Question in their Science Logbooks (Lesson 3 Activity Guide).

- **What does the rock layer you were assigned reveal about the landscape?**
 - *There was once an ocean there, but there isn't now.*
 - *The layer showed a different environment used to be where the Grand Canyon is now.*
 - *Different plants and animals lived in the environment back then. Some of them left fossils in the layer when they died. And some of them left tracks in the ground that became fossils.*

Tell students they will continue learning about this Phenomenon Question as they begin to observe and interpret patterns in fossil evidence in the next lesson.