Reflect

Sea shells can be found on beaches, but every now and then, you may find them far from the sea. For example, you may have found a shell stuck in a rock high on a mountain. What does this tell you? How can fossils tell us which organisms lived millions of years ago? Fossils are preserved parts or traces of animals or plants that lived in the past. Fossils are clues to the past. They tell us what organisms lived in a certain place.

They can tell what the organism looked like and what the environment was like where the organism lived. Fossils also show how organisms have changed over time.

Fossils of seashells high in a mountain indicate that the mountain used to be underwater at some point in the past. Fossils do not have dates printed on them, yet scientists can tell the order in which the organisms lived on Earth and when the organisms lived on Earth (or their age) by dating particles found around or in the fossil.

Figuring out the order is relatively simple. Look at the photo on the right. It shows layers of rock formed one on top of the other. The bottom is the oldest layer, so it was laid down first. The top layer was laid down last, so it is the youngest layer. Imagine that you baked layers of a cake with different ingredients each day for Monday (walnuts), Tuesday (raisins), Wednesday (cranberries), and Thursday (chocolate chips). Monday's layer on the bottom would be the oldest. Thursday's layer at the top would be the youngest.

What does this have to do with the age of fossils? Think of the walnuts, raisins, cranberries, and chocolate chips as fossils. The rock layers (cake layers) in which fossils (special ingredients) are found tell the order of the ages of the fossils. Fossils in the bottom layer are older than fossils in higher layers. Scientists also have ways to find the actual age of fossils.

Look Out!

Determining the age of fossils.
One way to find the actual age of a fossil is to determine the age of the rock layer in which the fossil is found. This makes sense because the organism that produced the fossil was trapped in the rock when the fossil was formed.

How long ago did the last dinosaurs become extinct (die out forever)? The youngest dinosaur fossils are found in rock layers that are about 65 million years old. Therefore, we can use that evidence to conclude that dinosaurs became extinct about 65 million years ago.

Evidence from fossils shows that dinosaurs became extinct about 65 million years ago.

You may be wondering how scientists figure out the actual age of rock layers and fossils. The process is a bit complex, but if you are curious, do an Internet search using the keywords “radioactive dating.”

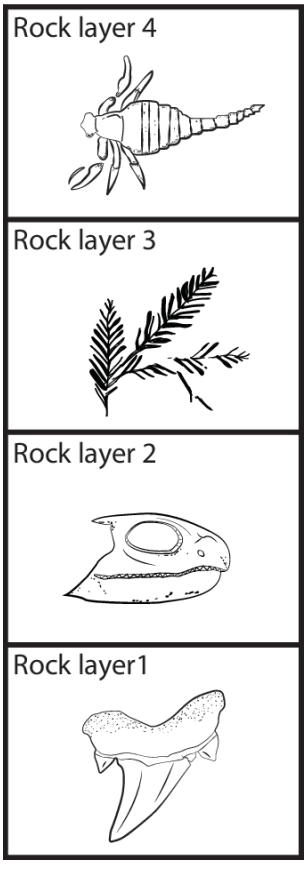
Try Now

Take a look at the illustrations on the right. They show fossils found in different layers of rock.

What is the order of these fossils from oldest to youngest?

_____
_____
_____
_____

Remember that these fossils are not the actual organisms themselves. Rather, their body parts have been replaced with mineral solutions that hardened into rock.



Look Out!

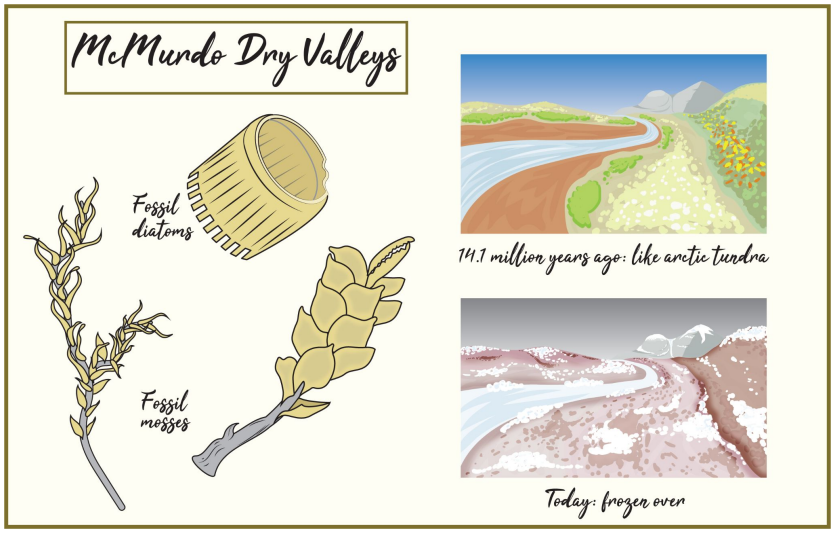
How can fossils tell us what environments were like millions of years ago?
Scientists tell us that environments change over time. But what evidence backs up this claim? In 1988, Gordon Hubbell and a team of fossil hunters dug a hole in a desert in Peru. This desert is one of the driest places on Earth today. Almost no rain falls there.

