

Fossils are the remains or evidence of an ancient organism that has been hardened or preserved. The remains can be the entire organism or part of an organism. They can also be a trace from an organism, such as a footprint. Fossils range in size from huge dinosaur skeletons to tiny living things that can only be seen under a microscope. Fossils are quite old, existing long before humans lived on the Earth.

A fossil is any evidence of past plant or animal life contained in sediment or a sedimentary rock, from bones, shells or teeth to imprints of a dinosaur's foot. To hold a fossil is to hold millions of years of history in your hands. For example, the ridges, bumps, and curves of a fossilized clam are the same ridges, bumps, and curves that existed as it filtered water from the sea long ago. Studying fossils gives us clues about the Earth's past: its climate, natural disasters, and changing landforms and oceans.

Through fossils, scientists have learned that the Earth has been inhabited by living things since very early in its four-and-a-half-billion-year history. For most of that time, however, up until about six hundred million years ago, organisms were small primitive cyanobacteria (blue-green algae) that lived in the oceans. Around that time, evolution began to speed up. By about 500 million years ago the oceans were teeming with larger marine **invertebrates** (lacking a backbone or spinal column) such as mollusks, brachiopods, bryozoans, and echinoderms.

The fossil record of early life is very scanty. Fossils become much easier to find, in the right kinds of sedimentary rocks, after the great, explosive development of shelled invertebrates. Eventually, both plants and animals invaded the land, which is not as hospitable to life as the oceans. Life both on land and in the sea has had its ups and downs in the past half billion years. There have been several major episodes during which large percentages of all life forms on Earth became extinct. The cause (or causes) of these mass extinctions is not yet entirely clear. After each, however, the surviving life forms evolved into new living things that populated both the oceans and land.

For most organisms, fossilization is very rare. Most places where organisms live and die, whether in air or underwater, have a good deal of oxygen. Oxygen and water lead to decay. In this process the organic material that makes up the tissues of the dead organism is changed back mostly to carbon dioxide and water. Only when an organism is quickly buried by sediment and sealed off from any oxygen can it escape decay and become fossilized. This happens as the sediment is slowly transformed into sedimentary rock. The picture is better, of course, with animals with hard skeletal materials.

PETRIFIED FOSSILS



PETRIFIED FOSSIL

The Field Museum in Chicago displays a fossil of a *Tyrannosaurus rex*.

- The word “**petrified**” means “turning into stone.”
- Petrified fossils form when minerals replace all or part of an organism.
- Water is full of dissolved minerals. It seeps through the layers of sediment to reach the dead organism. When the water evaporates, only the hardened minerals are left behind.

MOLDS AND CASTS



MOLD FOSSIL

This mold, or imprint, is of an extinct mollusk called an ammonite.



CAST FOSSIL

This ammonite cast was discovered in the United Kingdom.

- A **mold** forms when hard parts of an organism are buried in sediment, such as sand, silt, or clay.
- The hard parts completely dissolve over time, leaving behind a hollow area with the organism's shape.
- A **cast** forms as the result of a mold.
- Water with dissolved minerals and sediment fills the mold's empty spaces.
- Minerals and sediment that are left in the mold make a cast.
- A cast is the opposite of its mold.

CARBON FILMS



FERN FOSSIL

This carbon-film fossil of a fern is more than 300 million years old.

- All living things contain an element called **carbon**.
- When an organism dies and is buried in sediment, the materials that make up the organism break down.
- Eventually, only carbon remains.
- The thin layer of carbon left behind can show an organism's delicate parts, like leaves on a plant.

TRACE FOSSILS



FANCY FOOTWORK

This dinosaur footprint was found in Namibia, Africa.

- **Trace fossils** show the activities of organisms.
- An animal makes a footprint when it steps in sand or mud.
- Over time the footprint is buried in layers of sediment. Then, the sediment becomes solid rock.

PRESERVED REMAINS

Some organisms get preserved in or close to their original states. Here are some ways that can happen.

		
Amber An organism, such as an insect, is trapped in a tree's sticky resin and dies. More resin covers it, sealing the insect inside. It hardens into amber.	Tar An organism, such as a mammoth, is trapped in a tar pit and dies. The tar soaks into its bones and stops the bones from decaying.	Ice An organism, such as a woolly mammoth, dies in a very cold region. Its body is frozen in ice, which preserves the organism—even its hair!

Vocabulary words to know:

Fossil - are the remains or evidence of an ancient organism that has been hardened or preserved

Vertebrate - animal with a backbone

Invertebrate - animal without a backbone

Paleontologist - person who studies fossilized animals & plants

cast fossil - when a mold fossil is filled with water and sediment and harden; the opposite of a mold

mold fossil - hard parts of an organism are buried in sediment & dissolve over time leaving a hollow shape

trace fossil - a fossilized footprint or other evidence of an organism's life or activities