

Lesson Outline for Teaching

Lesson 1: Fossil Evidence of Evolution

A. The Fossil Record

1. Fossils are the preserved remains or evidence of once-living organisms.
2. All the fossils ever discovered on Earth make up the fossil record.
3. Fossils help scientists figure out what species that no longer exist looked like when the organisms were alive.

B. Fossil Formation

1. Most fossils are formed of the hard parts of an organism.
2. Sometimes when the remains of an organism get buried in mud, wet sand, or other sediments under a body of water, the molecules that formed the remains get replaced by minerals in the water.
 - a. This type of fossil formation is called mineralization.
 - b. Most mineralized fossils are formed of shell or bone, but wood can also become a mineralized fossil.
3. In carbonization, a fossil forms when a dead organism is compressed over time and pressure drives off the organism's liquids and gases.
4. Sometimes organisms or parts of organisms make a(n) impression in sand or mud.
 - a. The kind of fossil that forms as an impression in rock is called a(n) mold.
 - b. If the impression gets filled with sediments that harden to rock, a(n) cast is the result.
 - c. Molds and casts show only external features of organisms.
5. The preserved evidence of the activity of an organism, such as its tracks, is called a(n) trace fossil.
6. In rare cases, the original tissues of an organism can be preserved, such as mammoths frozen in ice.

C. Determining a Fossil's Age

1. Scientists cannot date most fossils directly. Instead they usually find the age of the rocks around the fossils.
2. In relative-age dating, scientists determine the relative order in which rock layers were deposited.
 - a. In a(n) undisturbed rock formation, the older layers of rock are below the younger layers of rock.
 - b. Relative-age dating has helped scientists figure out the order that species have appeared on Earth.

Lesson Outline continued

3. Absolute-age dating is more precise than relative-age dating and involves radioactive isotopes that decay to become stable isotopes over time.

D. Fossils over Time

1. The geologic time scale is a chart that divides Earth's history into different time units.
2. Earth's history is divided into four eons.
3. Earth's most recent eon—the Phanerozoic eon—is subdivided into three eras.
4. Neither eons nor eras are equal in length.
5. When scientists began developing the geologic time scale in the 1800s, they did not have absolute-age dating methods, so they marked time boundaries with fossils.

E. Extinctions

1. When the last individual organism of a species dies, a(n) extinction has occurred.
 - a. A(n) mass extinction occurs when many species die off within a few million years or less.
 - b. The fossil record shows evidence of five mass extinctions during the Phanerozoic eon.
 - c. Extinctions can occur if the environment changes quickly; for example, as the result of a meteorite impact.
 - d. Extinctions can also occur if the environment changes gradually; for example, as a result of the formation of mountain ranges.
2. The fossil record contains clear evidence of the extinction of species over time as well as evidence of the appearance of many new species.

Discussion Question

Compare and contrast relative-age and absolute-age dating.

In relative-age dating, scientists determine the relative order in which rock layers were deposited. In an undisturbed rock formation, the bottom layers are oldest and the top layers are youngest. Relative-age dating helps scientists determine the relative order in which species have appeared on Earth over time. Absolute-age dating is more precise than relative-age dating. Scientists take advantage of radioactive decay, a natural clocklike process in rocks, to learn a rock's absolute age in years. In radioactive decay, unstable isotopes in rocks change into stable isotopes over time. Scientists measure the ratio of unstable isotopes to stable isotopes to find the absolute age of a rock. This ratio is best measured in igneous rocks. To measure the age of sedimentary rock layers, where most fossils are embedded, scientists calculate the ages of igneous layers above and below them. Then, they can estimate the ages of the fossils embedded within the sedimentary layers.