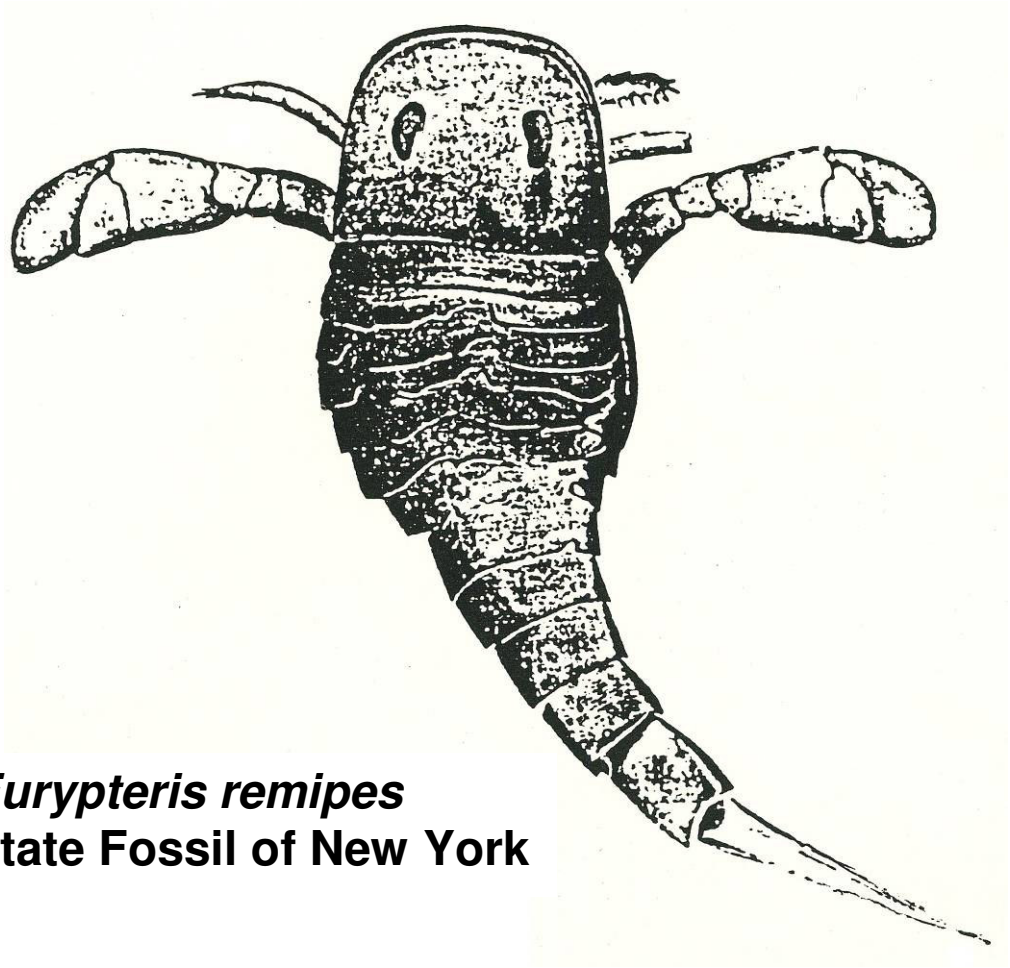
GENERAL GUIDE TO FOSSIL IDENTIFICATION AND PALEOECOLOGY



