ES 089 Paleontology

Paleontology tells us much about past life.

A disciplined study of evidence can not only tell us about the visible species that existed in Earth's history, it can also tell of how they behaved, and the kind of environment in which they lived.

Fossils are preserved in quite few different ways.

Actual remains, whether they are frozen or dehydrated or have survived chemical and thermal effects can be recognized because s very little will have changed. This can include retention of colour, and pearly luster (the latter especial in the case of mollusks.

Replacement occurs when solutions bearing dissolved minerals react with the fossil and a foreign mineral will substitute for the original. Pyrite and quartz are common replacements for calcite and aragonite.

Recrystallization occurs when the original material grows into larger crystal grains. There is no change in the chemistry of the fossil. This may be conversion of aragonite to calcite for example, or conversion of silica gel (as found in some kinds of plankton) to quartz in the form of chert.

Permineralization involves the deposition of mineral grains in pore spaces such as marrow cavities and the interiors of cells in wood.

Moulds are formed when sediment envelopes and in-fills remains. When part disappears due to dissolution, a void space is left, but the external and internal moulds remain. At such time as material fills the void space, a **cast** of the original fossil is formed.

Traces of activity are sometimes the only evidence that can be found of an animal. This is especially true if the animal is soft-bodied and prone to scavengers and predators. It has been possible to deduce something of the way dinosaurs walked by looking at their track-ways.

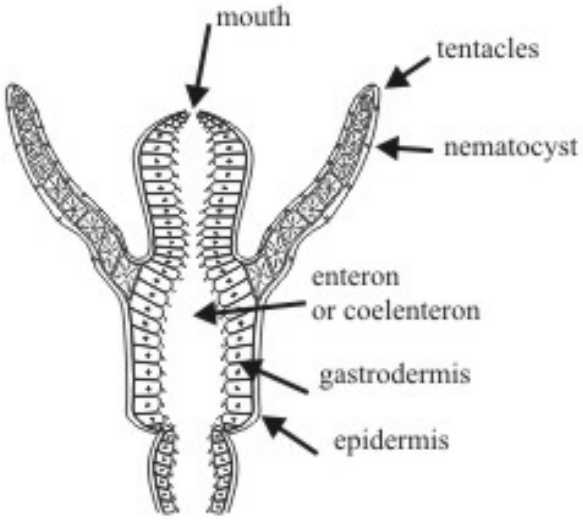
Human beings have utilized fossils for a variety of purposes, from amulets, to evidence in support for legends. Fossils have even found their way into the medicine of some cultures.

The following pages are an attempt to provide you with a simplified "who is who" and "what is what". Be sure to use these to help you complete the exercises.

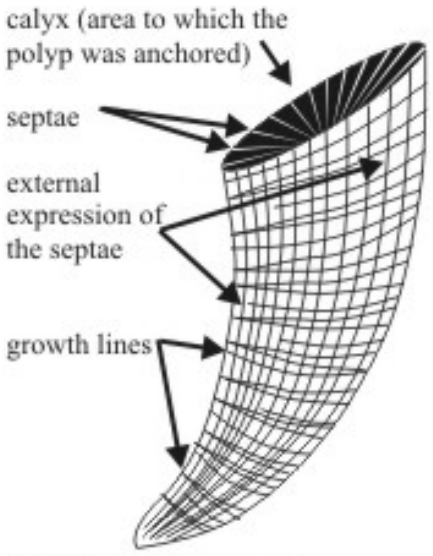
COELENTERATA

These animals consist of cells that have specific purposes: epidermal tissue (skin), gastrodermal tissue (like a stomache), and nematocysts (stinging cells).

