

Fossils

What are fossils? How do they form?

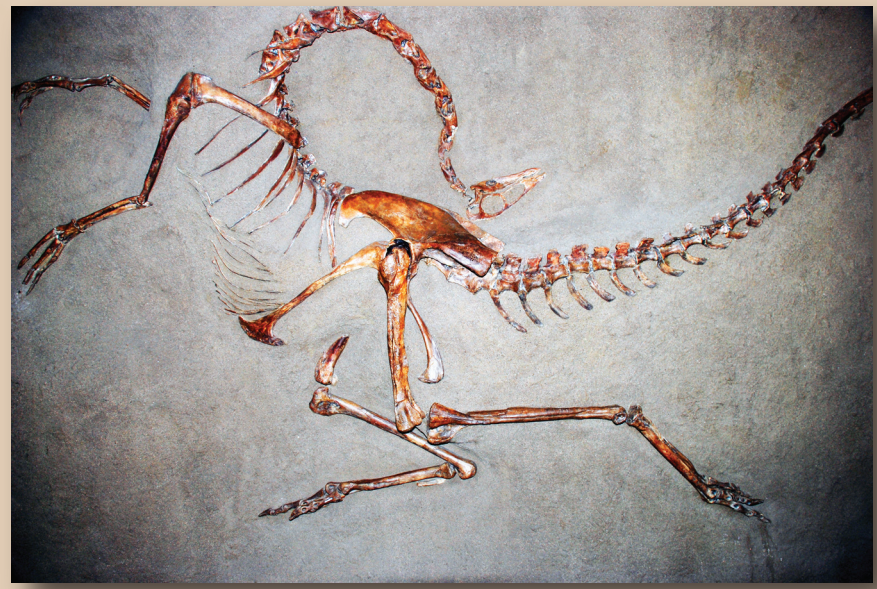
Fossils are the preserved remains or traces of ancient animals, plants, and other organisms.

The word "fossil" comes from the Latin word *fossus* which means "dug up." Paleontology is the study of fossils.

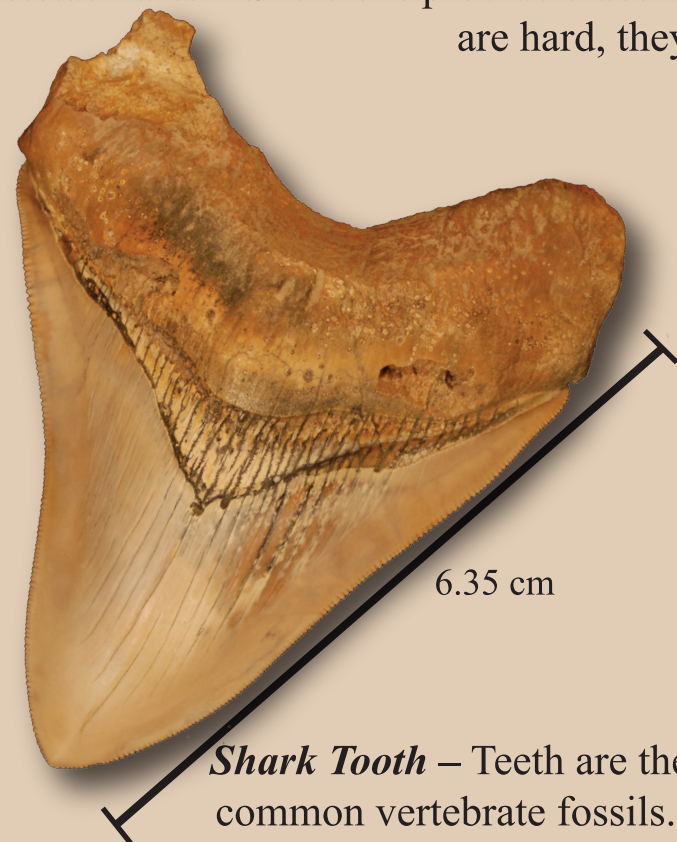
TYPES OF FOSSILS

Body Fossils

Preserved remains of an organism's body parts in an original or altered state, usually in a rock matrix.



Skeletal Parts – Skeletons provide clues to what organisms looked like and how they moved. Because bones, teeth and shells are hard, they are preserved more commonly than other body parts.