Eurypteris remipes
State Fossil of New York

Compiled by J. R. Ebert
Illustrations from Linsley (1994) and other sources

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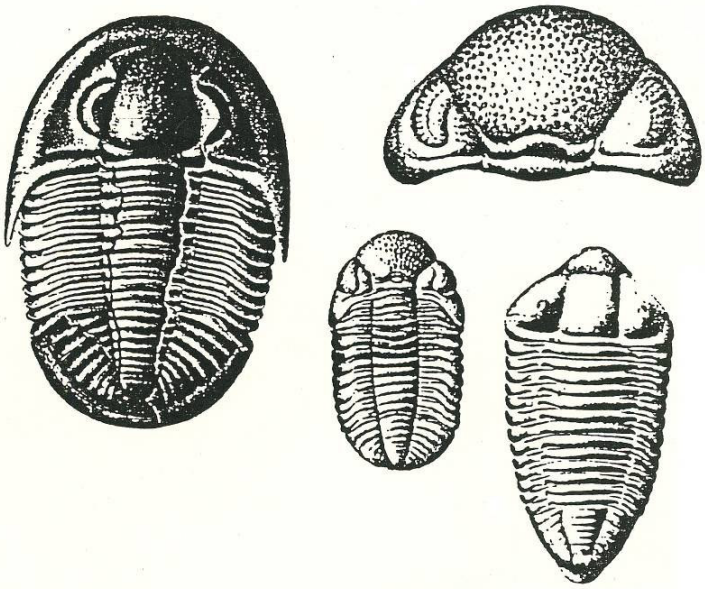
These shells are the greatest and most lasting monuments of antiquity, which in all possibility, will far antedate all the most ancient monuments of the world, even the pyramids, obelisks, mummys, heiroglyphics, and coins --- nor will there be wanting media or criteria of chronology which may give us some account even of the time when they formed.

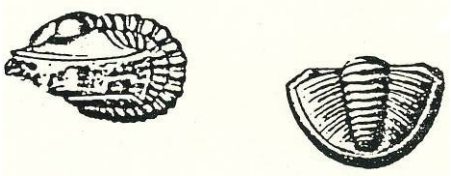
(Robert Hooke 1703)

PHYLUM ARTHROPODA

Arthropods are animals with jointed appendages. The familiar insects, arachnids, lobsters, crabs, etc. are arthropods. The most common fossil arthropods are trilobites. Although the appendages are rarely preserved, the jointed arthropod carapace or exoskeleton is distinctive. Trilobites are divisible into three longitudinal lobes, hence their name. A distinct head, segmented thorax and tail are also diagnostic.

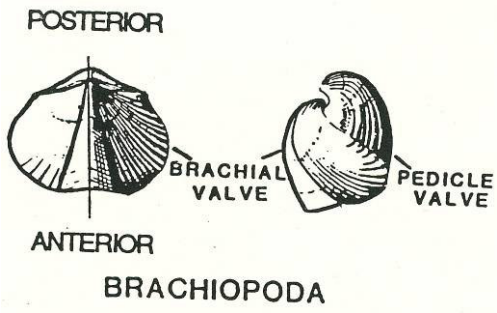
Other common fossil arthropods are the ostracods (aquatic flea-like creatures with a two-valve shell) and the eurypterids (sea scorpions). Ostracods are very small, seldom exceeding 3 to 6 millimeters in size. Eurypterids vary in size and are often fragmented. *Eurypteris remipes*, a Silurian eurypterid, is the state fossil of New York (see illustration on cover).

