

EVOLUTION

Introduction-

Evolution is the fundamental process where life's traits change across generations through genetic alterations (like mutations in DNA), leading to adaptation, diversity, and the emergence of new species from common ancestors, primarily driven by natural selection where advantageous traits are passed on.

No one has witnessed organic evolution because it is incredibly and unimaginably a very slow process. But there are certain evidences in support of evolution. One of them is Palaeontology.

Study of Fossils is referred as Palaeontology.

Fossil word derived from Latin word Fossalis meaning something which is dug up. Fossil May be Defined as **“The remains or prints of animals and plants of past ages preserved in the rocks/earth’s crust.”**

Or

“Remainants of the past are known as fossils”

The importance of fossils as an evidence of evolution was first recognized by **L. da Vinci** (1452-1519). The significance of fossils was also realized by **Charles Darwin**. Fossils form the concrete evidence of organic evolution. They are regarded as "the written documents" of evolution. It is stated that "Palaeontology the study of fossils is the final court of appeal when the doctrine of organic evolution is brought to bear. "Fossils not only form the concrete evidences of evolution but also provide valuable information about the following.

1. They have chronological significance. Because the organisms now represented as fossils lived at definite times during the geologic past i.e. they indicate the age.
2. The sequences of rocks formed during geologic time constitute the geologic column. The fossil remains have value for determining stratigraphic position in the geologic column. Certain remains which are used for this purpose are called index fossil.
3. They are used in determining ancient environment and also indicate something of the nature of ancient climate

4. Fossils reflect the geography of the ancient earth ie distribution of mountains, seas, deserts, forest etc.
5. They indicate the routes of migration of ancient organisms.
6. They indicate the affinities between certain groups.
7. They help in understanding the evolutionary history of certain animals like horse, camel, elephant, man etc
8. The greatest economic use of fossils is in petroleum exploration. Fossils foraminifers and other microfossils are used as indicators of oil reservoirs.

Types of Fossils

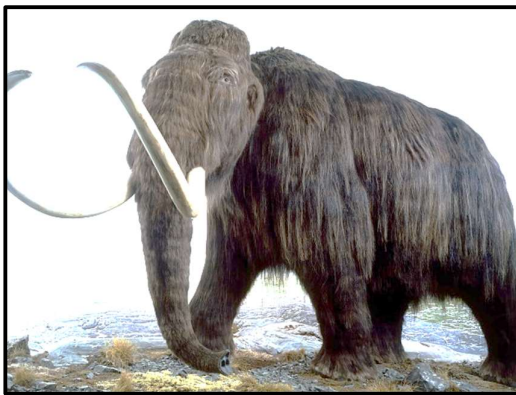
There are Mainly two types of Fossils,

1. Unaltered Fossils
2. Altered Fossils

Unaltered Fossils:-

In this type, the whole bodies of organisms are found well preserved. The preservation is so nice, that there is very little or no alteration at all. The best examples are

- (1) Woolly mammoth About 25,000 years old frozen elephant like wooly mammoths were found buried in ice in Siberia
- (2) Insects trapped in amber The fossilized resin of conifers is called as amber. When an insect gets trapped in resin and when such a resin gets fossilized to form an amber. then the insect, trapped in it gets converted into an unaltered fossil.



Woolly Mammoth



Insect trapped in Amber

Altered Fossils:-

These fossils, in which certain changes or alterations have taken place in the morphological or anatomical aspects of the original organism. Altered fossils are those that have undergone changes during the fossilization process, often involving transformations of the original materials through various geological and chemical processes. There are following types of altered fossils:-

1. Petrified fossils-

- i. These fossils are hard, rock like and hence are called petrified fossils.
- ii. It is the process of removal and then replacement of organic matter by inorganic minerals.
- iii. This replacement takes place molecule by molecule gradually.
- iv. There are about twenty mineral substances known to cause petrification; but the most common are silica, calcite, dolomite, pyrite, limonite etc.
- v. The most common is the silicified wood, such fossils show many external as well as internal details. (refer the Petrified wood fossil at the entry of botanical department of our college.)

