chapter 6 Evolution—Evidence of Change

lesson 1 Fossils and Evolution

Grade Seven Science Content Standard. 4.e. Students know fossils provide evidence of how life and environmental conditions have changed.
Also covers: 3.c.

Before You Read

Think about footprints or shoeprints made in the dirt or sand. Describe what information the prints can provide on the lines below. Then read the lesson to learn about the information scientists have discovered from studying fossils.

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MAIN Idea

Fossils show how living organisms and the environment have changed over time

What You'll Learn
how fossils provide evidence of evolution

Read to Learn

What are fossils?

Organisms leave evidence that they were once on Earth. Some of this evidence lasts for only a short time, but some lasts for a long time. **Fossils** are the naturally preserved remains, imprints, or traces of organisms that lived long ago. Fossils can be bones, shells, and footprints. Fossils come in many sizes. Very small fossils, called microfossils, can only be seen with a microscope. Some fossils are larger than humans.

A **paleontologist** (pay lee ahn TAH luh just) is a scientist who studies fossils. Paleontologists study fossils to understand relationships between organisms. They try to find out when different organisms first lived on Earth. Paleontologists also try to learn when organisms died off. Some paleontologists work outside, and others work in a laboratory.

When do fossils form?

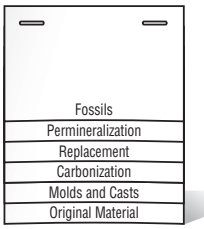
A dead organism can only become a fossil if it is protected from decomposers, scavengers, heavy rains, and acidic soils. Organisms with hard parts, like shells, bones, or teeth, are more likely to become fossils. Scavengers don't usually eat animals with hard parts and those hard parts don't decay as easily as soft parts.

Study Coach

Make Flash Cards As you read, write important questions on note cards. Write the answer to each question on the back of the card. After you read, test yourself by seeing if you can answer the questions without looking at the answers.

FOLDABLES™

A Discuss Make a layered Foldable. Label the front tabs as illustrated. Describe ways fossils form under the tabs. Use what you learn to discuss how fossils you have seen might have formed.



How are fossils formed?

It took a long time for scientists to understand how fossils form. Before the seventeenth century, most people thought that fossils could not be from ancient organisms.

Fossils only form when the right conditions exist. Usually fossils are only part of an organism that once lived. Most of the time, you find preserved hard parts. Sometimes soft parts are also preserved. Scientists have even found whole organisms preserved, but this is very unusual. There are different ways that organisms or their parts may be preserved.

What is permineralization?

The hard parts of a living organism usually have tiny spaces filled with air, blood, or other substances. The substances in the spaces break down after the organism dies, leaving the space empty. When this happens, water in the ground can get into the tiny spaces where minerals may be left behind in a process called **permineralization** (pur mihn ur ul i ZAY shun). Usually silica, calcite, or another mineral is left in the spaces. Permineralization forms a strong, rock-like fossil. The details of the hard part of the organism are preserved. Most bones and trees become fossils through permineralization. Trees that become fossils this way are called petrified wood. ☑

Reading Check

1. **Summarize** How is petrified wood formed?

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What is replacement?

When replacement occurs, the hard parts of the organism dissolve and minerals replace them. Silica, iron, and pyrite are common mineral replacements. Fossils formed by replacement show the shape of the original organism, but they do not usually show details. For example, a solution of water and dissolved silica might flow into and through a shell of a dead organism. The acidic water dissolves the shell. At the same time, the silica crystallizes and fills the places where the shell had been.

Reading Check

2. **Clarify** Under what conditions does carbonization happen?

