

The Study of Taphonomy

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Fossils are the remains or traces of ancient life. They provide evidence that evolution occurred, and allow paleontologists to chronicle and study the history of life on earth. Although few organisms become fossils, and a considerable amount of biological information is lost during **fossilization**, fossils are important data sources for addressing a variety of evolutionary and ecological questions. They provide information on much more than **morphology** (that is, the size and shape of the fossil itself). Fossils also document: 1) the geographic distributions of ancient life; 2) changes in global environmental conditions; 3) the ecological habitats that extinct organisms lived in; and 4) patterns of movement and behavior (from tracks and trails).

It is obvious that certain types of information are lost during fossilization: the soft parts of organisms usually decay, and many hard parts may be broken and scattered. Rather than focusing on the loss of information during fossilization, here we focus on the information that can be gleaned from the way in which fossils are preserved. The orientation of fossils in rock, and their level of disarticulation and fragmentation tell us much about the environments in which the fossils were formed, the sedimentary processes that led to fossilization, and how the organisms lived. The types of fossils found in a rock can also be used to determine if the area was terrestrial, marine, or freshwater. A slab of Paleozoic rock filled with clams is used to demonstrate some of the non-morphological data that can be gained from studying fossils.

A Paleozoic fossil deposit filled with thin-shelled marine clams with both shells articulated (still together) provides data about the **depositional environment** that the clams lived in, how rapidly they were buried and preserved, and if the rock was formed in marine or freshwater conditions. Such information is important for understanding these extinct organisms. Let's focus on the information we can extract from these fossils:

- Thin-shelled clams would be broken if they were deposited in a high-energy (turbulent) environment, such as an intertidal habitat. Our clams are not fragmented and therefore were deposited under calm conditions and not transported far from where they originally lived.

- The ligament that holds the two shells of a clam together decays in a few weeks after death, so our Paleozoic clams (with both shells together) were buried while alive or very soon after death.

- The region the clams lived in was once marine, based on the fact that they are closely related to living forms restricted to saline waters.

What non-morphological data can you extract from the following fossil samples? Discuss the habitat, environment, time between death and burial, and amount of transportation after death.

1) You are given a slab of Devonian sedimentary rock from Chicago containing Rugose Corals. Corals require warm, shallow, normal-salinity waters. All the fossil corals are oriented perpendicular to the surface of the slab (upright) and have similar numbers of growth lines on the skeleton.

2) A paleontologist sends you a slab of Pliocene sandstone from Mt. Diablo packed with clams closely related to an extant species that lives buried under at least 15 cm of marine sediments. About 10% of the clams are disarticulated and fragmented. The articulated clams are not oriented in any particular direction in the rock. Barnacles, which live above the sediment on top of hard objects, cover some of the articulated clam shells.