Lesson 1.3
Fossil Formation
In this lesson, students gather information from images of fossils, the Simulation, and a book to help them answer the Investigation Question: How do fossils form? First, students observe two images of fossils and begin to consider how fossils form. Then, students gather information in the Sim about how fossils form and use that information to tell a story about the organisms in the Sim and how they fossilized. Students then revisit Clues from the Past and consider what additional information it provides about fossil formation. The lesson concludes with a reflective writing activity during which students apply their understanding of fossil formation to explain how an unfamiliar fossil formed. The purpose of this lesson is for students to construct and reflect on their understanding of how fossils form.

Anchor Phenomenon: A rocky outcrop in Desert Rocks National Park has a fossil in it.
Investigative Phenomenon: There are fossils embedded in rock.

Students learn:

- A fossil forms when an organism dies and is covered with sediment that turns into rock.
- Sedimentary rock forms from sediment.
Investigating Fossils in the Simulation

Students investigate fossil formation in the Sim.

Instructional Guide

1. Define the term *model* and post vocabulary card.

   We can’t observe fossils forming because it takes a very long time, so we will gather information about how fossils form by using a model. A model is something scientists make to help them answer questions about the real world. The *Earth’s Features* Simulation is a model.

   Post the *model* vocabulary card to the classroom wall.

2. Have students turn to page 9, How a Fossil Forms, in their notebooks. Read the instructions on page 9 aloud.

   - Step 1: Using the *Earth’s Features* Simulation, work with your partner to observe how a fossil forms.
   - Step 2: Press ADD ORGANISMS.
   - Step 3: Move time forward until a fossil forms.
   - Step 4: Answer the questions below based on what you observed in the Sim.

3. Project the *Simulation* and review the following features.

   - **Time controls**: time can be moved forward or backward by 10,000 years, as indicated on the timeline, using the time controls at the top.
   - **Add organisms**: organisms can be added to each location by pressing this button.
   - **Analyze layers**: selecting this reveals the types of rock, sediment, organisms, and fossils in each location. This also reveals the depth of the canyon in location 1.
4. Distribute digital devices. Distribute one digital device to each pair of students and have them access the Earth’s Features Sim via the Student Apps Page.

5. Have students begin simulating creating fossils. Circulate to support students. Give students 15 minutes to make fossils in the Sim and record their observations. Remind students to incorporate their details from the Sim into their observations. Remind students to answer all questions on the page.

6. Ask volunteers to share their observations with the class. Draw attention to the detail that students included in their observations.

7. Collect digital devices. Ask students to make sure that their digital devices are turned off.

Teacher Support

Instructional Suggestion

Classroom Management: Sharing Devices with a 1:2 Ratio
It is highly recommended that students work in pairs with digital devices in this unit to maximize students’ time to explore independently while still in a supportive environment. We recommend that students work with a partner so they can engage and talk to each other while modeling their thinking. Try to establish clear expectations with the routines for the use, handling, and storage of the devices, to decrease transition time between activities and minimize any potential conflict that could come from sharing a limited number of devices.

Background

Science Practices: About Models
Scientists develop and use models to help them conceptualize, investigate, and communicate ideas about how the natural world works. Scientists create models to portray structures and processes that are thought to exist in the real world but are not readily observable. A model can be a physical setup that is smaller or larger than what it represents, a diagram that depicts things that are not visible, or a computer simulation that represents salient features of a phenomenon, system, or process. Models are used to describe tentative ideas to be tested, as substitutes for situations that are difficult to investigate directly, to clarify ideas for oneself, or to communicate ideas to others. In all cases, scientific models approximate whatever is being modeled in an intentional way, simplifying some aspects in order to clearly focus on others.

Instructional Suggestion

Going Further: Making Fossils
If you’d like to give your students a physical experience with fossil formation, you might consider engaging them in making fossil models. For this activity, you will need the following materials included in the Earth’s Features kit: plaster, water, clear cups, and plastic spoons. (Note that the kit does not include enough of these materials for each student to make a fossil—have students work in groups of four and be conservative in the amount of plaster you use for each group.) You will also need petroleum jelly and a shell or other small figurine (teacher-provided).
- Using a plastic spoon, mix two parts plaster with one part water.
- Wipe the plaster from the spoon and use it to coat the shell or figurine with petroleum jelly on one side only. This is an important step—it prevents the object from becoming permanently stuck inside the plaster.
- Gently place the petroleum jelly-coated side of the object into the plaster.
- Push it down only slightly so that an edge sticks out (you will use this edge to pull the object out of the plaster).
- Let your plaster dry overnight.
- After the plaster has dried, remove the object and observe the fossil mold that formed.