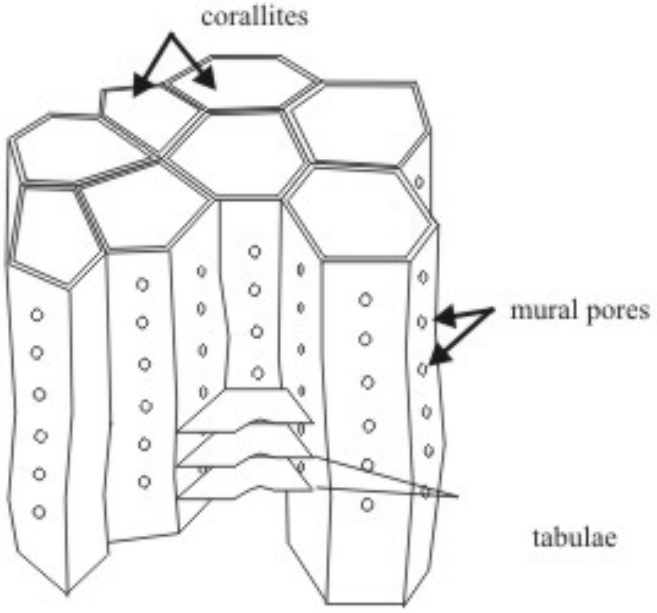
See the figures below for the genral morphology of coelenterates and the corals (Class Anthozoa). Like sponges, coral polyps lived a benthic sessile life style.



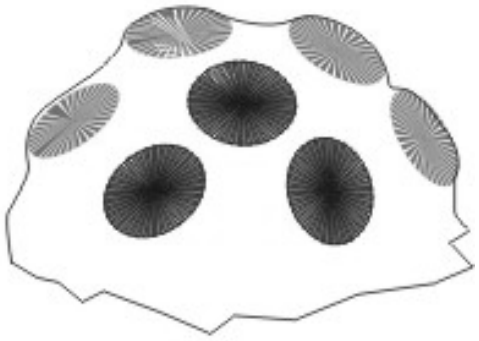
A polyp



remains of a solitary coral



a colonial tabulate coral



a scleractinian coral

Figure p.01. Phylum Coelenterata. Class Anthozoa - the corals. Cross section of a polyp, morphology of solitary rugose and colonial tabulate and scleractinian corals.

BRACHIOPODA

Brachiopods are filter feeders like bryozoans and pelecypods. That is, they took water into their shells and sent it back out minus the edible stuff. They are identified on the basis of bilateral symmetry of the shells. In other words, each side of a shell is the mirror image of the other side. Many are found with the brachial valve and pedicle valve still attached. The figures below shows the symmetry and anatomy of brachiopods. Most were attached to the sea floor by means of a pedicle. Some actually burrowed into the sediment and were somewhat vagrant.

