

Fossils



We're all familiar with fossils, but how did they come to be?



We've all heard of fossils, probably even seen some. A few of us may even have gone on a fossil dig. From giant dinosaur fossils strung together into a reconstructed skeleton to jewelry made from ammonites, relics of Earth's 4.6-billion-year history are an important part of its present and they tell us stories about its past. But what

exactly are fossils and how did they form? What makes one dead animal or plant fossilize while millions of others simply decompose?

What Are Fossils?

Fossils are the ancient remains or traces of deceased life forms preserved in rock, amber, asphalt, or ice. Fossils fall into two categories, **body fossils** and **trace fossils**. Body fossils include preserved hard parts of organisms such as bones, teeth, shells, and seeds as well as, rarely, whole or nearly whole organisms. Trace fossils are preserved traces of organisms, including burrows, footprints, or feces as well as impressions left behind in rock beds. Fossils are generally defined as being older than 10,000 years.



Fossilized footprints are trace fossils.

How Are Fossils Formed?

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There are five broad types of fossilization: petrification, compression, molds and casts, mummification, and complete preservation.

Petrification is the process by which organic material (e.g., wood, bone, shell) transforms into another substance, typically stone. In this type of fossilization, the soft parts of an organism's



Petrified wood is formed via permineralization.

remains have decomposed, leaving behind only the hard parts. Most fossils are formed via petrification in one of two ways:

permineralization or replacement.

Permineralization is the most common type of fossilization. In this process, water carrying various dissolved minerals washes through the remains. Minerals are left behind in cavities and pores within the remains and these minerals crystallize,



solidifying the remains just as sedimentary rock is cementing and solidifying around them. Permineralized remains retain some of the original organic material.

Replacement occurs when groundwater dissolves the remains of an organism. Minerals within the groundwater replace the minerals that originally composed the organism's hard parts. Replacement can take place slowly or quickly. When replacement is slow, more detail can be preserved, while fast replacement results in only the shape of the original material.

Compression fossils are flattened organic remains of deceased organisms. Plants are often

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Casts fill cavities called molds.

Molds and **casts** are formed when an organism leaves behind a three-dimensional impression. Such an imprint could include a footprint or could occur when an organism decomposes within a hardened rock layer, leaving behind a cavity shaped like the organism. This cavity is called an external mold. An internal mold forms when sediment fills an empty shell and the shell itself dissolves away, leaving

behind an impression of the inside of the shell. When molds are filled in by sediment, the filling is called a cast.

Mummification, also called **desiccation**, results in preservation of both soft and hard parts. When an organism dies in a dry location protected from the elements, such as a desert cave, its remains become dehydrated. This prevents bacteria colonization and allows even soft tissues such as skin and hair to be preserved.



There are four means of fossilization via **complete preservation**: freezing, encasing in ice, encasing in amber, or encasing in asphalt. Like mummification, complete preservation results in soft tissue retention. Much like dehydration, freezing slows or prevents bacterial colonization of remains. Other types of complete preservation result when an organism dies and is covered by water or tree



Mummification occurs when desiccation prevents bacterial colonization.

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What Fossils Can Tell Us

Fossils are evidence of events and processes in Earth's past. Through the study of fossilized remains, scientists can learn about the first appearance of life, even how early life forms developed and how they became extinct. Fossils can also teach us about the evolution of various life forms and the changes in the climate surrounding them throughout Earth's long history. Scientists can compare modern organisms to extinct life forms to determine the traits passed down through the generations from ancestors to descendants.



Fossils can teach us about the history of life on Earth.

Fossils also provide the means of connecting rock layers from different areas. Certain life forms existed at certain times in different locations. Thus, even though different types of rock may have formed at the same time in different areas, if they contain the same fossils, scientists can readily match them up. This allows them to compare past environmental conditions that may have affected different regions. Through radiometric dating of fossils, a technique using radioactive isotopes to determine the absolute age of a sample, rock layers can be assigned to a time in Earth's past.



Fossils can teach us about past environments.

Reading Comprehension Questions

1. What
2. What are the two kinds of fossils? Explain and give three examples of each.
3. What conditions
4. What
5. Briefly
6. How do compression fossils form?
7. What
8. Describe mummification.
9. How can
10. Summarize what information can be learned from fossils.

Extension Questions

11. Why do you think
12. Have you ever seen a fossil? If so, where? What kind of fossil was it? If not, what type of fossil would you most like to see and why?

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