

17-1 The Fossil Record

Fossils and Ancient Life

Paleontologists are scientists who collect and study fossils.

All information about past life is called the **fossil record**.

The fossil record includes information about the structure of organisms, what they ate, what ate them, in what environment they lived, and the order in which they lived.

The fossil record provides evidence about the history of life on Earth. It also shows how different groups of organisms, including species, have changed over time.

- The fossil record provides incomplete information about the history of life.
- Over 99% of all species that have lived on Earth have become **extinct**, which means that the species has died out.

How Fossils Form

Fossils can be as large as a complete, preserved animal, or as small as a fragment.

Most fossils form in **sedimentary rock**. Sedimentary rock forms when exposure to the elements breaks down existing rock into small particles of sand, silt, and clay.

Interpreting Fossil Evidence

Paleontologists determine the age of fossils using **relative dating** or **radioactive dating**.

In **relative dating**, the age of a fossil is determined by comparing its placement with that of fossils in other layers of rock.

Rock layers form in order by age—the oldest on the bottom, with more recent layers on top.

Relative dating allows paleontologists to estimate a fossil's age compared with that of other fossils.

Scientists can also use index fossils to date rocks from different locations.

Index fossils are used to compare the relative ages of fossils.

An **index fossil** is a species that is recognizable and that existed for a short period but had a wide geographic range.

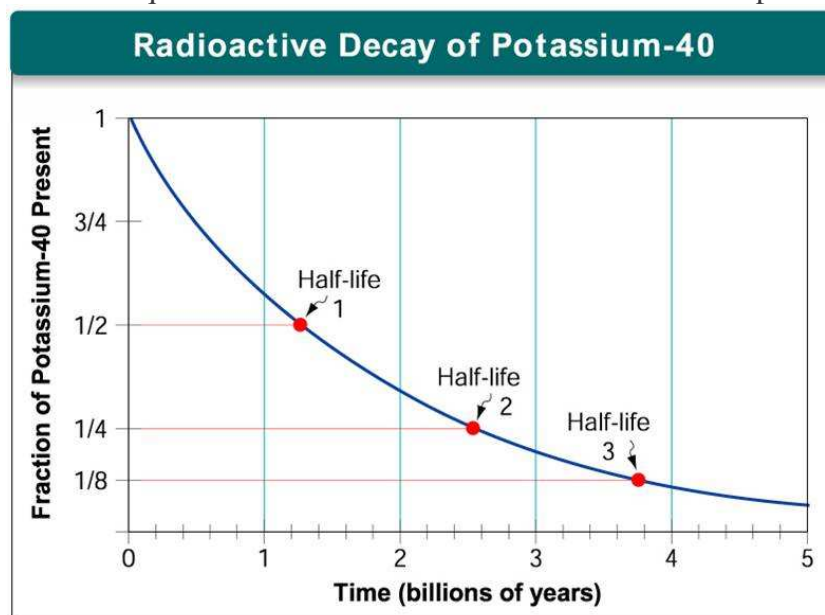
Radioactive Dating

Scientists use radioactive decay to assign an absolute age to rocks.

Some elements are radioactive and steadily break down into nonradioactive elements.

Radioactive dating is the use of half-lives to determine the age of a sample.

A **half-life** is the length of time required for half of the radioactive atoms in a sample to decay.



Radioactive dating involves measuring the amounts of radioactive isotopes in a sample to determine its actual age. Such measurements enable scientists to determine the absolute age of rocks and the fossils they contain.

In radioactive dating, scientists calculate the age of a sample based on the amount of remaining radioactive isotopes it contains.

Carbon-14 begins to decay when an organism dies.

Carbon-12 is not radioactive and does not decay.

By comparing the amounts of carbon-14 and carbon-12 in a fossil, researchers can determine when the organism lived.

Geologic Time Scale

Paleontologists use a scale called the **geologic time scale** to represent evolutionary time.

Scientists first developed the geologic time scale by studying rock layers and index fossils worldwide.

The basic divisions of the geologic time scale are **eras** which are divided into **periods**.

Geologic time begins with **Precambrian Time**, which covers about 88% of Earth's history.

The basic units of the geologic time scale after Precambrian Time are eras and periods.

Each era is divided into periods.

Eras

Geologists divide the time between Precambrian time and the present into three **eras**:

- **Paleozoic Era**
- **Mesozoic Era**
- **Cenozoic Era**

The Paleozoic began about 544 million years ago.

Many vertebrates and invertebrates lived during this time.

The Mesozoic began about 245 million years ago.

Dinosaurs lived during this time.

Mammals began to evolve during this era.

The Cenozoic began about 65 million years ago and continues to the present.

Mammals became common during the Cenozoic.

Periods

Eras are subdivided into **periods**, which range in length from tens of millions of years to less than two million years.

Many periods are named for places around the world where geologists first discovered the rocks and fossils of that period.

Earth's history is often compared to a familiar measurement, such as the twelve hours between noon and midnight. In such a comparison, notice that Precambrian Time lasts from noon until after 10:30 pm.