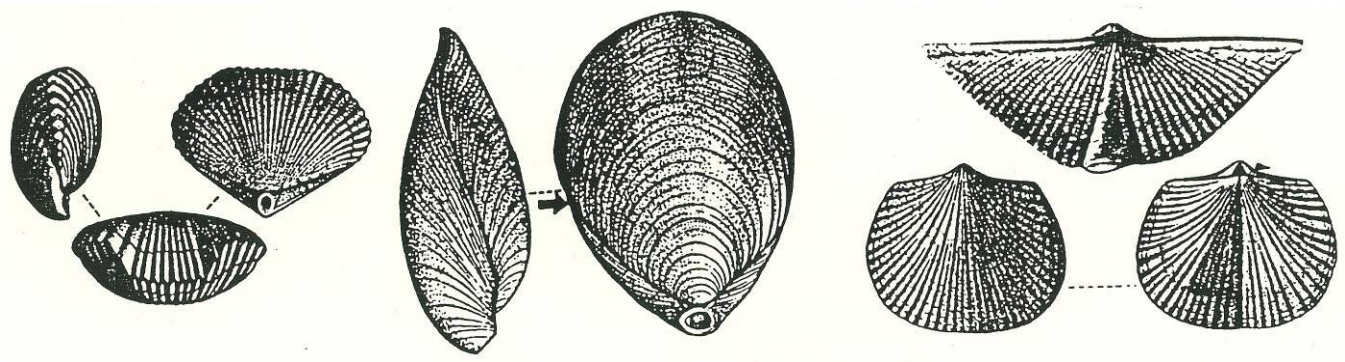




PHYLUM BRACHIOPODA

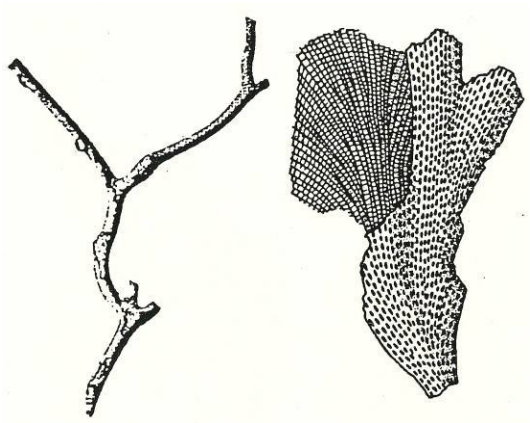
Brachiopods are among the most common of invertebrate fossils. They are characterized by two different valves which may be smooth or strongly ribbed. Each individual valve is symmetrical about a central plane. In other words, the plane of symmetry cuts the plane of juncture between valves.

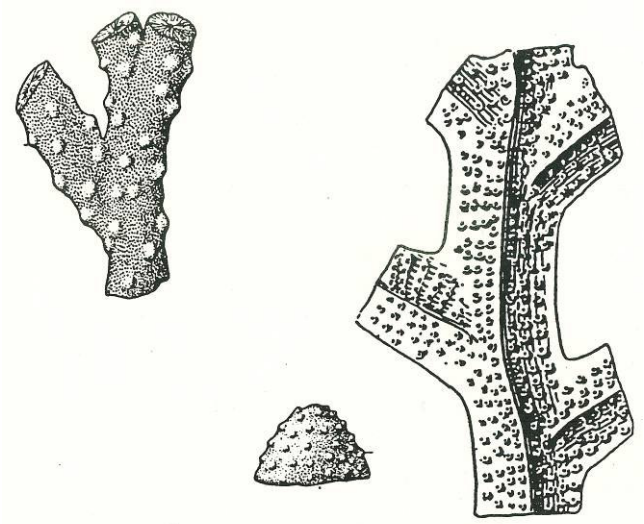




PHYLUM BRYOZOA

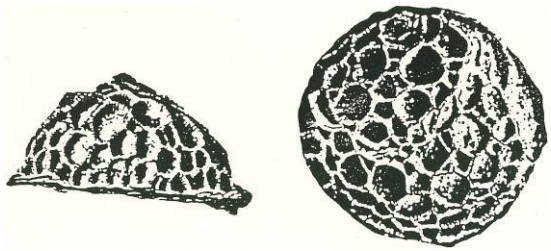
The bryozoans are also common fossils. They are colonial organisms whose colonies exhibit a wide variety of shapes and sizes. Common forms are branching, encrusting, fan-shaped and globular. Regardless of colony form, the most distinguishing feature of bryozoans is the many small living chambers of the individual bryozoa. These chambers range in size from a few tenths of a millimeter to a few millimeters.