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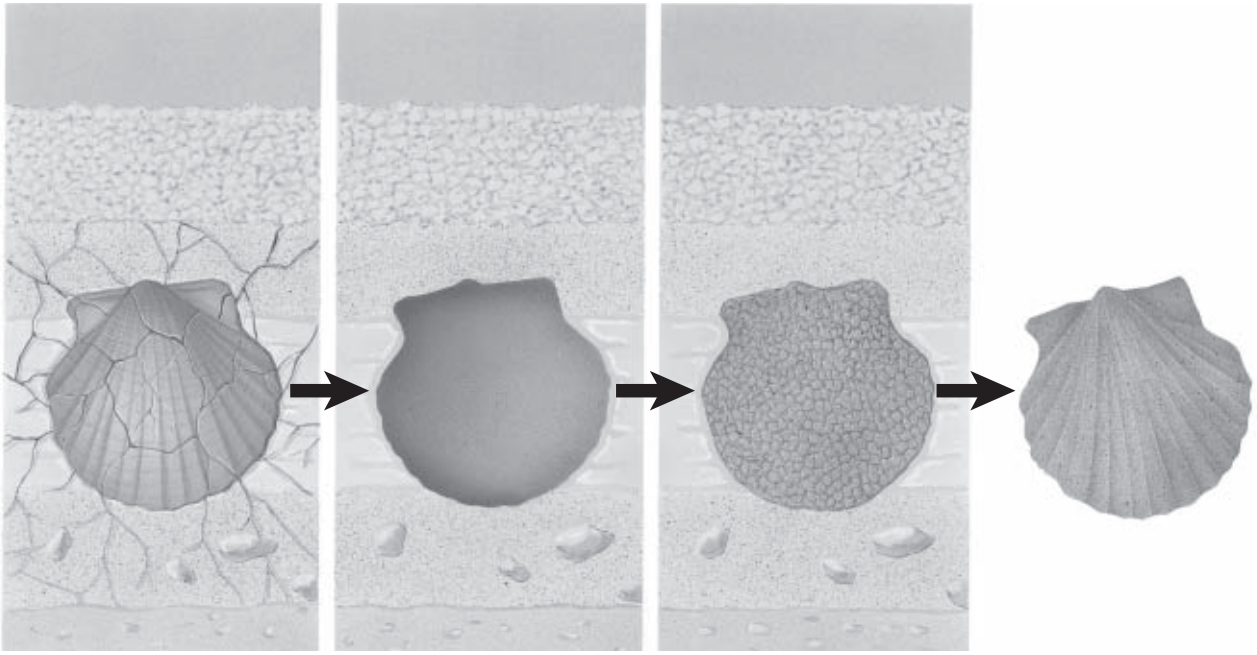
What is carbonization?

Elements such as hydrogen, oxygen, and nitrogen leave an organism once it dies, leaving only a thin layer of carbon. In the process called carbonization, if sediment pushes on a buried organism, an image of the shape of the organism is preserved in the sediment. This image is called a carbon film. Many plant fossils are preserved as carbon films and can be found in coalfields today. Soft materials of animals, such as skin, fur, and feathers, can also be preserved this way. ☑

How are molds and casts formed?

Molds and **casts** are formed from the print of an organism. These fossils have no remaining parts from the original organism. Molds can be imprints from a shell or the skin of an animal. Bite marks, footprints, and eggs in a nest can produce molds. If the mold of a shell fills with sediment that hardens into rock a cast is formed, as shown below.



What is original material?

In the movie Jurassic Park, a whole organism was preserved in amber. Amber is the fossilized sap from a very old seed tree. When an organism is preserved in amber, the fossil is called original material. An original material fossil contains the preserved organism with no replacement or change of hard or soft parts. It is unusual to find original material fossils, but they do provide important information when they are found. Most original material fossils were formed more recently than other types of fossils.

What do fossils tell us?

Fossils tell us about evolutionary relationships between organisms. Natural selection is the survival and reproduction of organisms with traits that allow them to live under particular conditions. Over time, species change when organisms that do not have these traits die off. Fossils provide a record of which organisms lived in the past.

Picture This

3. Explain What is the key difference between the shell on the left and the cast fossil on the right?

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Academic Vocabulary
found (FOWND) (verb) to locate or discover

Reading Check

4. **Compare** Which are typically older, fossils found in deep layers of rock or fossils found in shallow layers of rock?

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Reading Check

5. **Explain** Why are there gaps in the fossil record?

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How do scientists determine the ages of fossils?

Older rock layers are usually deeper in the Earth. This means that if fossils are found in both shallow rock layers and in deeper rock layers, the fossils in the deeper layers are usually older. This is true unless the rock layers have been moved around. Fossils found in rock layers help scientists determine which species are older and which changes have occurred over time.

What does the fossil record reveal about species and changes in the environment?

The **fossil record** is made of all known fossils and their placements in the formation of rocks and positions of time. The fossil record provides evidence that supports the evolution of plants and animals. There are breaks, called gaps, in the fossil record because many organisms decayed before they could become fossils. In addition, geological processes have destroyed some fossils. Other fossils have not yet been discovered. The fossil record shows that most species that once lived on Earth are now extinct.

