BSc. Botany (Hons) – 2ND Year

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Fossil Preservation

When a living organism dies, it falls either to the ground or to the sea floor. Here, if it is quickly covered and buried by sediment, it can be preserved in the form of a fossil. If there is no rapid burial or sedimentation, the dead organism can be scavenged or moved away, and no fossil can form. It is generally the hard parts of organisms that are preserved, e.g. their skeletons and shells, as these are stronger and more resistant. Therefore, it can be said that the fossil record is biased to organisms with hard parts. Organisms can also be preserved in environments where there is no air e.g. amber, oil sands/oil spills/ tar pits, ice, bogs, and they are essentially 'mummified'.

Type of Preservation

Permineralization occurs in porous tissue such as bone and wood. In this type of preservation, minerals dissolved in water such as quartz, calcite, or pyrite permeate the pore space and crystallize. The addition of these minerals results in denser and more durable fossils. The original bone or wood material may be preserved, or it may be replaced or recrystallized.

Recrystallization involves a change in the crystal structure but not in mineral chemistry, similar to recrystallization in metamorphic rocks. For example, the mineral aragonite, a common mineral of many shells, sometimes changes to calcite, a more geologically stable form of the same chemical composition, $CaCO_3$ (aka a polymorph). Typically, the overall size and shape of a recrystallized fossil do not vary substantially from the original unaltered specimen, but fine details may be lost.

Replacement is the substitution of original skeletal material by a secondary mineral. For example, the calcite of an oyster shell may be replaced on a molecule-by-molecule basis by silica. Remarkably, the replaced fossil may retain some of the fine cellular detail present in the original even though its composition changed. In this type of fossilization, pore space is not filled, and the fossils are not as dense. The most common replacement minerals are silica (quartz), pyrite, dolomite, and hematite. Replacement by pyrite creates some spectacular fossils, especially those hosted by black shales.

Carbonization is a type of fossil preservation in which the organism is preserved as a residual, thin film of carbon instead of the original organic matter. Leaves, fish, and graptolites are commonly preserved in this way. Compression of the original organism results in thin layers of carbon. Carbonization can also result in the formation of coal.

Molds and casts form when the original skeletal material dissolves. The organism leaves behind an impression in the sediment called a mold. If that impression fills with new sediment, it creates a cast. Thus, casts are made from molds.

Internal molds form when sediment fills the inside of a shell before it dissolves; this occurs inside bivalves, snails, or skulls. Often, people confuse casts and internal molds because both have positive relief. However, internal molds preserve a 3-dimensional mold of the inside of the organism, whereas a cast preserves the structure of the outermost part of the organism.