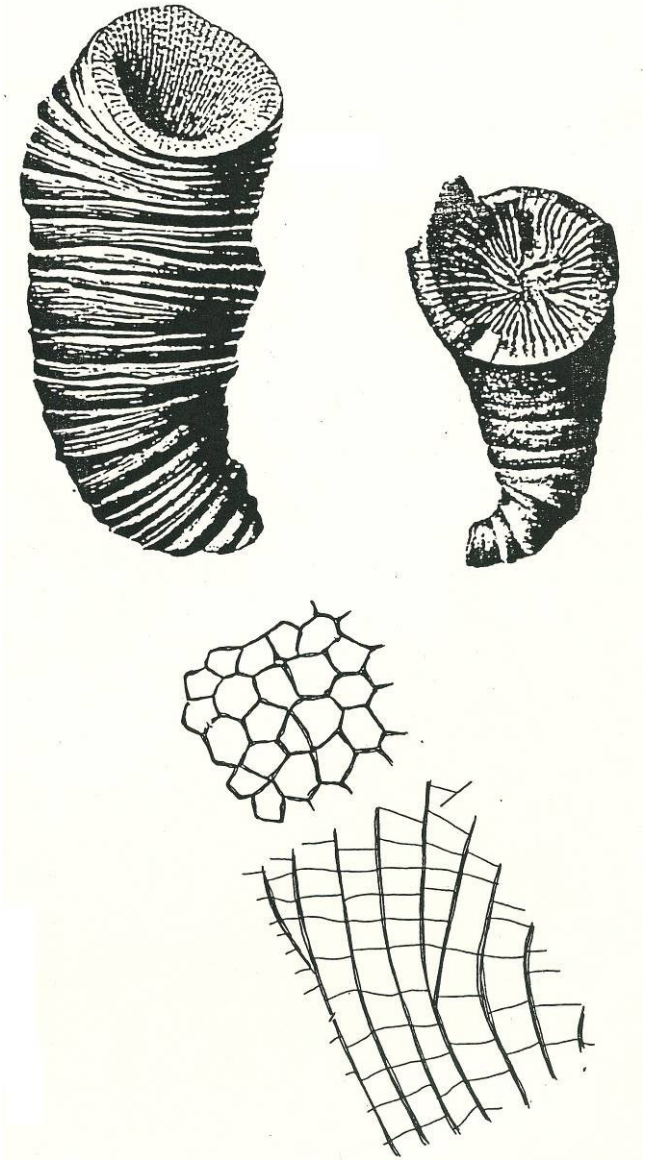




PHYLUM CNIDARIA

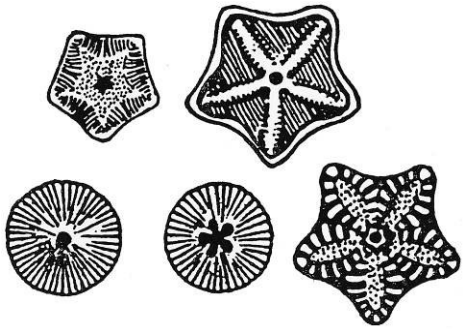
Cnidarians are characterized by stinging cells that are used to subdue microscopic prey. The most familiar modern cnidarians are jellyfish and corals. Fossil cnidarians are represented by **rugose corals** and **tabulate corals**. Rugose corals have corrugations or rugosities in portions of their skeletons. Rugosans are most common as single horn or tube shaped forms that may be up to several centimeters in diameter. Less commonly, they may be colonial. Tabulate corals are exclusively colonial. Colonies are commonly globose or massive, although encrusting or branching forms also occur. Tabulates are characterized by horizontal tabulae or partitions within the colony. Individual chambers are typically hexagonal or some other polygonal shape in horizontal section. This tends to give tabulates a "honeycomb" appearance. Both rugose and tabulate corals are extinct. Modern corals belong to a group known as scleractinians.

