

Notes 5.1 - Fossils

Clues to earth's past

January 14, 2010

SUMMARY

There are many types of fossils representing thousands of organisms. Fossils are rare because they require certain conditions to form. When fossils are found, they reveal clues to what Earth and early life were like.

Rocks, fossils, and original remains give clues about the past.

- Earth changes over time through the rock cycle, mountain formation, movement of plates, asteroid impacts, and so on. We know dinosaurs existed on our planet 200Ma and then disappeared 65Ma. How do we know about this?
- Scientists have learned about these changes by studying rocks, fossils, and earth's layers, other natural evidence.
- **Fossils** are traces or remains of living things from long ago.
 - Dinosaur bones and footprints are examples of fossils. (Really anything that gives us proof something was living in the past is a fossil.)
- The study of fossils is called **paleontology**. Paleontology is a combination of biology and geology attempting to understand life in the past.
 - Example: Even though no one has ever seen a dinosaur, fossils tell us what they most likely looked like and even how they behaved.
- Fossils not only reveal what life existed long ago but what the past environment was like.
 - Example: If we find a skeletal fossil of an amphibian, we know the environment had to be warm and wet.
- They also help scientists identify similar rock layers around the world.
 - Example: If the same fossilized organism is found in two places in the world, the rock they both formed in must be the same age.
- Fossils exist in many different forms.
 - Most fossils are hardened animal remains such as shells, bones, and teeth.
 - Other fossils are impressions, such as footprints, teeth marks, or skeleton outlines.
 - The most rare are fossils of complete animals like insects in amber and mammoths in ice.

Certain conditions favor fossil formation.

- A small fraction of the organisms that lived in the past have been preserved.
- Most animals or plants are destroyed before they become fossils.
- In order to form fossils two conditions are needed: rapid burial and an organism with hard parts.
 - When most organisms die, their bodies are eaten by scavengers or decomposed by bacteria and fungi.

- Occasionally, organisms are buried by sediment. This prevents:
 - The decay of the organism from scavengers and bacteria, and
 - The wear down of the organism from the environment.
- In addition, animals and plants with hard parts are more likely to be fossilized.
 - Flesh, muscle, and other soft tissues decay rapidly. (Note: there are fossils of soft organisms such as jellyfish, worms, and insects but they are very rare.)
 - Hard parts decay and breakdown very slowly and are more likely to be preserved.
- Because of these conditions, the fossils we find are mostly organisms with hard parts that lived in water (sediments are readily available to bury the organism). This also means we only find fossils in sedimentary rock.

Some fossils are organisms preserved in their original form.

- Fossils that are the actual bodies or body parts of organisms are called **original remains**.
- Usually, soft parts, such as skin, organs, or leaves of dead animals and plants decay and disappear.
- The soft parts can become fossil evidence if they are sealed in a substance that keeps out air and organisms (such as bacteria).
- Original remains are found in places where conditions prevent the **decomposition**, or breakdown, that normally occurs.
- Scientists absolutely LOVE original remains because they're awesome and they give direct evidence of life that lived long ago.
- There are three substances that form original remains fossils.
 - **Ice**
 - Ice is one of the best preserves of the remains of prehistoric life.
 - Ice fields in Siberia and Alaska contain the bodies of 10,000 year-old mammoths and prehistoric rhinos. These organisms still have their bones, muscle, skin, and even hair in place.
 - Ice preserves the organisms after they die.
 - **Amber**
 - Amber is a natural substance that forms from resin, a sticky substance found in trees.
 - The resin protects the tree from insects (apparently very well) by trapping them in it.
 - If the resin remains on the tree (or nearby) after it dies, the resin can harden into amber.
 - Amber can contain the remains of insects, arachnids, lizards, and leprechauns.
 - **Tar**
 - Tar, a thick oily liquid, also traps organisms and preserves them.
 - Tar can be found under a layer of water. Some organisms would wade into a lake to drink the water only to be stuck in the tar that is underneath its surface.

Most fossils are impressions or petrification of organisms.

- Recall that most fossils form in sedimentary rock. The sediments bury the organism and provide a protective “cocoon” that shields it from the environment and organisms.
- Many fossils we find are modified body parts. There are two ways to modify an organisms so it can become a fossil:
 - **Preminalization**: the holes and gaps between of organism are filled with minerals leaving the organism intact. Eventually the organism will breakdown and what is left is mineral version of it.
 - **Petrification**: the cells are removed and replaced with minerals.
- A type of fossil that forms through these ways is **petrified wood**.
 - The stone fossil of a tree is petrified wood.
 - In certain conditions, a fallen tree can become covered with sediments.
 - Over time, water passes through the sediments and into the tree’s cells.
 - Minerals in the water take the place of the cells producing the fossil.
- Not all fossils are petrifications. Many are impressions. There are several types of impression fossils.
- **Molds and casts** are a type of impression fossil.
 - A **mold** is a visible shape that was left after an animal or plant was buried in sediment and then decayed away.
 - In some cases, the hollow mold later becomes filled with minerals, producing a **cast** fossil.
 - The cast fossil is a solid model in the shape of the organism.
 - These fossils do not reveal any information about the organism’s internal structures. It only reveals external features.
- **Carbon Films** are another type of impression fossil.
 - Carbon is an element found in all living things.
 - Carbon films form when a plant or animal dies and is buried. Pressure squeezes out the liquid and gas parts of the organism leaving behind a thin layer of carbon.
 - This layer of carbon is the carbon film. It reveals the soft parts of the animal, such as the wings of an insect.

Some fossils are traces of an organism

- **Trace fossils** are not part of an organism but give evidence of an organism’s existence in a given location.
- There are many types of trace fossils including footprints, trails, burrows, coprolites (fossilized feces), and nests.
- These fossils are important to scientists because they reveal how prehistoric life lived, what it ate, and how it behaved.