

Earth Files - The Fossil Record

By Trista L. Pollard

¹ Imagine having no knowledge of the dinosaurs and early animals that roamed our planet! What if we did not learn about the prehistoric plants and insects that made up the forests and plains of Earth? Without **fossils** our understanding of Earth's early history would be non-existent.



² Fossils, which are the remains of plants and animals, provide scientists with information about earlier geologic periods. They serve as the file for every geologic, evolutionary, and environmental event that occurred in Earth's prehistoric file cabinet. Fossils are also used by scientists to determine both absolute and relative ages of rocks. To understand the importance of fossils, you must venture into the world of **paleontology**.

³ Paleontologists find the majority of their fossils in sedimentary rocks. Once animals, plants, and other organisms die, sediments eventually are deposited on top of them. Instead of decaying at rapid rates, the fossils are protected by the sediment. The process of decay is slowed down or stopped completely, and the organism is protected from damage by Earth's other elements. For this reason, fossils are very rarely found in igneous or metamorphic rock. They would not survive the intense heat, pressure, and numerous chemical reactions that occur as these rocks are formed.

⁴ Finding the fossil is half of the work for **paleontologists**. Interpreting the age of the fossil and the environmental conditions of the prehistoric organism is even more challenging. Fossils are the best type of evidence that exists about our planet's geologic history. They are also very rare. Most dead plants and animals are decomposed by bacteria or eaten by scavenging animals. Unprotected bones and shells may also decay and leave no record of the organism's existence. Fossils develop after dead plants and animals have been buried quickly and protected from decay. Usually wood, bones, shells, and teeth become fossils. Paleontologists have, on rare occasions, found entire organisms that have been preserved. Others have found replicas of the original organism in fossils. Fossils also provide evidence that life once existed during prehistoric times on our planet.

⁵ There are five ways that fossils are formed. **Mummification** occurs when an organism's internal organs are extracted, and the body is wrapped carefully using prepared strips of cloth. Ancient cultures have used this method to prepare their dead before burial. Mummified remains tend to be found in areas that are very dry and free of decaying bacteria. Insects have been found in hardened tree sap called **amber**. Before it hardens, this sticky substance encases itself around the insect. Scientists have found entire insects trapped in amber and, on very rare occasions, have recovered the DNA of these insects from the amber. **Tar seeps** occur when thick petroleum rises to the Earth's surface. This petroleum forms a tar seep which is commonly covered by water. Unsuspecting animals come to drink the water and are trapped in the sticky tar. Even the animals that come to feed on the trapped animals can become stuck. As a result, both are covered with tar and preserved. Some fossils are found in areas where **freezing** has occurred. Dead organisms can become buried in frozen soil and ice. The frozen soil and ice preserve the organism because it is too cold for bacteria to survive. The last form of fossilization is called **petrification**. Petrification occurs when groundwater and other mineral solutions replace original organisms covered by layers of sediment with new materials. These materials may be silica, calcium, and iron. Once

the mineral solutions have taken the place of the organism, a nearly perfect mineral replica of the original organism is produced.

⁶ Paleontologists encounter different types of fossils. **Trace fossils** are fossils that contain evidence of past animal life including the animal's appearance and activities. These are usually fossils of animal tracks, footprints, borings, and burrows. In this case, the original organism did not survive decay to be saved in a fossil. These fossils that formed many years ago may have been covered with many years of sand, silt, and other sediment. Scientists have also classified other types of fossils. **Imprints** are carbonized impressions of leaves, stems, flowers, and fish that are usually made in soft mud or clay. Scientists have found imprints preserved in sedimentary rocks. The organism partially decays and leaves behind a carbon-rich film. Imprint fossils only display the surface features of the organism. **Molds** are the empty cavities of shells that are within hardened sediment. The mold is formed when sand or mud fills the empty space that was once filled by the shell's decayed remains. Once it hardens, a natural **cast** is formed making a replica of the original organism.

⁷ **Coprolites** are the type of fossil that people and scientists wonder about, but may never talk about. These are fossilized dung or waste materials that have been left behind by ancient animals like dinosaurs. Paleontologists may cut thin sections of the coprolite to observe under a microscope. These fossils help to identify the feeding habits of ancient animals. **Gastroliths** also provide scientists with information about the digestion patterns of ancient animals. Some of Earth's dinosaurs had stones in their digestive systems that would help them to grind food. They have smooth, polished surfaces and are usually found very close to the remains of the ancient animal.

⁸ Fossils have helped paleontologists to determine the relative ages of rock layers. **Index fossils** are fossils found in rock layers that represent a particular geologic age. There are four requirements for a fossil to be categorized as an index fossil. All index fossils must be scattered over a large region; must have features that make them distinguishable from other fossils; must be formed from organisms that lived during a short span of the geologic time; and must be found in large numbers within the rock layer. Index fossils have also been used for estimating absolute age of rock layers. These fossils were formed by organisms that lived for a short span of time during the geologic period. As a result, scientists are able to date the rock layers that contain these fossils accurately. These fossils are also used to date rock layers that are located in different areas. Since index fossils are formed during specific geologic periods, these fossils, when found in rock layers around the world, prove that the rock layer formed during the same time period. Index fossils have also helped geologists locate oil and natural gas deposits. The fossils indicate if plant and animal remains are located within certain rock layers. These remains may have been chemically changed for millions of years to form oil and natural gas.

⁹ When most people think of fossils, they imagine massive dinosaur bones and giant footprints. However, even the smallest fossils help scientists to unlock the key to the Earth's past.

Earth Files - The Fossil Record

1. Why are fossils found rarely in igneous and metamorphic rock?
 2. Explain the importance of the fossil record.
 3. _____ forms when tree sap is hardened over time.
 - A Amber
 - B Gastroliths
 - C Casts
 - D Coprolites
 4. Which type of fossil shows a more detailed image of an organism- an imprint or a mold and cast? Explain why.
 5. How do trace fossils differ from index fossils?
 6. Index fossils may be formed from organisms that did not live during the specific geologic period of the rock layer in which they were found.
 - A False
 - B True
 7. Describe how a footprint of a dinosaur may have been preserved to form a trace fossil.
 8. Explain how the meanings of these words differ: gastroliths and coprolites.
-