CHAPTER 6 The Rock and Fossil Record

SECTION 4

Looking at Fossils

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What are fossils?
- How do fossils form?
- What can fossils tell us about the history of life on Earth?

National Science Education Standards

ES 1k, 2b

What Are Fossils?

Scientists can tell us many things about organisms, such as dinosaurs, that lived millions of years ago. How do scientists learn about these organisms if they have never seen them? They study fossils. A **fossil** is the trace or remains of an organism that lived long ago.

Some fossils are made from parts of an organism's body. These fossils are called *body fossils*. Other fossils are simply signs, such as footprints, that an organism was alive. These fossils are called **trace fossils**.

STUDY TIP

Organize As you read, make a chart comparing the five ways that body fossils can form.

Critical Thinking

1. Compare How is a trace fossil different from a body fossil?

_____

_____

_____

_____

_____

FOSSILS IN ROCKS

Usually, when an organism dies, it begins to decay or it is eaten by other organisms. Sometimes, organisms are quickly buried by sediment when they die. The sediment can help preserve the organism. Hard parts, such as shells, teeth, and bones, are preserved more often than soft parts, such as organs and skin. When the sediment hardens to form sedimentary rock, the parts of the organism that remain can become body fossils. ☑

READING CHECK

2. List Give three examples of hard parts of an organism that could become fossils.

_____

_____

_____

FOSSILS IN AMBER

Sometimes, organisms such as insects are caught in sticky tree sap. If the sap hardens around the insect, a fossil is created. Hardened tree sap is called *amber*. Some of the best insect fossils are found in amber. Frogs and lizards have also been found in amber.

This insect is preserved in amber. It is more than 38 million years old.

Say It

Discuss Have you ever seen any fossils? What kind of organisms were they? Where did you see them? How did they probably form? In a small group, talk about the fossils you have seen.

READING CHECK

3. Define What is petrifaction?

_____

_____

FROZEN FOSSILS

Ice and cold temperatures slow down decay and can allow body fossils to form. Woolly mammoths, which are relatives of modern elephants, became extinct about 10,000 years ago. However, scientists have found frozen remains of mammoths preserved in blocks of ice.

PETRIFACTION

Organisms can also become fossils by petrifaction. During *petrifaction*, minerals replace all or part of an organism's tissues. For example, minerals may fill the tiny spaces in an animal's bones. Sometimes, the organism's tissues are completely replaced by minerals. For example, petrified wood forms when minerals replace all of the tissue in a piece of wood. ☑

FOSSILS IN ASPHALT

In some places, asphalt or tar bubbles up to the Earth's surface and forms sticky pools. The La Brea asphalt deposits in Los Angeles, California, are at least 38,000 years old. These pools have trapped and preserved many different organisms. From these fossils, scientists have learned about the ancient environment of southern California.

FOOTPRINTS

Remember that trace fossils are evidence that an organism was once alive. A footprint is an example of a trace fossil. Footprints may be preserved as trace fossils when they are filled with sediment and harden into rock. Footprints can show how big an animal was and how fast it was moving. For example, parallel paths of dinosaur tracks have led scientists to hypothesize that some dinosaurs moved in herds.

TAKE A LOOK

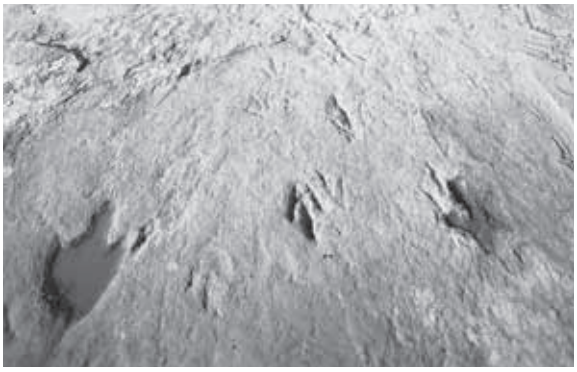
4. Explain Why are these tracks considered trace fossils?

_____

_____

_____

_____



These dinosaur tracks are found in Arizona. They show that the dinosaur was running when it made the tracks.

BURROWS AND COPROLITES

Burrows are another kind of trace fossil. Burrows are shelters made by animals, such as clams, that dig into sediment. A burrow can be preserved when it is filled with a different kind of sediment and buried quickly.

Coprolites, or preserved animal dung, are another example of trace fossils.

MOLDS AND CASTS

Molds and casts are two more kinds of fossils. A **mold** is an *impression*, or print, left in sediment where a plant or animal was buried. The figure below shows two types of molds from the same organism. One is an internal mold of the inside of the shell. The other is an external mold of the outside of the shell. ☑

A **cast** is an object that forms when sediment fills a mold and becomes rock. Like a mold, a cast can show what the inside or outside of an organism looked like.

The fossil on the left is the internal mold of an ammonite. It formed when sediment filled the ammonite's shell. On the right is the external mold of the ammonite. The shell later dissolved.

What Can We Learn from Fossils?

Think about your favorite outdoor place. Imagine the plants and animals around you. Now, imagine that you are a scientist at the same site 65 million years from now. What types of fossils would you dig up? Would you find fossils for every organism that existed? Based on the fossils you found, what would you guess about how this place used to look?

