

Fossil: Their mode of formation and age determination

Fossils are the remains or impressions of organisms preserved from the geological past. They are virtually anything that is formed by or derived from a prehistoric organisms. This includes bones, wood, shells, teeth, skin, pollen, tracks, burrows and even faeces or dung. The fossil record provides us with evidence that there were organisms that have become extinct. The study of fossils is called Paleontology.

Process of fossil formation - The animals or plants are only preserved and fossilized when they are suddenly buried in the silt of water, lava, ice or sand. After death of living organisms, its body decomposes by the help of microorganisms. The soft parts are decomposed, harder tissues such as shell, bones and wood are more resistant. The harder parts also decompose with time due to the action of enzymes, acids and environmental factors like wind and water but some parts may be preserved with varying amounts of modification, to form fossils.

Thus some of the inorganic substances are preserved completely with any change or mineralized or petrified (converts into stone).

The organic matter of bone gradually disappears, leaving the structure porous. Water seeps into the pores of bones and brings minerals into it like lime or silica.

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But some of organic materials like amino acids remains there for thousand of years.

Conditions of fossilization - Formation of fossils takes place in following conditions -

(1) Presence of hard parts such as teeth, shell, chitin, skeletons, woody tissues must be there in organism.

2) If the organism gets protected by immediate destruction by physical, chemical and biological agents.

(3) When the organisms are immediately buried under the lava of volcano, or oil rich soil, pile of sand or under water in layers of silt piling one above another.

4) After burial the fossils undergo changes like flattening and petrification by the lime or silica.

(5) Fossilization generally occurs in sedimentary rocks like limestone, sandstone and shale etc.

Sedimentary rock are also called metamorphic rocks formed by Petrification of layers of soil.

Determination of Age of Fossils -

Determination of age of fossils in previous time was done by using the known rate of accumulation of silt in the ocean.

Presently rock deposits are dated largely by that certain radioactive elements are transformed into other elements at rates which are

which are slow and essentially unaffected by the pressure and temperature to which rock has subjected. For example geologists use Uranium lead dating (Boltwood 1907) to estimate the time of solidification of rock. Radioactive Uranium decays spontaneously to lead. The half life of Uranium is about 4,500,000,000 years.

Since the uranium of the earth was formed four to five billion years ago when the great pressure of contracting dust cloud created thermonuclear heat.

Radioactive Carbon dating is another method for determination of age of fossil. Carbon¹⁴ is a natural radioactive form produced in the atmosphere from the contact of naturally occurring Carbon¹² with UV light. It passes down as ¹⁴CO₂ and enters plants and then animal material. The ratio of C¹⁴ to C¹² remains constant during life because of the constant interaction of biological organisms with the environment. Upon death and fossilisation, this ratio decreases as the ¹⁴C undergoes decay thus making it possible to determine the age of fossilised organism.

Radioactive Carbon has half life period of about 5687.30 years and can only be measured upto 25,000 years or about 5 half lives as the amount of C¹⁴ is very less in living organism.

Radioactive carbon dating was devised by (Libby 1954) and it is an excellent tool for the archaeologist to know about early civilizations.

The transformation of radioactive potassium⁴⁰ to argon and rubidium to strontium has been used in a similar way for dating fossil-bearing rocks. It is a more accurate method of dating fossils.

Types of fossils → A fossil is a record of an organism that lived in the past whose remains have come into equilibrium with the sediments in which it was buried. Fossils are formed in a variety of ways depending upon the organic material involved and environmental conditions. Fossils are of two main types.

① Unaltered fossils -

The fossils whose body parts remain unaltered or there is no remarkable change in the original form is called unaltered fossils. eg - Mammoth are found with hair in Siberia (a type of elephant).

② Altered fossils - The organism in this case becomes changed due to infiltration of minerals from surrounding rocks during the process of petrification (stone formation). eg - The petrified forests of Arizona. The plants have large amount of deposition of silica.

In India, Birbal Sahni Institute of Paleontology, Lucknow, studies the fossils present in the region.