Shark Tooth – Teeth are the most common vertebrate fossils. Their shape can tell us whether they were herbivores or carnivores.



Shells – Mineralized parts of marine invertebrates.



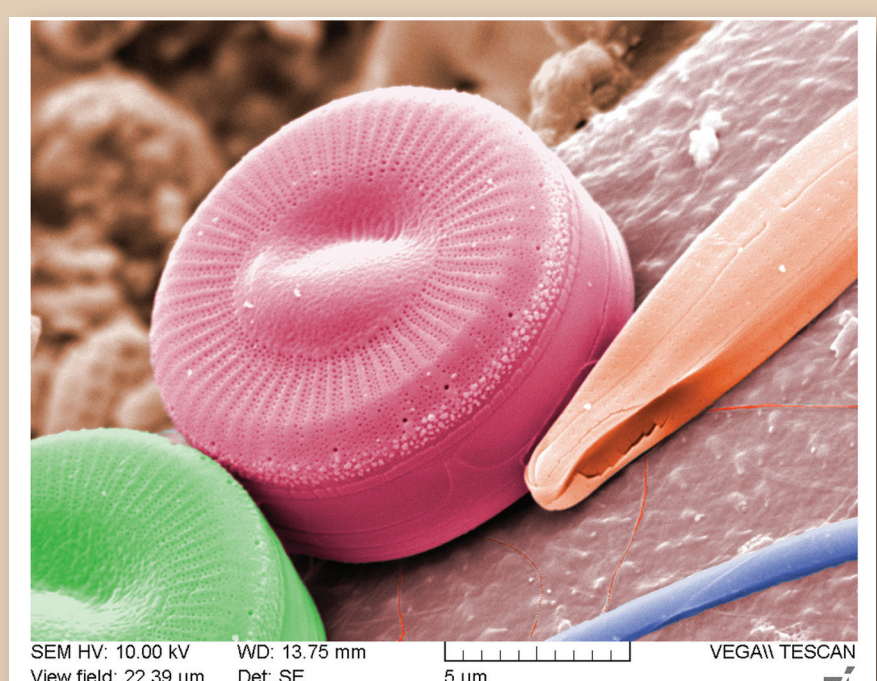
Amber – Formed when tree resin hardens. Often insects and other small animals or plant parts are found trapped inside. This example contains ants.



Fossil Plants – Remains can often show us details of ancient plant anatomy. In some cases, such as the fossil fern (above left) details of veins can be seen. In other cases, such as the petrified log (above right), the mineralization process did not preserve finer details of the original plant.



Impressions – Sometimes very soft organisms are preserved in rocks. None of the organic matter remains, but the impression does, as is the case with this jellyfish.



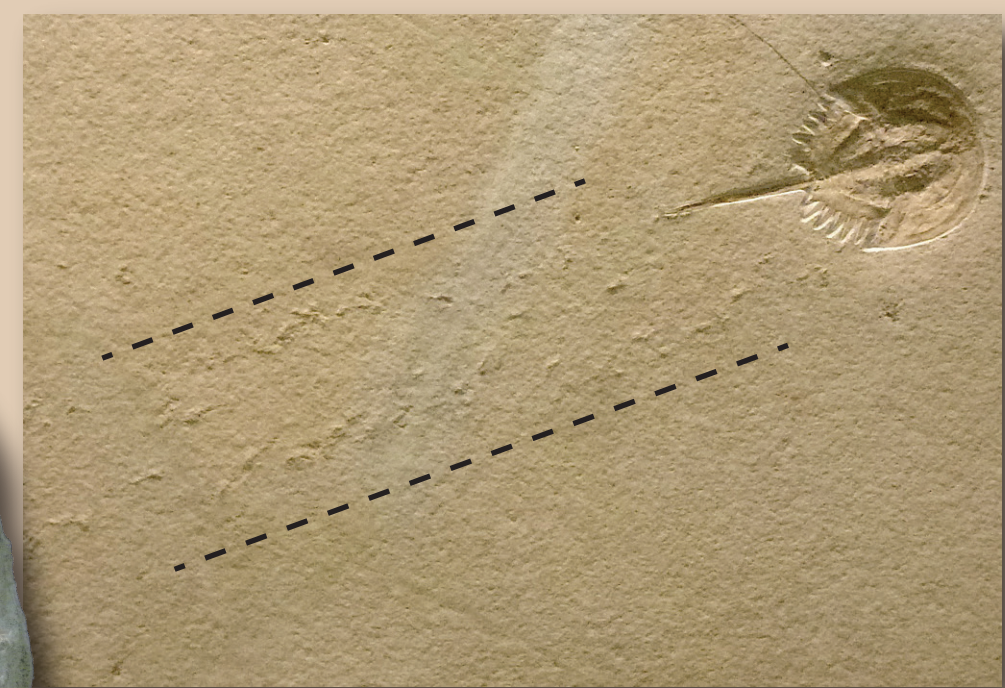
Microfossils – These are fossils that are so small they can only be seen clearly with a microscope. The pink and green organisms are diatoms which are made of silica. Diatoms are actually white in color; these have been digitally colored so they can be more clearly seen.

