



Fossils of the Northeastern US: *a brief review*

Fossils are found almost exclusively in sediment and sedimentary rocks. Igneous rocks, which form from cooling magma or lava, would not normally be expected to preserve fossil material or be likely to have any. The elevated temperature and pressure necessary to form a metamorphic rock likewise would destroy any fossil material within the rock, unless it is only weakly metamorphosed. Fossils usually are the mineral skeleton of an organism, such as the shell, bones or some kind of impression. Most shells and bones never become fossils, but instead are broken to tiny bits or dissolved. In order to become a fossil, the skeletal material must be buried before it is destroyed. Often, the shells or bones leave fossil impressions or casts of their shape in the sediment in which they are buried. Records of the movement of animals in the rock are also fossils; these are known as *trace fossils*.

Fossils are especially useful in geology because of where they occur. Particular kinds of rocks are formed as a result of processes that are not unique to time or space. A sandstone formed in the Devonian in the Northeast, for example, may look very similar to a sandstone formed in another time period or another region. Fossils, on the other hand, are unique to particular times and places because the organisms preserved as fossils have evolved through time, and live in specific geologic areas and environments. There are, however, important generalities about the distribution of groups of organisms in the Northeast with respect to age and types of rocks in which they are found.

The Northeast preserves an excellent record of:

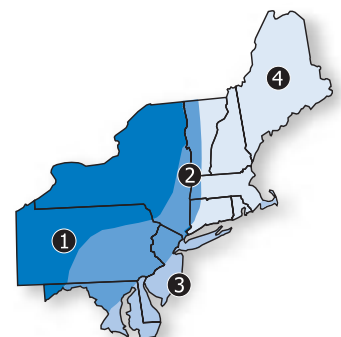
- *the shallow marine realm of the inland ocean that existed in the early and mid-Paleozoic. Brachiopods, trilobites, corals and sea lilies are especially numerous.*
- *Devonian, Mississippian and Pennsylvanian plants that accumulated in swampy coastal wetlands bordering the inland ocean.*
- *organisms that lived in the lakes that existed in parts of the Triassic/Jurassic rift basins and on the land during the same period.*
- *Cretaceous and Tertiary shallow marine organisms, mostly clams and snails, in Coastal Plain sediments.*
- *and late Pleistocene land, freshwater, and marine animals that lived during the most recent ice age.*

see *Rocks*, p.5



The soft parts of an organism, including the skin and internal organs, tend to rot away and are not normally preserved in the fossil record. The exceptions to the rule occur when minerals replace soft parts before they rot away, such as petrified wood, or where the oxygen content is low enough that rotting is slowed down to near zero, such as leaves in swamp sediments or insects preserved in amber.

Trace fossils do not preserve shell or bone material. Rather, they preserve the evidence of the movement of an organism, such as a footprint, burrow, trail or trackway. Trace fossils cannot always be linked to a particular species, but they can often be associated at least with a group of organisms or way of life. The first trace fossils appear a couple hundred million years before the first animal fossils, and burrows through sediment seem to become deeper from the Paleozoic through the Cenozoic.





The *history of life* in the Northeast has been pieced together from fossil records in many different areas. As is evident in the Northeast, a complete record of rocks from every period is not preserved. Not all sediments end up as rocks, and likewise, not all rocks that have formed are still preserved. Many have been weathered and eroded away completely. It is the same with the fossil record. Not all organisms are preserved as fossils and rocks that have contained fossils have not necessarily been preserved (or may be well below the surface, out of sight from *paleontologists*). The majority of the fossil record in the Northeast is comprised of marine invertebrate organisms such as brachiopods, bivalves and gastropods. There are relatively few fossil remains from dinosaurs and other land-dwelling vertebrate organisms. However, this does not mean that dinosaurs and other vertebrates did not live in the Northeast! They probably did but were simply not preserved. The fossil record is only a small window to the past, reflecting the type and diversity of organisms that once lived and the environments they inhabited. The primary opportunity for sedimentary deposition over a large part of the Northeast has been an inland ocean that existed for many millions of years. Thus it should not be surprising that marine organisms dominate the fossil record of much of the Northeast.

Not only is the *history of life* recorded in rocks of the Northeast, life has had a direct influence on the type of rocks formed in the Northeast. For example, limestones are formed from an accumulation of skeletons of sea life, which in turn affect soil composition, agriculture and topography. Pennsylvanian-age forests and swampy, wetland vegetation are responsible for the coal and dark-colored, fine grained rocks formed in the Inland Basin and Appalachian/Piedmont regions.

Paleontology is the study of fossils. The field of paleontology grew quickly in the 19th and early 20th centuries because fossils could be applied to determine the relative age of a rock and something about the environment in which a sedimentary rock was created. This information was (and is) helpful in tracking down energy resources such as petroleum and coal.

Determining the environment

The kind of animals and plants living in a particular place depend on the local environment. The fossil record preserves not only a fossil organism, but also elements of the local environment in which the organism lived. By looking at the geological and biological information recorded in a rock that preserves a fossil, you can often determine the type of environment that a fossil organism lived in:

- **Grain size and composition** of the rock tells you the type of surface the animals and plants lived on (unless they have been transported).
- **Sedimentary structures** such as ripples and cross-beds indicate the organism lived in moving water. Mud cracks and wave ripples are characteristic of shoreline environments.
- **Broken shells or concentrated layers of shells** may indicate pounding waves or storms.
- **Clarity of the water** in the environment can be determined by the type of rock. Fine grained shales are made of tiny clay particles that easily remain suspended in water. Thus a fossil found in a shale might have lived in muddy water. Filter feeding organisms such as corals and sea lilies are not usually found in muddy water because the suspended clays clog their filters!
- **Amount of oxygen in the water** can be determined indirectly from the rock. If there is not enough oxygen in the water, organic material in sediments will not decompose and the rock formed will be dark gray to black in color.

