Earth Science Reviewer

Fossils and Geologic Time Scale

Fossils are the remains of life that are preserved within sediments and sedimentary rocks.

Paleontology is the study of fossils linking concepts of geology and biology in order to understand prehistoric life over geologic time.

When an animal or plant dies, decomposition, scavengers, and other natural factors usually remove the soft parts of the organism. So in order to produce a fossil, two conditions must be observed: **(1) The organism must possess hard parts** (bones, teeth, etc.) and **(2) rapid burial of the remains** increases the chance of preservation.

Different Ways a Fossil Can Be Preserved.

1. Permineralization.

Credit: The Virtual Petrified Wood Museum

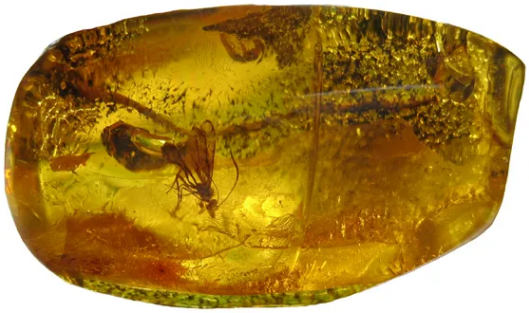
This occurs when pores and open spaces in tissue (such as bone and wood) are filled up with minerals precipitated from mineral-rich solutions such as groundwater.
An example of permineralization at work is when silica precipitates inside the pores of the wood, creating petrified wood. The image above is an example of a permineralized dinosaur vertebra.

2. Molds and Cast.

Credit: The Virtual Petrified Wood Museum

When organisms buried in sediment dissolve or decay away, it leaves behind a hollow space called **mold** in the shape of the organism. If this hollow space is eventually filled in by minerals, a **cast** is made.

3. Amber.



Credit: The Virtual Petrified Wood Museum

Organisms in amber are exceptionally preserved well, often still containing its soft parts. These organisms are preserved when they fall into a viscous tree sap which hardens into amber.

4. Carbonization.

Credit: The Virtual Petrified Wood Museum

Soft-bodied organisms and delicate plant parts can be conserved via carbonization. This happens when these organisms are buried in sediment and eventually dissolve away, leaving behind a thin layer of carbon outlining the organism's shape.

5. Freezing

Credit: Ruth Hartnup/Flicker

Organisms can also be exceptionally preserved when they are encased in ice. The image above is of Lyuba, a baby mammoth that was found frozen in ice in Siberia.

6. Trace Fossils.

Credit: The Virtual Petrified Wood Museum

A fossil doesn't only pertain to the actual organism. A fossil can preserve records of its activities such as tracks, burrows, **coprolites** (fossilized poop), and **gastroliths** (stomach stones).

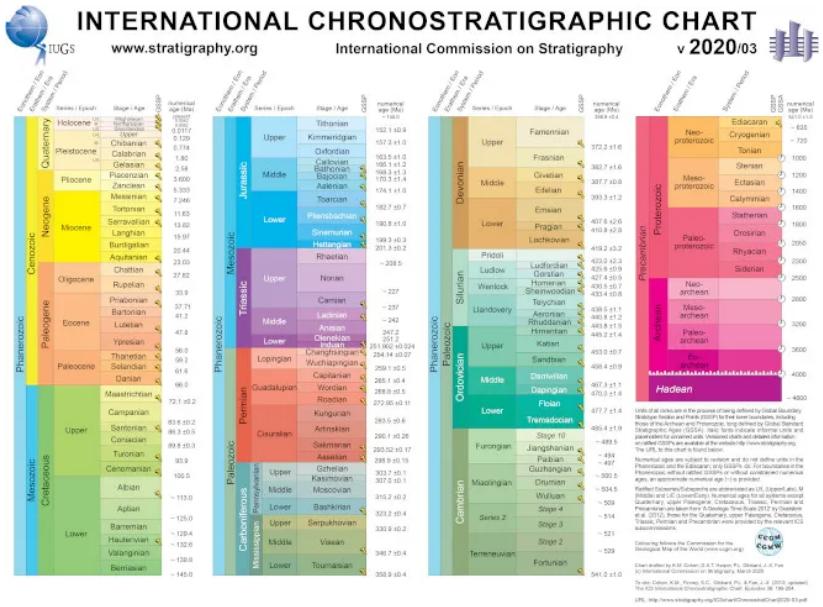
Trace fossils can tell a lot about how an organism lived– how it moved, what it ate, and other types of behavior.

The Geologic Time Scale.

The **geologic time scale (GTS)** is a tool used by geologists in order to classify and date rocks and fossils. Instead of using numerical ages, time is divided into units such as eons, eras, periods, epochs, and ages (in descending order of duration).

The GTS is maintained by an international body called the **International Commission on Stratigraphy (ICS)** which aims to create unified terminologies for geologists around the world to use in stratigraphy.

Boundaries of time units change often, depending on new findings and discoveries. You can get the latest version of the GTS here.



GTS v. 2020/03. Source: ICS

Based on the radiometric dating of the oldest rocks on Earth, **the age of Earth is believed to be 4.534 billion years old**. Since then, a lot has transpired on our little Earth.

Below is a very, very, *very* condensed history of the Earth:

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From the past…

- **Hadean Eon**: The formation of the Earth; magma ocean; intense bombardment of space bodies (“Late Heavy Bombardment”)
- **Archean Eon:** Life begins as prokaryotic bacteria; Blue-green algae start to produce oxygen in the atmosphere
- **Proterozoic Eon:** Multicellular life emerges
- **Cambrian Period:** Multicellular life flourishes and diversifies (“Cambrian Explosion”)
- **Ordovician Period:** “Age of Invertebrates”
- **Silurian Period:** Emergence of plants on land
- **Devonian Period:** “Age of Fishes”; Towards the end, true amphibians emerged
- **Carboniferous Period:** “Age of Amphibians”
    - Mississippian: Amphibians diversified; large coal swamps formed
    - Pennsylvanian: Emergence of reptiles
- **Permian Period:** Existence of Pangaea; largest mass extinction in Earth’s history occurred towards the end (“The Great Paleozoic Extinction”)
- **Triassic Period:** Dinosaurs emerged; start of the Age of Reptiles; first true mammals (therapsids) emerged as well
- **Jurassic Period:** Dinosaurs dominated the Earth; first birds emerged
- **Cretaceous Period:** first flowering plants emerged (angiosperms); marked the end of the Age of Reptiles with the Cretaceous-Tertiary Extinction (“K-T Extinction”)
- **Paleogene Period:** start of the Age of Mammals
- **Neogene Period:** Mammals and birds evolved into modern forms; hominids, the ancestors of humans, appeared towards the end
- **Quaternary Period:** current period; a cycle of glacial and interglacial periods

…to the present!