Trace Fossils

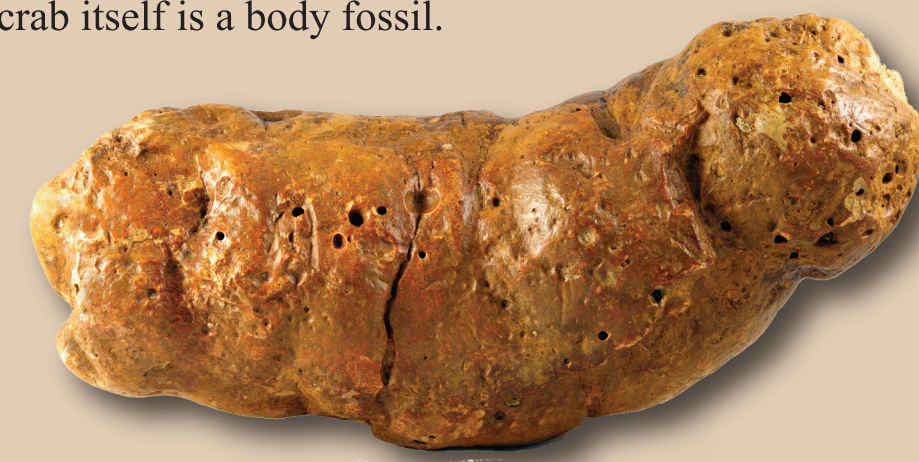
Evidence of the activity of organisms, but not a part of the organism itself.



Footprints or Tracks – These impressions formed when organisms walked on soft sediment leaving a depression that was then filled in with more sediment. The picture (above) on the left shows dinosaur footprints from Italy. In the center is a 3-D camel-like footprint from Barstow, California. The picture on the right shows tracks (between the dashed lines) that have been made by a horseshoe crab and were found in Germany. The tracks are trace but the crab itself is a body fossil.



Coprolite – Fossil feces. This specimen comes from South Carolina and weighs 1.36 kg! Coprolites can sometimes provide information about the diet of an organism.



Fossil Burrows – This spiral burrow (left) is called *Gyrolithes*, and it is believed to be formed by crustaceans (e.g., crabs) digging down into the sediment. *Thalassinoides* burrows (right) are also thought to be made by crustaceans. (scales in cm)