Fossils show how life and the environment have changed over time. Scientists who study fossils have determined that early in Earth's history, life was not as complex as it is today. Scientists use fossils to make models of what organisms might have looked like. They also use fossils to find out if an organism lived alone or in a family group. Sometimes scientists can find out what foods were eaten by an organism. Scientists might also learn about an organism's environment from studying the organism's fossil.

How do fossils provide evidence of the past?

Most plants and animals decompose after dying and do not leave fossil remains. The parts of plants and animals that do become fossils can tell us much about when organisms lived, how they changed, and when they became extinct. Fossils provide clues that paleontologists can use to reconstruct extinct organisms. The locations of fossils in sedimentary rock layers can indicate the relative ages of fossils. The theory of evolution by natural selection best explains the patterns seen in the fossil record.

chapter 6 Evolution—Evidence of Change

lesson 2 Biological Evidence

Grade Seven Science Content Standard. 3.c. Students know how independent lines of evidence from geology, fossils, and comparative anatomy provide the basis for the theory of evolution.

Before You Read

All dogs are the same species, but there are differences in the appearance of dogs based on their breed. For example, some dog breeds have long, silky fur, while another breed has short, curly fur. On the lines below, describe how two dogs you have seen are the same and how they are different. Read the lesson to learn about how evolution can result in changes to organisms' physical structures.

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MAIN Idea

The theory of evolution by natural selection best explains what is seen in studies of comparative anatomy and molecular biology.

What You'll Learn

to explain that patterns of body structures are the result of evolution

Read to Learn

Comparative Anatomy

Fossils provide evidence of evolution. In addition to fossils, the comparison of the physical structures of organisms also supports the theory of evolution by natural selection. **Comparative anatomy** is the study of similarities and differences in the structures of organisms. Scientists used comparative anatomy to search for the common ancestor of true flies and scorpionflies. Scientists who study insects know that true flies and scorpionflies are similar. But, a true fly has one pair of large, thin wings and one pair of small sticklike legs behind the wings. A scorpionfly has two pairs of large, thin wings. Scientists predicted that these two types of insects had the same ancestor, but there were no fossils to show this. ☑

Scientists continued to search for the ancestor of true flies with two pairs of wings. Then, in 1976, scientists found fossils of four-winged true flies that showed their prediction was correct. These insect fossils provided evidence to support the theory of evolution.

Mark the Text

Identify Answers

Underline each question head with a colored pencil. Use another color to underline the answer to the question.

Reading Check

1. **Define** What is comparative anatomy?

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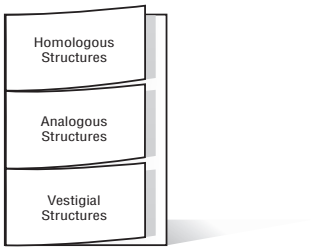
FOLDABLES™

B Describe Make a three-tab Foldable. Label the front tabs as illustrated. Describe three structures that help support the theory of evolution.



What structures are seen in organisms?

Humans, frogs, bats, birds, and cats all have a common set of three bones—a humerus, an ulna, and a radius. The sizes of these bones are different in each organism, but the shapes of the bones are the same. This shows that at some point in the past, humans, frogs, bats, birds, and cats all shared a common ancestor. However, some of those organisms share more recent ancestors than others.

Homologous (huh MAH luh gus) **structures** are the parts of organisms that have similar origins and similar structures. Homologous structures show that two or more species share the same ancestors. As shown in the figure below, the forelimbs of three very different animals are homologous structures.

Analogous (uh NAH luh gus) **structures** are the parts of an organism that are similar in some ways, but have different ancestral origins. For example, both birds and insects have wings. The analogous structures of wings resulted from similar environmental conditions that affected the two distantly related organisms.

Vestigial (veh STIH jee ul) **structures** are the parts of an organism that have no function in the present-day organism. Scientists hypothesize that vestigial structures once functioned in an ancestor. For example, most mammals have pelvic bones that support legs. Present-day whales have pelvic bones, but they do not have leg bones. The vestigial structure of the pelvic bones indicated that whales' ancestors had legs. Vestigial structures are genetically connected to a trait that helped the species survive at one time.

Academic Vocabulary

affect (uh FEKT) (verb) to influence; to have an effect upon

Picture This

2. Compare Use a different color marker to highlight the similar bones in the whale, crocodile, and bird.