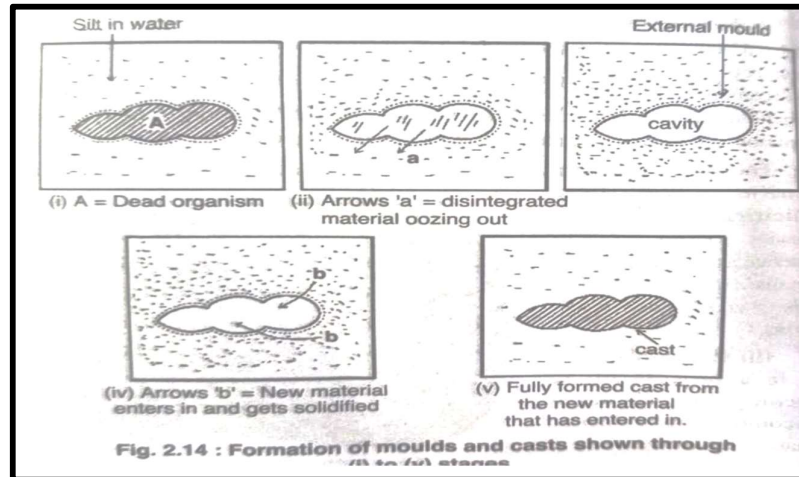
2. Carbonisation-

- i. It is the process of and incomplete chemical decomposition of organic matter, reducing it to a carbon residue.
- ii. Buried stem, leaves etc. undergo dehydration and decomposition. During this process, it loses nitrogen, oxygen and hydrogen.
- iii. Simultaneously, relative abundance of carbon is increased. Hence this process is also called carbonisation.

3. Moulds and Casts-

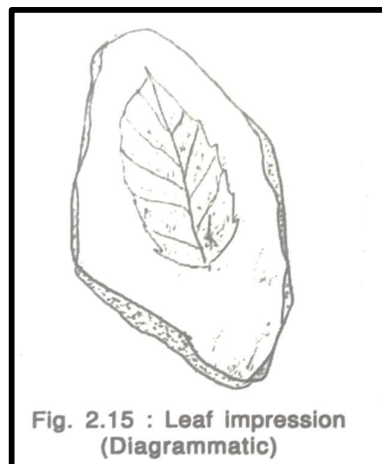
- i. Sometimes, a dead organism gets buried in mud and gradually the mud gets converted into a sedimentary rock.
- ii. Meanwhile, there is disintegration of the internal parts of the organism and this material gets washed away. This leaves behind a cavity or void. But during this the external form gets maintained as shown in the diagram.
- iii. This leads to formation of a mould. Thus, the mould retains true copy of the shape and size of the organism.
- iv. Sometimes, in the mould, water with minerals percolates inside.

- v. Gradually, the interior of the mould gets filled with a mineral. This mineral gets hardened; and this is nothing but the formation of a cast.
- vi. When from a mould, cast is obtained, using a suitable material like plaster of paris, the cast indicates the form and features of the dead organism.



4. Imprints-

- i. Imprints are nothing but the impressions, which are found in sedimentary rocks. Leaf imprints of several plants are found in many parts of the world.
- ii. Sometimes a leaf falls on mud. This leaf leaves the impression of its shape, size, venation etc.
- iii. The leaf then gets completely disintegrated.
- iv. But when such a mud later gets converted into a sedimentary rock, the impression remains forever in the form of an imprint.



5. Trace Fossils-

- i. A geological record of any biological activity is called a trace fossil. These fossils reveal some behavioural aspect or activity.
- ii. Trace fossils are also called as ***ichnofossils***.
- iii. Any particular marking like scratch of a nail on wood, foot prints, cave paintings, tracks, trails, burrows, stone tools, gastroliths, coprolites etc. are called trace fossils.

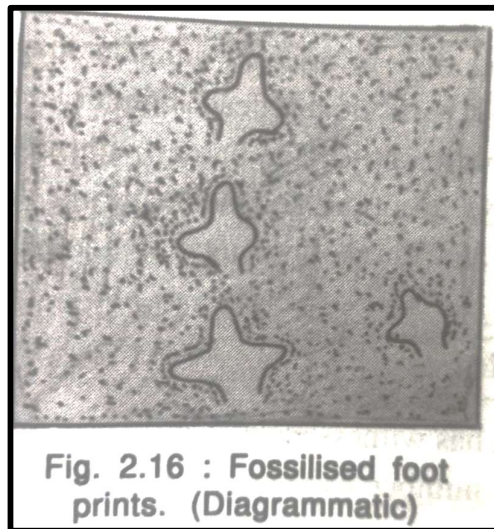


Fig. 2.16 : Fossilised foot prints. (Diagrammatic)

- iv. **Gastroliths** are nothing but the stones, purposely swallowed by certain animals to grind the food.
- v. Gastroliths are also called stomach stones. They are smooth, rounded and appear polished. Crocodiles also get gastroliths to grind the food
- vi. When a faecal matter gets fossilised, it is called a **coprolite**. The size of coprolite can indicate the size of the ancient organism.
- vii. The analysis of coprolite can throw light on the dietary habit of the ancient organism.