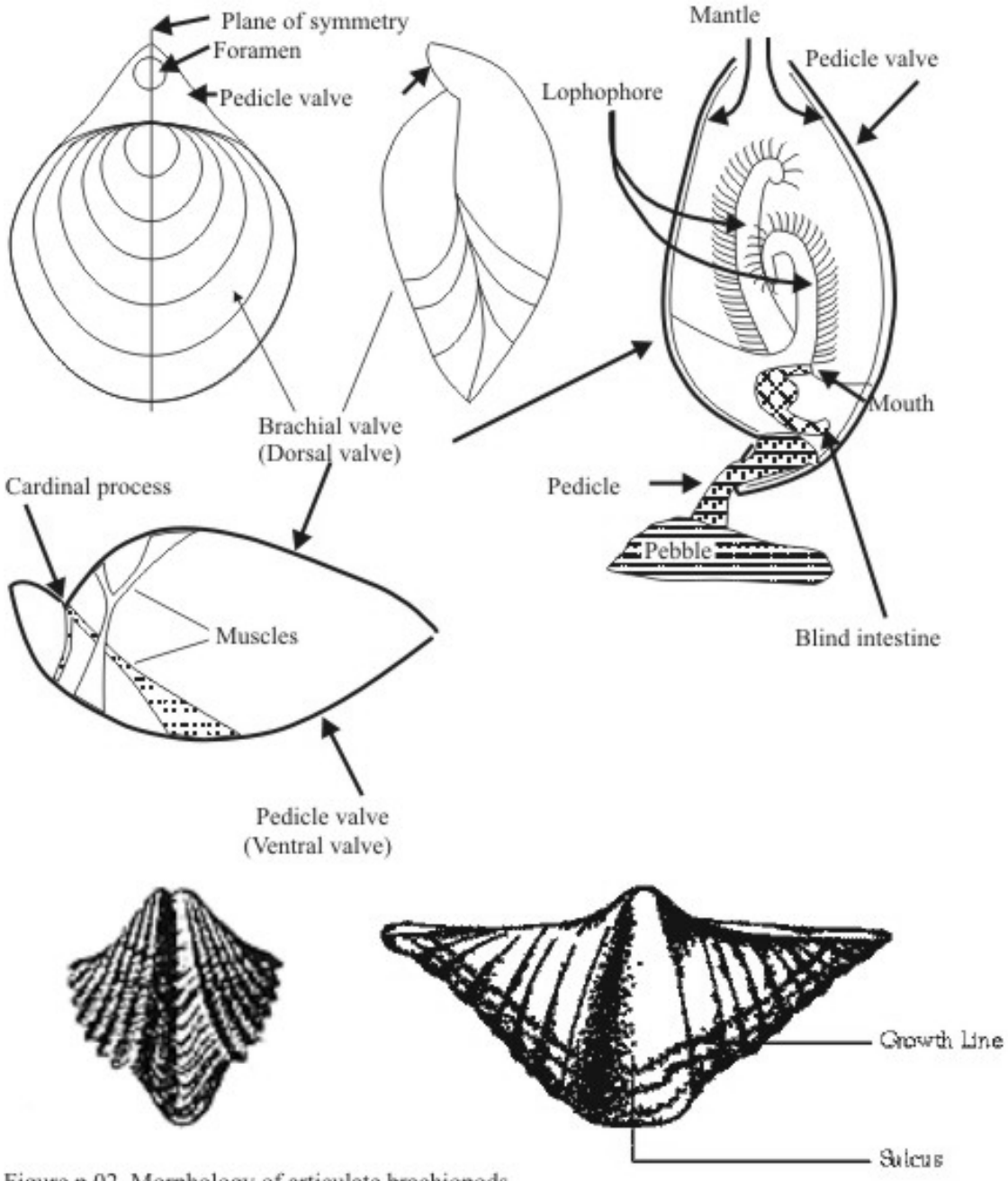


Figure p.02. Morphology of articulate brachiopods

MOLLUSCA

CLASS - PELECYPODA

These are the clams. They are filter feeders with pairs of shells that are most commonly mirror images of each other. The figure below shows the anatomy. Notice that there is only one set of muscles and these are used to close the shell.. In the relaxed state the two shells tend to gape as a result of the tension provided by the ligament. In the relaxed state, water is allowed to flow into the shell, or allow the foot to extend so that the clam can move. Most pelecypopds are move about the sea floor.