Fossils can show scientists three main things:

- What kind of organisms lived in the past
- How the environment has changed with time
- How organisms have changed with time

READING CHECK

5. Define What is a mold?

_____

_____

STANDARDS CHECK

ES 2b Fossils provide important evidence of how life and environmental conditions have changed.

Word Help: evidence information showing whether an idea or belief is true or valid

Word Help: environment the surrounding natural conditions that affect an organism

6. List Name three things fossils can show scientists.

_____

_____

_____

_____

_____

_____

THE INFORMATION IN THE FOSSIL RECORD

Scientists have used fossils to learn some of the history of life on Earth. However, scientists cannot learn everything about life from fossils. This is because most organisms never became fossils, and many fossils have not been discovered yet.

Scientists know more about some kinds of ancient organisms than others. Remember that hard body parts are more likely to form fossils than soft body parts. Therefore, scientists know more about organisms with hard body parts than about organisms with only soft body parts. Some organisms lived in environments where fossils can form more easily. Scientists know more about these organisms than those that lived in other environments.

TAKE A LOOK

7. Explain Why do scientists know more about some kinds of ancient organisms than others?

_____

_____

_____

_____

_____

Fossils of organisms with hard parts, such as shells, are more common than fossils of organisms without hard parts.

This organism lived in an environment with a lot of sediment. Fossils form more easily in environments with a lot of sediment. Therefore, organisms that lived in these environments are more likely to be found as fossils.

A HISTORY OF ENVIRONMENTAL CHANGES

Fossils can show evidence of climate change. For example, Antarctica is covered with ice and snow in the present. However, scientists have found fossils of forest and freshwater organisms in Antarctica. They have even found fossils of dinosaurs in Antarctica! These fossils show that Antarctica's climate must have been warmer in the past.

READING CHECK

8. Explain How can scientists find out how life has changed?

_____

_____

_____

A HISTORY OF CHANGING ORGANISMS

To understand how life on Earth has changed, scientists compare fossils. Scientists also look for similarities between fossils and living organisms. However, only a small fraction of the organisms that have existed in Earth's history have been fossilized. As a result, the fossil record is incomplete. This means that scientists do not have a complete record of changes in life on Earth. ☑

How Do Scientists Know How Old Fossils Are?

To understand the history of life on Earth, scientists have put fossils in order based on their ages. Scientists learn the ages of fossils in different ways. In some cases, they can use *absolute dating methods*, such as radiometric dating, to determine the age of fossils. More commonly, scientists use relative dating methods. ☑

Relative dating methods can't tell scientists the exact age of a fossil. However, relative dating can show which fossils are older than others. Fossils found in older layers of rock come from more ancient life forms. Fossils found in younger layers of rock are from more recent organisms.

READING CHECK

9. Describe How do scientists put fossils in order?

_____

_____

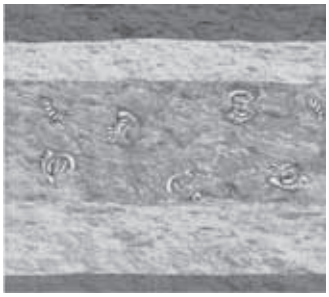
USING FOSSILS TO DATE ROCKS

Scientists can use fossils of certain types of organisms to learn how old rock layers are. These fossils are called index fossils. **Index fossils** are fossils of organisms that lived during a relatively short period of time. Because they lived for only a short time, their fossils are only found in rocks of a certain age. To be an index fossil, a fossil must have three features:

- The organism must be common in rocks from most of the world.
- The organism must have lived for only a geologically short period of time (a few million years to a few hundred million years).
- The organism must be easy to identify.

Trilobites and ammonites are two kinds of organisms that are used as index fossils. The figures below show examples of these fossils.

The trilobite *Phacops* is an example of an index fossil. *Phacops* lived about 400 million years ago. Therefore, rocks that contain *Phacops* fossils are probably about 400 million years old.



The ammonite *Tropites* is an index fossil. *Tropites* lived from between 230 million and 208 million years ago. Because it lived for such a short time, it is a good index fossil.

TAKE A LOOK

10. Identify What feature of these organisms made them more likely to be preserved as fossils?

_____

Name _____ Class _____ Date _____

Section 4 Review

NSES **ES 1k, 2b**

SECTION VOCABULARY

cast a type of fossil that forms when sediments fill in the cavity left by a decomposed organism	**mold** a mark or cavity made in a sedimentary surface by a shell or other body
fossil the trace or remains of an organism that lived long ago, most commonly preserved in sedimentary rock	**trace fossil** a fossilized mark that formed in sedimentary rock by the movement of an animal on or within soft sediment
index fossil a fossil that is used to establish the age of a rock layer because the fossil is distinct, abundant, and widespread and the species that formed that fossil existed for only a short span of geologic time	

1. **List** Give three examples of trace fossils.

_____

_____

_____

2. **Explain** Why is the fossil record incomplete?

_____

_____

_____

3. **Infer** Which organism is more likely to be found as a fossil in amber, a beetle or a rabbit? Explain your answer.

_____

_____

_____

4. **Apply Concepts** What could you conclude if you found a fossil of a tropical plant in a cold climate?

_____

_____

5. **List** What three features must a fossil have in order to be an index fossil?

_____

_____

_____

	_____	_____
	_____	_____
	_____	_____
	_____	_____