Hubbell was an expert in fossil sharks. After digging for a while, he discovered a jaw bone and more than 200 sharp triangular teeth. Hubbell recognized that the teeth belonged to an ancestor of the great white shark. He kept these fossils in his private collection until donating them to the Florida Museum of Natural History in Gainesville, Florida in 2009, where scientists were able to figure out that the age of the fossil teeth was six and a half million years old!

A great white shark bares its teeth.

The conclusion? More than six and a half million years ago, one of today's driest places was under water and had ancient sharks living there. Fossils proved that the environment in this place has greatly changed.

Today, the continent of Antarctica, at Earth's South Pole, is the coldest place on our planet. Temperatures there can dive below -89°C (-129°F). No plants or animals make their homes there permanently. Was Antarctica always that cold and empty of living things? According to fossil evidence, the answer is no. Scientists explored an area in Antarctica called the Dry Valleys and found 14.1 million-years-old fossils of mosses and tiny animals in ancient lake beds where shrubs and insects flourished during warmer temperatures. Again, fossils proved that an environment on Earth has changed greatly over time.



Try Now

Not all parts of an ancient organism can form a fossil. Fossils are most often formed from the hard parts of organisms (like bones). The soft parts usually break down before they can be preserved in rock. However, there are exceptions. For example, animals trapped under ice may be preserved whole, such as the woolly mammoth, shown in the top image to the right. Woolly mammoths are extinct animals that looked a bit like modern elephants. Some lived in the icy regions close to the North Pole. Some insects have also been found preserved whole in tree sap. When the sap hardens, the insect is preserved inside. This happened to the mosquito in the bottom image to the right.

How can we represent fossils and past environments using models? Scientists often use models to describe objects or events in nature. A model is a representative of a real thing. A model may be as simple as a drawing or a shape made out of clay. It may be an animal reconstructed from just a few fossil bones. The dinosaur skeleton shown to the left is used to make a model of the complete dinosaur.

Another type of model is a diorama that shows both an organism and its environment. The environment may be in the present. It may also be in the distant past. The American Museum of Natural History in New York City displays two organisms related to human beings walking on a dusty plain in Africa. This model was based on actual fossil footprints preserved in rock. By using the shape of the footprint, scientists can draw conclusions about the body shapes and sizes of those organisms that made the prints.

Collect a variety of small objects, such as stones, leaves, coins, or marbles. Make an imprint of each object by pressing one side of the object into a piece of modeling clay. These imprints represent fossils. Label each imprint with a number, and create a key to identify each imprint. Ask your classmates to try to identify the source of each "fossil"— that is, the object that made each imprint. Ask your classmates to explain how they came up with their answers.

What Do You Think?

The following chart lists five fossils that scientists have found and the locations on Earth where they were found. Based on the type of fossil found there, think about how the location has changed over time. In particular, decide whether each location:

- Used to be a forest
- Used to be underwater
- Used to be a tropical island
- Has not changed since the fossil was formed

Fossil	Where was it found?	How has the location changed?
Seashell	The side of a mountain	
Palm branch	An ice sheet in the Arctic	
The imprint of a cactus leaf	A desert	
Insect trapped in tree sap	Under the ocean floor	
Shark tooth	A wide open grassland	

Connecting With Your Child

Fossil Safari

There are a number of ways to give your child a first-hand experience with fossils. If your community or a nearby community has a museum of natural history or if you are planning a family trip to such an area, be sure to visit exhibits that contain fossils or organisms reconstructed from fossils. Alternatively, arrange for a visit to a local college or university where fossils are kept. Check with the geology and biology departments, which are most likely to keep collections of fossils. In either case, try to arrange a visit with a curator or an educator who could identify a particular fossil and explain where it was found and how it is significant. You might ask your child to prepare for such an experience by making a list of questions concerning fossils.