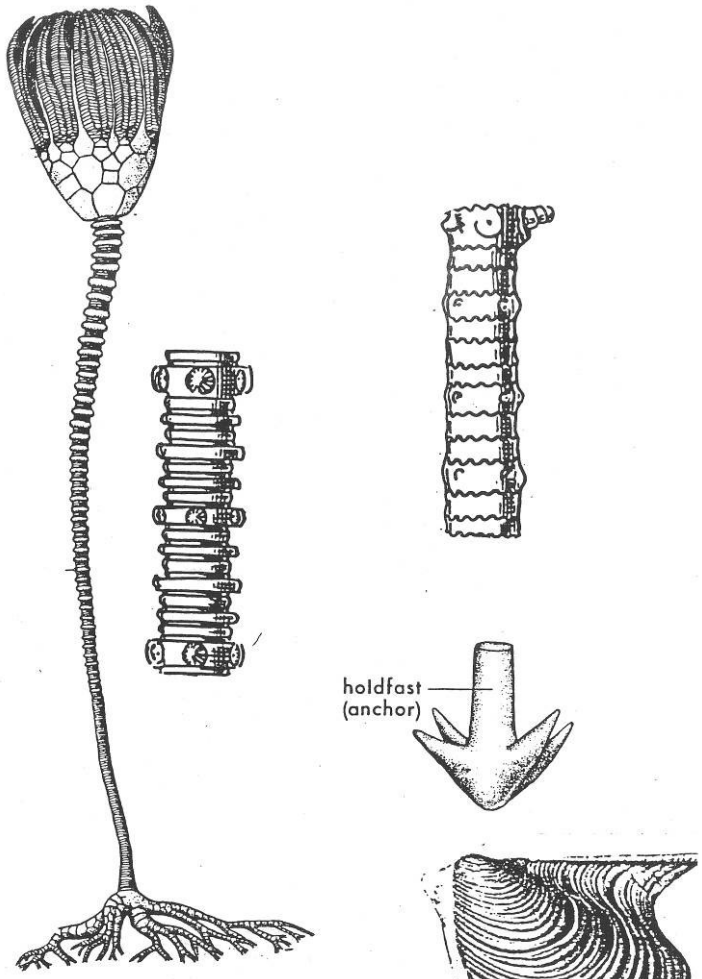




PHYLUM ECHINODERMATA

Echinoderm means "spiny skin". These organisms are characterized by spines such as those exhibited by the familiar star fish and sea urchins. The most common fossil echinoderms are the stalked "pelmatozoans", which include the **crinoids** and the extinct **cystoids** and **blastoids**. The stalk or stem of these echinoderms is made up of a series of disks that resemble a stack of poker chips, complete with serrations on the surfaces. Upon death, the stems commonly disarticulate into individual disks or "columnals" (i.e., individual poker chips). Another distinctive feature of echinoderms is that they precipitate their plates as single crystals of calcite. Therefore, broken pieces typically display cleavage, just as any crystal of calcite would. Light reflecting off these cleavage planes often gives echinoderm-rich rocks a sparkly appearance.





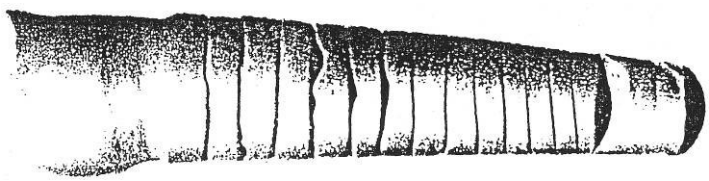
PHYLUM MOLLUSCA

Mollusks are among the most familiar of modern shelled organisms. Clams, mussels, scallops and snails are all mollusks. Fossil mollusks are represented by three classes: **PELECYPODA (BIVALVIA), GASTROPODA** and **CEPHALOPODA**.

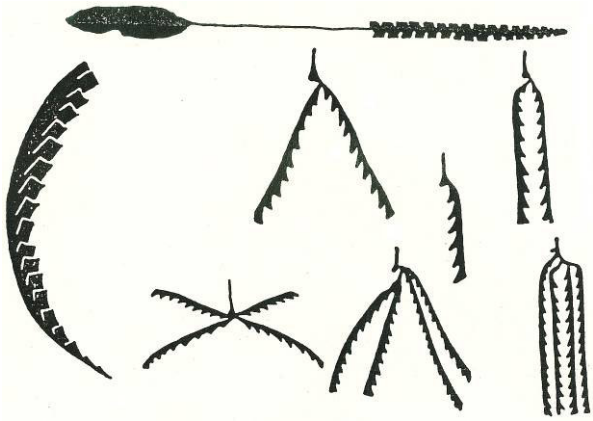
PELECYPODS are clams, etc.. They are characterized by two valves that are mirror images of each other. In other words, the plane of symmetry passed between the valves.

GASTROPODS are snails. Conical, coiled shells are typical.

CEPHALOPODS are represented by modern squids and octopi. Fossil cephalopods had straight or coiled (planispiral) shells.

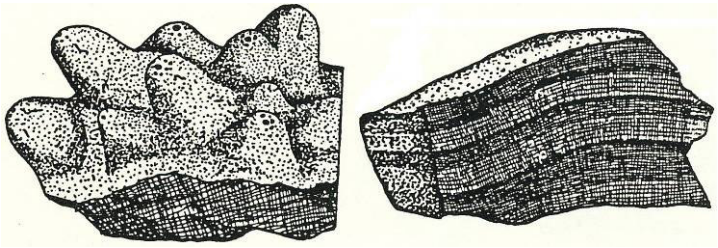


PHYLUM HEMICHORDATA
CLASS GRAPTOLITHINA



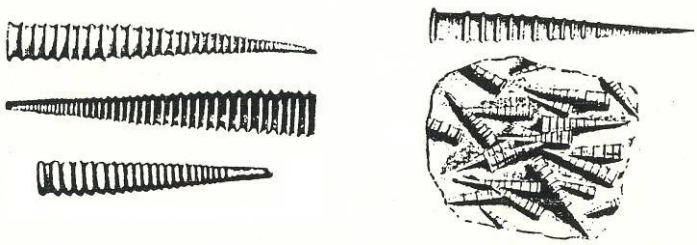
Fossil hemichordates are represented by the **graptolites**. Graptolites are most commonly preserved as carbonized films since they had no shell, although there was a leathery sort of "skin" on the animal. Most graptolites are flat, elongate blades with serrated edges. Each graptolite fossil is actually a small colony with individuals living in chambers that are now visible as serrations.

