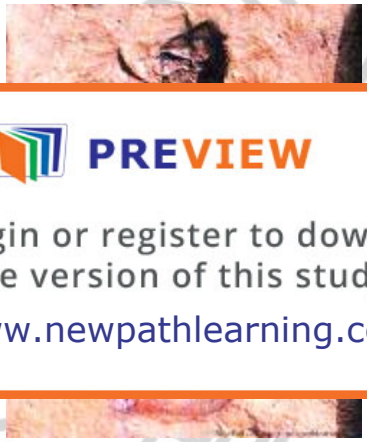
FOSSILS

Overview

Ancient life forms have been preserved, in part and in whole, in the rock record. These preserved pieces of ancient life forms are called **fossils**. Fossils reveal information about past ecosystems, the variety of life forms in those ecosystems, the relationships of the organisms, and more. Many of the fossilized organisms are now extinct. They are understood by comparing their fossilized remains to the body parts of living organisms. Scientists who specialize in the fossilized remains of ancient life forms are called **paleontologists**.

What Is a Fossil?



A **fossil** is the naturally preserved evidence of life. Fossils include pieces or the entire remains of organisms; these are called **body fossils**. Fossils also include traces and marks left by organisms, such as footprints. These are called **trace fossils**. In most cases, the hard parts of organisms, such as bones, teeth, and shells, are preserved. In rare geologic circumstances, the soft tissue is preserved as a fossil.

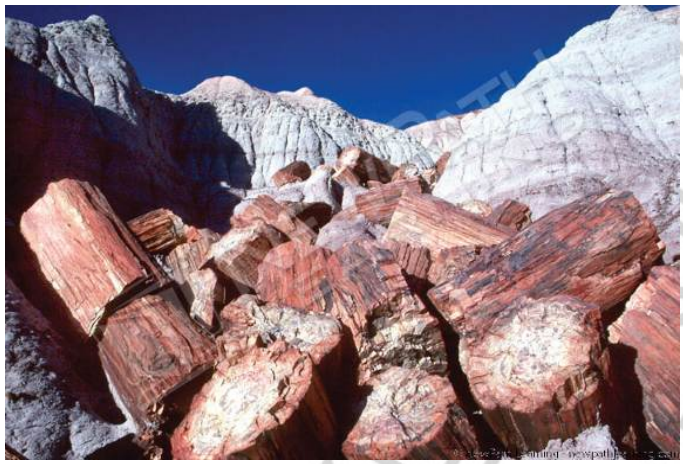
Lesson Checkpoint:
What does a trace fossil show us?

How Does a Fossil Form?

There are a number of ways that fossils are formed. Fossils found in limestone are usually formed by a process called **cast and mold**. The organism dies and its shell settles into the lime on the ocean floor leaving an impression of the shell. This is called the mold.

The lime hardens and then more lime fills in the mold. When this lime hardens, it forms a cast, which is a replica of the original shell. The original shell is gone, but its form is preserved.

Petrified wood is formed by a process called **petrification**. The original wood fibers are slowly and completely replaced by mineral material, usually quartz (agate). In some cases, the pores of the wood or bone are filled with mineral material. This is called **permineralization.**



In very hot, arid environments, flesh can be dried out and preserved indefinitely. This process is called **mummification**. Flesh can also be preserved in extremely cold environments such as the completely frozen woolly mammoths that are discovered in Siberia.

Plant leaves and stems have been preserved by a process called **carbonization**. In this process the leaves and stems deteriorate but leave a film of carbon which preserves their form. This usually occurs in coal beds.

Flies, dragonflies, and other insects have been preserved in amber. **Amber** is hardened tree sap. As the amber hardens, volatile components like gases are forced out of the amber. In the process the insects are literally dried out (desiccated). However, the form and color of the insects is very well preserved. The detail of the preservation of even the smallest body parts can be remarkable.

Lesson Checkpoint:
Where does the process of carbonization usually occur?

Fossils Tell a Fascinating Story

Fossils reveal information about ancient organisms. In addition, collections of fossils from a particular rock formation give information about the environment in which the organisms lived. Paleontologists call these **paleoenvironments**. Marine fossils indicate ancient marine environments and terrestrial fossils indicate ancient terrestrial environments. This is quite obvious. However, finding marine fossils on the top of a mountain indicates that what is now a mountaintop was, millions of years ago, an ocean floor.

It is also possible to discover more subtle details such as which organisms coexisted, which were predators and which were prey, how the organisms lived in coexistence with each other, and, in some cases, how the entire population died. Some paleontologists have even studied the fossilized fecal remains of dinosaurs to learn about their diets and the food available to them.

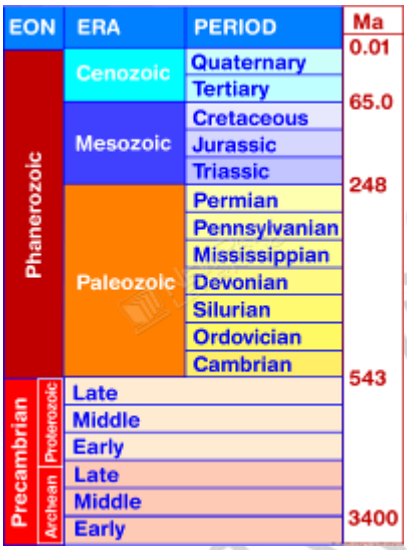
Fossils can factors such as te of a tropical ma geologists dramatical strong evidence s ntal drift.

Lesson Checkpoint:

What do fossils tell us about past ecosystems?

Using Fossils to Date Rocks

Geologists understand geologic time in two categories. **Relative time** is the age of a particular rock formation or fossil *relative to* other rocks and/or fossils. Earth history is broken into **eons**, **eras**, **periods,** and **epochs** (with each being a subset of the previous). Using this system, geologists can understand that reptiles are older than mammals because they appear in the fossil record before the mammals.



Notice that relative time does not use specific numbers. **Absolute time** refers to specific ages of rocks and fossils and geologic events using specific dates. For instance, the dinosaurs of the Triassic Period lived betw d" is the relative tin this geologic ti es and relative po lute time is recorde

Geol rom the beginning **geologic column**. rock layers and fossils found on the Earth, from the oldest on the bottom to the youngest on the top. It is actually the compilation of partial rock sequences gathered from all over the world. It represents all the time of Earth history.

There are some special fossils of species that lived for a relatively short period of time and were unique to that time range. Whenever these fossils are encountered anywhere in the world, geologists know that the rocks in which they are found have a specific absolute age. These fossils are called **index fossils**.

Lesson Checkpoint:
What is the difference between relative time and absolute time?

How Is Absolute Age Determined?

The absolute age of rocks is determined by analyzing the **radioactive isotopes** in a rock sample. Radioactive elements are unstable and decay over time. It has been possible to determine how long it takes for ½ of an amount of a radioactive isotope to decay. This is called its **half life**. When a radioactive element decays, it forms a new element which is called the **daughter product**. By measuring the amount of radioactive isotope in a sample and measuring the amount of daughter product and taking into account the element's half life, it is possible to calculate how old the specimen is in years. Uranium-238, Potassium-40 and Carbon-14 are some of the radioactive isotopes analyzed to determine absolute age. Uranium-238 is good for extremely old rocks; carbon-14 is most accurate for determining the age of relatively young samples.

Parent Material	Daugher Material	Half-Life
Uranium-		ars
Potassiu		rs
Carbon-1		