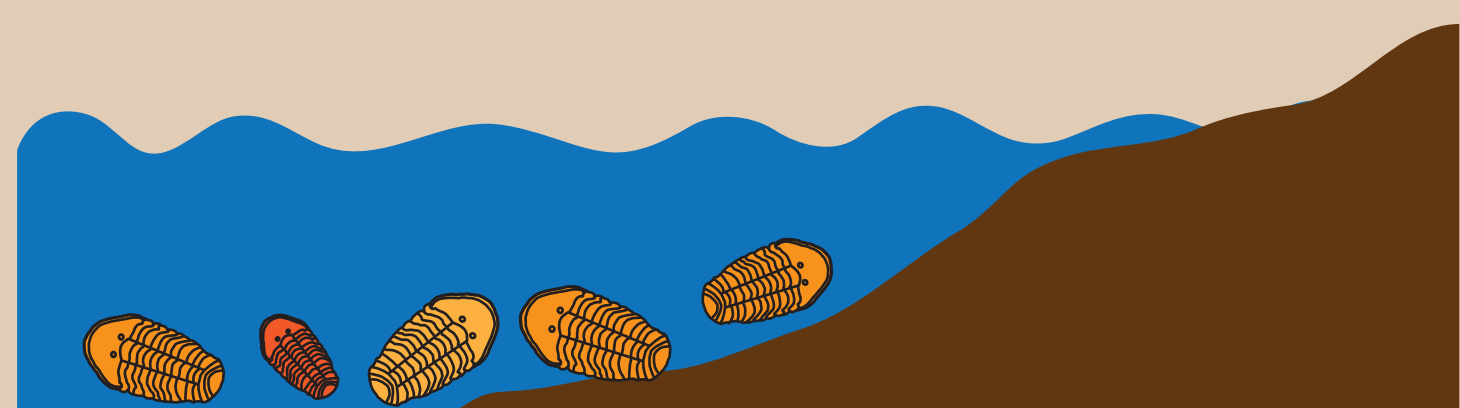


Fossil Burrows – Evidence showing that animals burrowed through sediment is common. Those burrows or galleries can have different shapes and sizes depending on the size of the burrowing animal, the particular burrowing activity of the animal (e.g., burrowing to feed on the sediment or to excavate a dwelling), and the geochemical conditions of the sediment at that time. The panoramic picture (above) shows the top surface of a sedimentary bed with ripples, which indicate that it formed under moving water. The burrow shown is called *Rhizocollarium*, and it is believed to have been formed by a large nematode worm feeding in the wet sediment before it hardened.

FORMATION OF FOSSILS

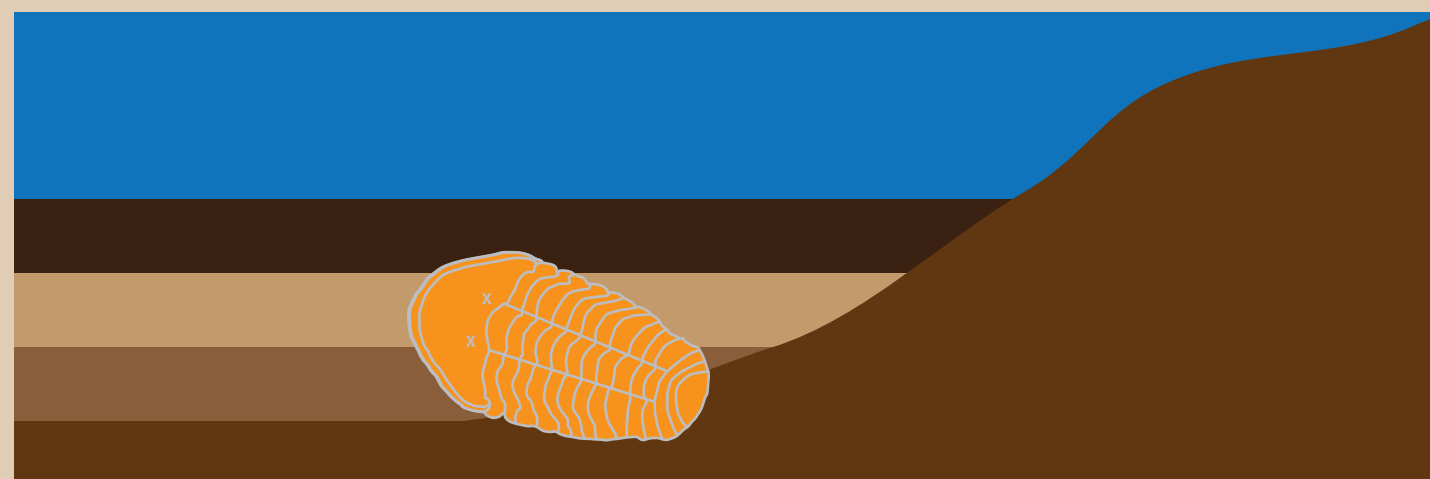
How fossils form:

Several conditions must usually occur for fossils to form. First, hard parts (bones, teeth, wood, shells, etc.) are important. Only in exceptional cases have soft tissue specimens been found fossilized. Second, organisms must be quickly buried to avoid destruction. Third, the sediment must have the right geochemical properties for minerals to precipitate and possibly replace the buried organism. For this to occur water is needed, thus fossilization is more likely in the initial stages of burial, when the sediment is still wet. Fossilization is usually a relatively rapid process, otherwise organisms would decay before they could be preserved.