Importantly, after students have completed this model, facilitate a reflection conversation with students about it. What parts of the model show the fossil formation process well? [An organism getting stuck in wet sediment, sediment hardening into rock, and an imprint of an organism’s body hardening over time show the fossil formation process well.] What aspects of fossil formation does this model not show well? [It does not show sediment sinking through water and building up on top of the dead organism; It does not show this process happening underwater.] This extension activity is a good opportunity for students to apply their understanding of fossil formation to evaluate a model.

**Possible Responses**

**What students should do and notice:**
Students should notice that fossils form when organisms are covered by sediment that falls through water. Students should notice that after the organisms are covered, the sediment around them turns to rock as more sediment builds up on top. Students should notice that trees in the upper river environment never fossilize because they are never covered by sediment.

**How do you think fossils form?**
An organism is covered with sediment. Next, the sediment turns into rock and the organism turns into a fossil. Then, more sediment falls on top of the rock and another rock layer forms.

**Can you find an environment in the Sim where a fossil does not form? What did you observe about that environment?**
Fossils do not form in the upper river environment. I observed that upper river environment was not underwater. I also observed that sediment did not stop there.
Reflecting on How Fossils Form

Students observe an image of a fossil and, using what they have learned, infer how the fossil formed.

Instructional Guide

1. Project fossil image.

2. Introduce notebook page. Have students turn to page 10 in the notebook, Reflective Writing: Fossils. Read the instructions aloud. Explain that students should use what they have learned about fossil formation to explain how this fossil may have formed.

3. Students write.

4. On-the-Fly Assessment: Students consider how fossils form. Circulate while students write. As students write, circulate and make note of how they understand how fossils form.

5. Have students share their thinking with the class.
Encourage students to explain why they wrote what they did, and point out similarities in the stories (such as sediment, rock, or an organism dying).

6. Debrief fossil formation. Direct students to the Investigation Question written on the board. Ask students to summarize what they learned about how fossils form.

7. Introduce and post the key concept. Post the key concept: A fossil forms when an organism dies and is covered with sediment that turns into rock.

A fossil forms when an organism dies and is covered with sediment that turns into rock.

8. Conclude the lesson. Explain that in the next lesson, students will continue thinking about fossils and the rocks that they are found in.

Embedded Formative Assessment

On-the-Fly Assessment 2: How Fossils Form

Look for: This reflective writing activity is an opportunity to formatively assess student understanding of how fossils form. Students should be able to explain that the fossil formed because the organism died and was buried in sediment that turned into rock over time. Note that students aren’t expected to provide details about how sediment turns into rock, as this content will be covered in the following lessons.

Now what? For students who are not yet demonstrating understanding of how fossils form, make sure that they first understand what a fossil is: an imprint or part of an organism that has been preserved in rock. To help students understand how fossils form, it can help to return to the Sim, which shows how an organism can get covered in sediment that hardens into rock. When you add organisms and move time forward, students can observe that organisms get buried in sediment that turns into rock. You may also reread pages 8–9 of Clues from the Past with students. Ask students to draw a picture showing how fossils are formed using the first sentence of page 8.

Teacher Support

Rationale

Literacy Note: Reflective Writing
The Reflective Writing: Fossils activity on page 11 of the Earth’s Features Investigation Notebook encourages students to reflect on what they have been learning about how fossils form. Students will apply what they have been learning to an unfamiliar fossil. Writing about a new fossil gives students the opportunity to activate prior knowledge, make connections, practice using science vocabulary, and apply their understanding of fossil formation to a new context. Student responses also provide a good window into students’ understanding of key concepts.
Background

Student Thinking: Preconceptions About Fossils
Students likely have alternate conceptions about the process by which fossils form. A common idea is that fossils form when animals are stuck in mud, which hardens. This idea represents two key misunderstandings: the duration of time that it takes for fossils to form, and the process by which the rock around the fossil forms. Observing images of fossils, reading about fossils in *Clues from the Past*, investigating fossils in the Sim, and discussing how they form helps to address alternate conceptions about fossil formation. Students will focus on sedimentary rock formation in the next few lessons, which will also support their new understandings about fossils.

Possible Responses

Answers will vary. One possible response:
The plant died and was covered in sediment. The sediment turned into rock and the fossil formed.
How a Fossil Forms

1. Using the Earth’s Features Simulation, work with your partner to observe how a fossil forms.
2. Press ADD ORGANISMS.
3. Move time forward until a fossil forms.
4. Answer the questions below based on what you observed in the Sim.