PHYLUM PORIFERA
CLASS STROMATOPOROIDEA

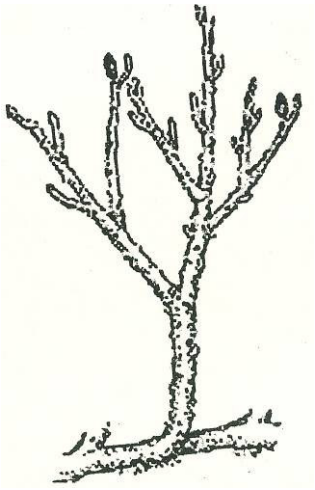


The **stromatoporoids** are a specialized group (sclerosponges) within the phylum Porifera (sponges). They are unique in that they possess a highly rigid skeleton made up of calcium carbonate. Most sponges have loose networks of spicules that are siliceous (SiO_2). Stromatoporoid colonies may look much like corals or bryozoans. However, their chambers tend to be smaller than corals and more box-like than bryozoans. Colonies are commonly globose or massive, although they may be branching or encrusting.

PHYLUM INCERTAE SEDIS
CLASS TENTACULOIDEA



The **tentaculitids** are small, conical shells with uncertain taxonomic affiliations (hence the phylum name). They are common fossils in Paleozoic marine strata. Like the similar, but smaller dacryoconarids and styliolinids, they may have potential as index fossils.



KINGDOM PLANTAE

Plants are almost exclusively preserved as carbonized films. Pyrite is often associated with plant fossils because it forms under the same reducing conditions that are necessary for the formation and preservation of carbonized films. Wood, leaves and spores are common fossils.

PALEOECOLOGY

Fossils seldom occur in the rock as isolated individuals, rather they tend to be found in groups or **assemblages**. These associations can provide very detailed information on the environmental conditions that existed at the time of deposition, in addition to being useful in establishing age relationships and correlations.

The study of the ecology of fossil organisms is known as **paleoecology**. Studying paleoecology is considerably more complex than studying modern ecology because it is not possible to observe the organisms in action. Instead, we must rely on inferences for our interpretations. Paleoecological information comes in several forms. Interpretations may be drawn on the lifestyles of organisms by observing their **functional morphology** and by making ***comparisons to living organisms***. If we can make interpretations as to how organisms lived (sessile or immobile, motile or capable of moving), how they fed (primary producers make their own food (e.g. plants), herbivore, carnivore, filter feeder, predator, scavenger, sediment feeder, etc.) then we may be able to add great detail to our interpretations of the environmental conditions that prevailed when the fossils were not fossils, but living organisms. Inferences may also be drawn based upon the types of other fossils that occur with a particular fossil. This technique is know as **paleosynecology** and is very useful when the fossil being considered has no living counterparts.

Post-mortem effects on fossils also provide useful information on environmental conditions. These studies are included under the heading of **taphonomy** or taphonomic studies. Such post-mortem effects as disarticulation, abrasion, sorting, alignment, boring and encrustation may provide extremely detailed insight into environmental conditions. The process of fossilization itself falls under the heading of taphonomy. One taphonomic distinction that will be important to keep in mind is the difference between a **life assemblage** and **death assemblage**. Life assemblages have intact (articulated) fossils in life positions (i.e., they were literally buried alive.). Death assemblages are made up of disarticulated, and possibly broken or rounded, fossils that may appear all jumbled together. Note that some assemblages may contain aspects of both life and death assemblages; these may be termed **mixed assemblages**. Finally, the **substrate** on which the fossils occur must not be over looked. The sedimentary rock that encases the fossils is the material upon which the organism lived and engaged in its daily activities. This can provide clues as to turbulence, oxygenation and mobility of substrate.