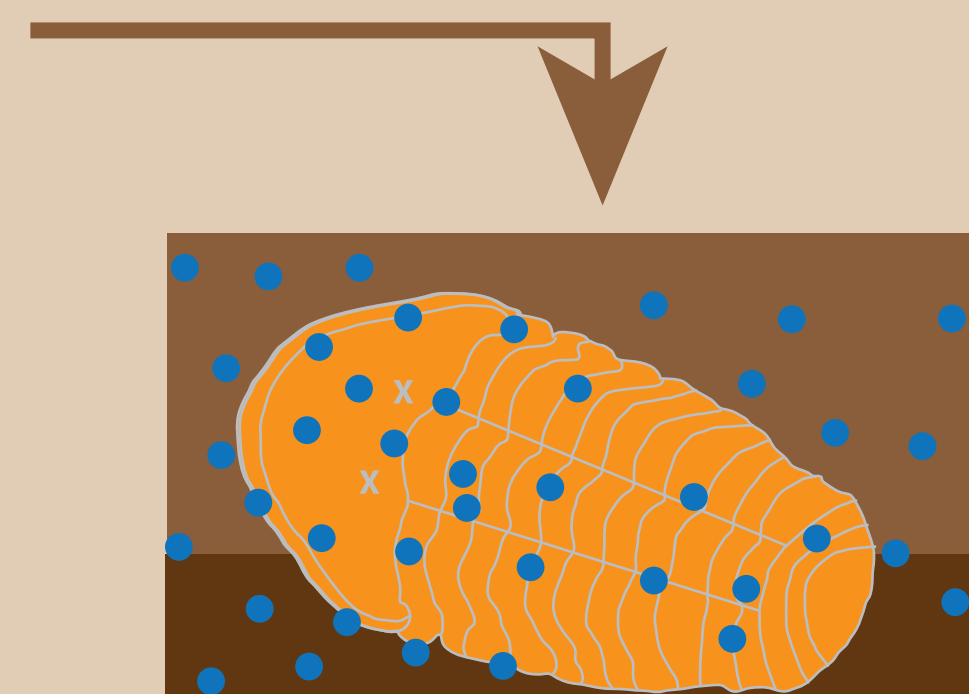
Organism dies

First, the organism dies. Those that die in the water are more likely to be preserved than those on land.