How do you think fossils form?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Can you find an environment in the Sim where a fossil does not form? What did you observe about that environment?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Reflective Writing: Fossils

Record a response to the question below. Think about the information you gathered from the Sim and Clues from the Past to help you answer the question.

How do you think this fossil formed?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Investigating Fossils in the Simulation

Students investigate fossil formation in the Sim.

Instructional Guide

1. Define the term *model* and post vocabulary card.

No podemos observar fósiles formándose porque eso toma un largo tiempo, así que reuniremos información sobre cómo se forman los fósiles usando un modelo. Un modelo es algo que hacen los científicos para ayudarles a responder preguntas sobre el mundo real. La Simulación de Características de la Tierra es un modelo.

Post the *model* vocabulary card to the classroom wall.

2. Have students turn to page 9, How a Fossil Forms, in their notebooks. Read the instructions on page 9 aloud.

   - Step 1: Using the *Earth’s Features* Simulation, work with your partner to observe how a fossil forms.
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6. **Ask volunteers to share their observations with the class.** Draw attention to the detail that students included in their observations.

7. **Collect digital devices.** Ask students to make sure that their digital devices are turned off.

**Teacher Support**

**Instructional Suggestion**

**Classroom Management: Sharing Devices with a 1:2 Ratio**

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**Instructional Suggestion**

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Importantly, after students have completed this model, facilitate a reflection conversation with students about it. What parts of the model show the fossil formation process well? [An organism getting stuck in wet sediment, sediment hardening into rock, and an imprint of an organism’s body hardening over time show the fossil formation process well.] What aspects of fossil formation does this model not show well? [It does not show sediment sinking through water and building up on top of the dead organism; It does not show this process happening underwater.] This extension activity is a good opportunity for students to apply their understanding of fossil formation to evaluate a model.

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Can you find an environment in the Sim where a fossil does not form? What did you observe about that environment?
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Reflecting on How Fossils Form

Students observe an image of a fossil and, using what they have learned, infer how the fossil formed.

Instructional Guide

1. Project plant fossil image.

2. Introduce notebook page. Have students turn to page 10 in the notebook, Reflective Writing: Fossils. Read the instructions aloud. Explain that students should use what they have learned about fossil formation to explain how this fossil may have formed.

3. Students write.

4. On-the-Fly Assessment: Students consider how fossils form. Circulate while students write. As students write, circulate and make note of how they understand how fossils form.

5. Have students share their thinking with the class.
Encourage students to explain why they wrote what they did, and point out similarities in the stories (such as sediment, rock, or an organism dying).

6. **Debrief fossil formation.** Direct students to the Investigation Question written on the board. Ask students to summarize what they learned about how fossils form.

7. **Introduce and post the key concept.** Post the key concept: *A fossil forms when an organism dies and is covered with sediment that turns into rock.*

8. **Conclude the lesson.** Explain that in the next lesson, students will continue thinking about fossils and the rocks that they are found in.

### Embedded Formative Assessment

**On-the-Fly Assessment 2: How Fossils Form**

**Look for:** This reflective writing activity is an opportunity to formatively assess student understanding of how fossils form. Students should be able to explain that the fossil formed because the organism died and was buried in sediment that turned into rock over time. Note that students aren’t expected to provide details about how sediment turns into rock, as this content will be covered in the following lessons.

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### Teacher Support

**Rationale**

**Literacy Note: Reflective Writing**

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Possible Responses

Answers will vary. One possible response:
The plant died and was covered in sediment. The sediment turned into rock and the fossil formed.
Cómo se forma un fósil

1. Usando la simulación Características de la Tierra, trabaja con tu compañero/a para observar cómo se forma un fósil.
2. Oprime ADD ORGANISMS (agregar organismos).
3. Mueve el tiempo hacia delante hasta que se forme un fósil.
4. Responde las preguntas debajo basándote en lo que observaste en la simulación.

¿Cómo crees que se forman los fósiles?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

¿Puedes encontrar un ambiente en la simulación donde no se forme un fósil? ¿Qué observaste sobre ese ambiente?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Redacción reflexiva: fósiles

Apunta una respuesta a la pregunta debajo. Piensa en la información que recolectaste de la simulación y de Pistas del pasado para ayudarte a responder la pregunta.

¿Cómo crees que se formó este fósil?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Nombre:____________________________________  Fecha: ________________