

## **The Significance of the Fossil Record**

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The fossil record indicates the evolutionary history of life. Many events together, including: continental drift, changes in climatic conditions as well as evolutionary novelties have guided the forces to yield interesting ranges of all manner of beasties (plants, microbes too). It is the goal of a group of scientists to determine the phylogeny (the evolutionary history of the organism). Those involved in systematics assign organisms to various taxa based on accumulated fossil record data as well as both anatomical and molecular similarities.

### **Objectives**

1. To become familiar with different types of fossils.
2. To understand various processes that lead to fossilization.
3. To examine the skulls of hominids.
4. To develop knowledge of the main Eras, their Periods and Epochs
5. To draw and label fossils that might appear on a laboratory practicum.
6. Students are strongly encouraged to view some of the books, magazine articles and references placed about the room.

Taxonomy is often not a favorite term of Bio II students. Often they use it in conjunction with other equally questionable words. We do so like to classify critters and it is somewhat important that we know the main taxa. Our system is going to reinforce those of Dr. Campbell, the author of the text.

The current system is the three domain system, previously mentioned. The following taxa will be used to classify organisms.

Learning tip: K P C O F G S (The expanded acronym is "King Phillip Came Over From Great Spain).

K~Kingdom P~Phylum, C~Class, O~Order, F~Family, G~Genus, S~Species

## Fossil Studies

1. A **fossil** is any preserved remnant or impression of a living organism that lived previously. Most fossils are found in sedimentary rock.

2. **Entire organisms are rarely fossilized.** Most often the hard parts of an organism including shells, teeth and bones, which do not decay quickly, remain as fossils.

3. Fossils can be formed in many ways, including **petrification; formation of imprints, casts, or molds; freezing; and entrapment in tar pits or amber.**

a. **Petrification** occurs when minerals dissolved in ground water seep into the tissues of a dead organism and replace its organic material, thus turning the animal or plant into stone. The petrified bones of dinosaurs and the petrified wood of trees are formed this way.

b. **Imprints**, such as footprints or leaf prints, are preserved depressions formed in soft mud or sand that subsequently dry and change into sedimentary rock. Dinosaur tracks are examples of imprints.

c. **Casts or molds** are formed when an organism such as a snail is buried in mud, under water for ages; as the organism undergoes decomposition, its shape is replaced by minerals, leaving a cast of the original animal in the surrounding sedimentary rock.

d. **Freezing** can occur if an organism is trapped in freezing soil, snow or ice that does not thaw over time. Bacterial decay can be prevented and much of the organism may be preserved. The preserved bodies of prehistoric mammoths have been found in Siberia.

e. **Tar pits** create a sticky material from which organisms cannot escape. Minimal bacterial decomposition occurs within these pits, thus the skeletons of many prehistoric animals, such as saber-toothed tigers, have been preserved.

f. **Amber** is the sticky, hardened resin of evergreen trees. It is responsible for trapping many prehistoric insects. As little bacterial decay occurred, the insect bodies have been preserved.

4. The age of fossils can be determined by **relative dating** and **absolute dating**.

a. **Relative dating** entails noting the layer of sedimentary rock in which the various fossils are found and estimating age from the position relative to the rock formation. Fossils found at the lowest point in a rock would generally be assumed to be the oldest.

b. **Absolute dating** may involve the use of radioactive isotopes to determine the ages of rocks and fossils on a scale of absolute time. These accumulated in the fossil when it was alive. Carbon 14 has a half-life of 5,600 years; thus half the carbon 14 will be gone in 5,600 years. It may also involve the measurements of the L and D forms of amino acids in the fossil. While alive, organisms synthesize only L forms of the amino acids but upon death these are gradually converted to D forms. By comparing the ratios we can determine the age of the organism.

5. Paleontologists have discovered evidence that life has progressed from simpler to more complex forms.

a. Study of successive geologic layers of fossil sites typically reveals that the next higher layer contains not only fossils of organisms found in the lower layers but also fossils of newer and more complex organisms.

b. Fossils of the most recent plants and animals are found only in the highest or newest layers of rock.

## Time-line for Paleontology

<b>Yrs. BP</b>	<b>Eon</b>	<b>Era</b>	<b>Period</b>	<b>Epoch</b>	<b>Events</b>
4.6 billion	Archaean				Origin of Earth
3.8 billion					Oldest known rocks
3.5 billion					Oldest known fossils
2.7 billion					Increase in atmospheric oxygen
2.5 billion	Proterozoic				
2.2 billion					Oldest eukaryotic fossils
600 million					Algae and soft-bodied invertebrates
542 million	Phanerozoic	Paleozoic	Cambrian		Origin of Invertebrates First Trilobites, Brachiopods, Graptolites, Mollusks, Corals, Echinoderms
488.3 million			Ordovician		Trilobites, Jawless Fish
443.7 million			Silurian		Fish (teeth, jaws) First Land Vertebrates First Land Plants
416 million			Devonian		Bony fish, Fleshy Fish, Rhipidistians, Mollusks, First Insects Diversification of Plants First Amphibians
359.2 million			Carboniferous		First Land Vertebrates, Origin of Reptiles and Amphibians Origin of Forests and seeds
299 million			Permian		Trilobites Extinct, Origin of Reptiles
251 million		Mesozoic	Triassic		Dinosaurs, First Mammals
199.6 million			Jurassic		First Birds, Flowering Plants
145.5 million			Cretaceous		First Primates, Extinction of Dinosaurs
65.5 million		Cenozoic	Palogene	Paleocene	Radiation of mammals and birds
55.8 million				Eocene	Mammals diversify
33.9 million				Oligocene	Origin of mammal orders
23 million			Neogene	Miocene	First Hominids
5.3 million				Pliocene	Hominids
1.8 million				Pleistocene	Ice-age humans
0.01 million				Holocene	Historical time

**Laboratory Questions (if you need more space to answer the questions, use extra sheets of paper):**

1. Write the eras, periods and epochs in order. A memory device may assist processing information.

2. Draw and label representative fossils and name them.

3. Write a two paragraph description absolute and relative dating methods of assessing fossil age. Your answer should address at least 4 different methods for absolute dating of fossils.

4. Write a 2-3 sentence paragraph for each of the six common methods of fossilization describing how the fossil is formed.