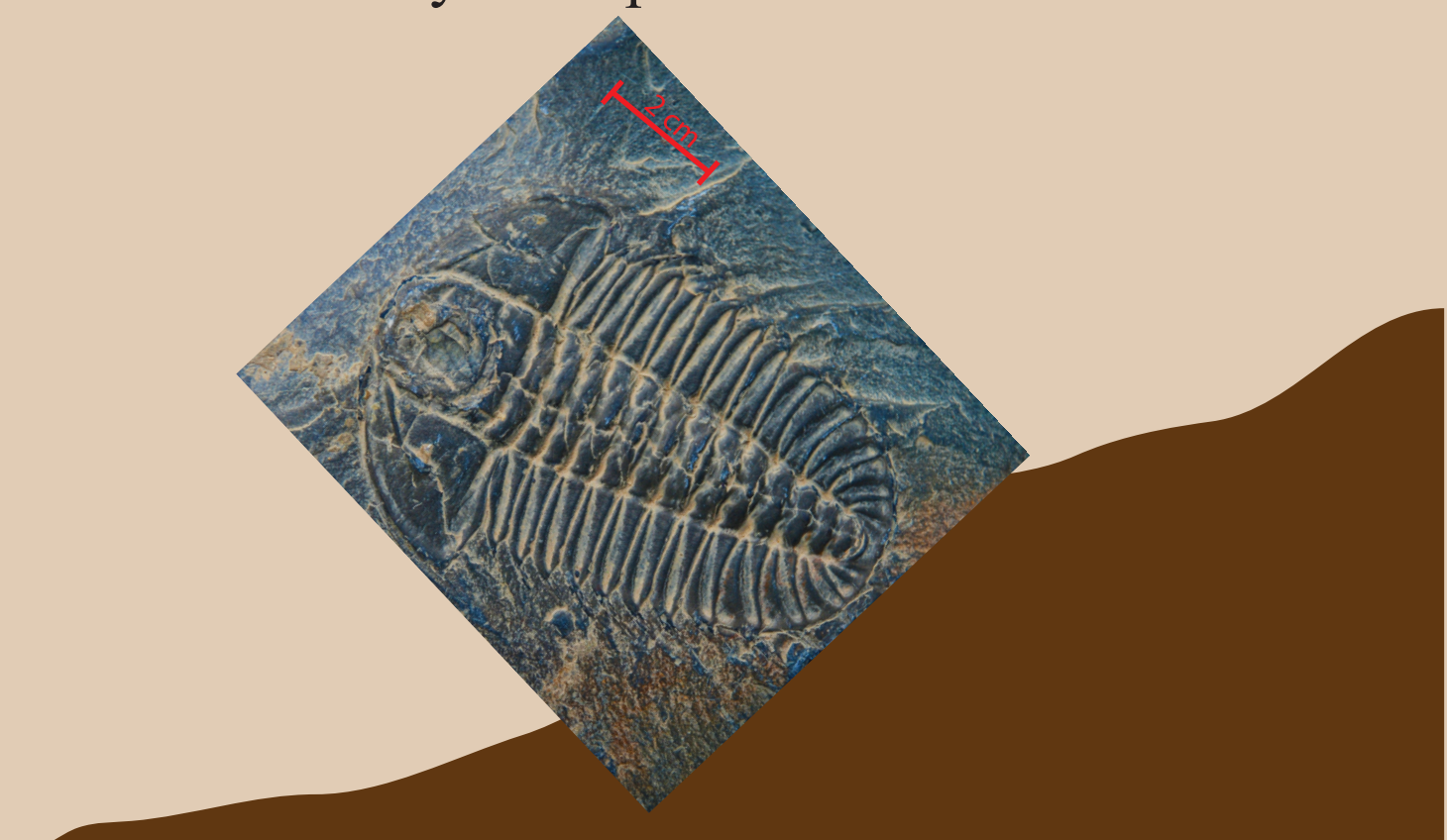
Organism is buried

Most organisms are eaten or destroyed before being buried. However, if they are rapidly buried they have a chance of fossilizing.



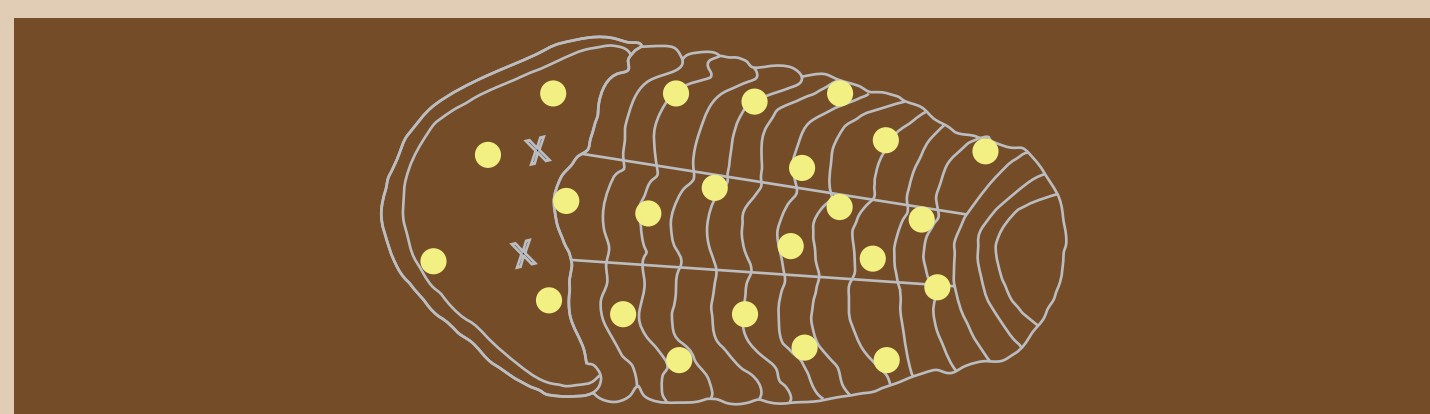
Water moves into pores

After burial, there are several ways that the fossilization can proceed. However, these generally require water (blue dots) moving through the buried organism/sediments.



The fossilized organism is found

Over time, the fossilized organism becomes exposed on the surface where people can find it.



Mineralization

Often, permeation by mineral-laden groundwater causes replacement of the minerals (yellow dots) that make up the original organism.