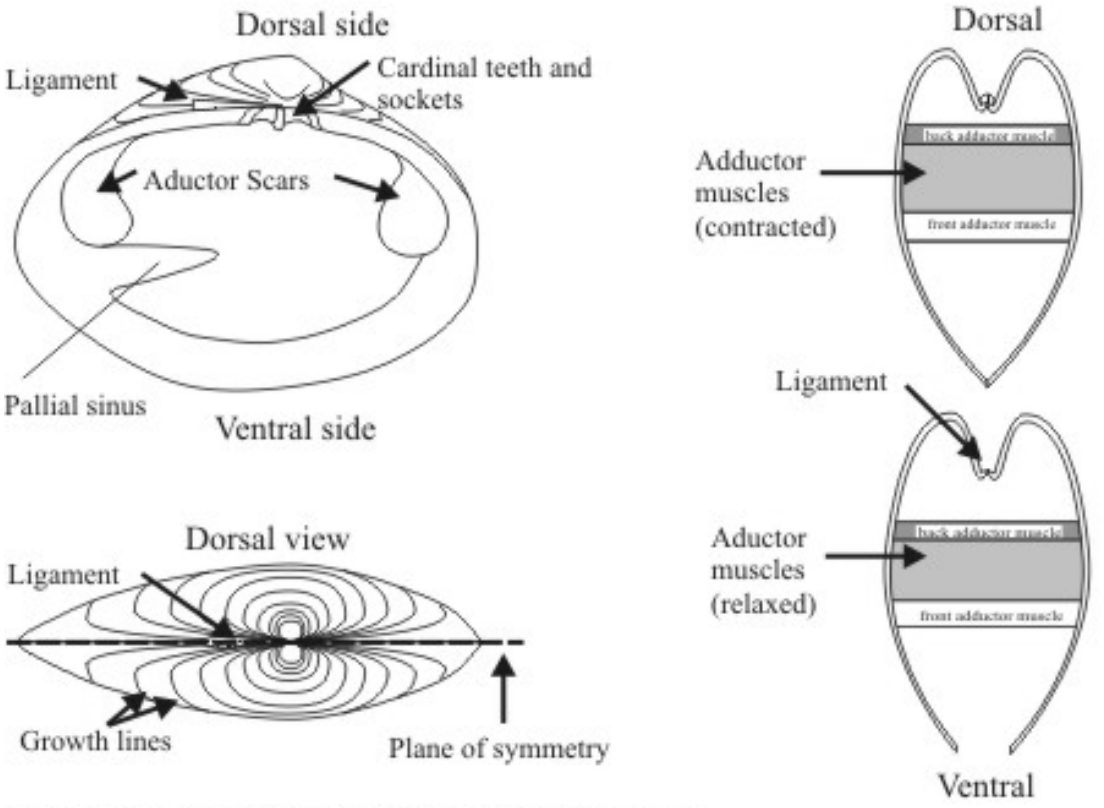


Figure p.03. Morphology of Pelecypods (bivalves).

MOLLUSCA

CLASS - GASTROPODA

These are commonly known as snails, but include limpets and slugs. The figure below shows some of the variety of gastropod shapes. Gastropods run the gamut of carnivores, scavengers and herbivores. They roam the sea floor and land in search of food.

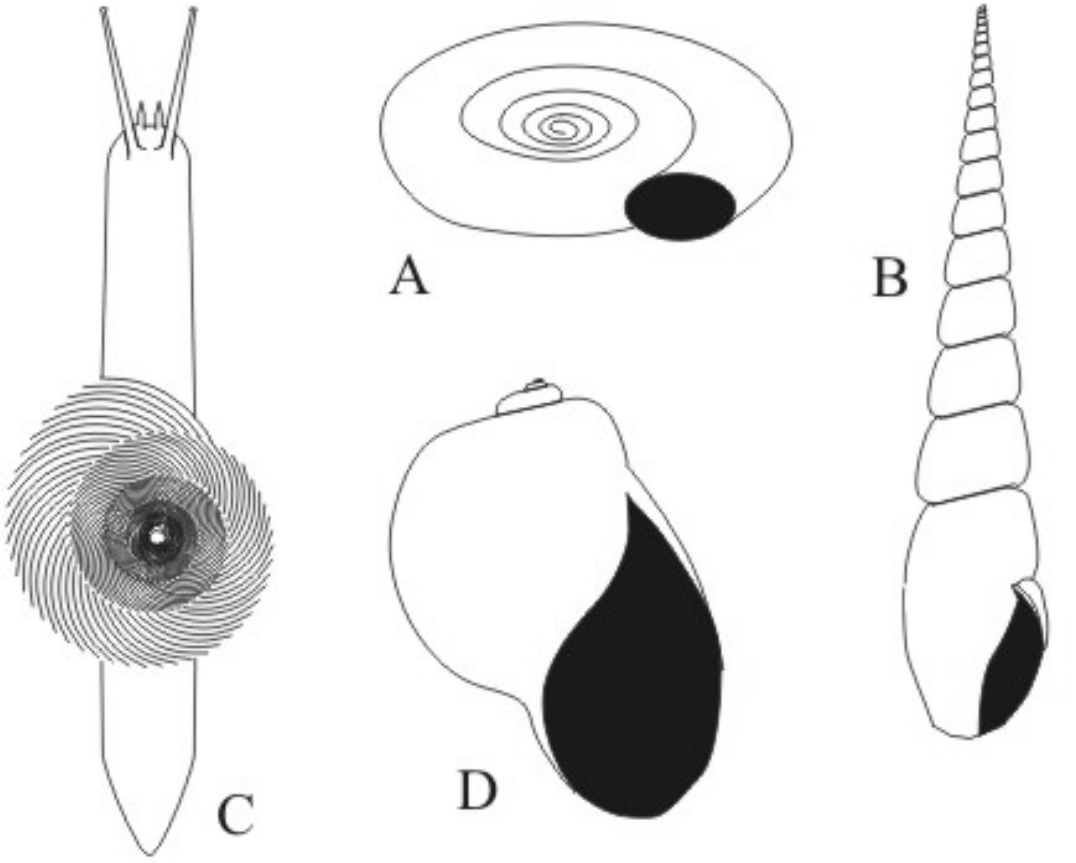


Figure p.04. Examples of gastropods - morphology and spire variation.
A - flattened spire B - greatly produced (highy tapered) spire C - gastropod extended from shell. The eyes are at the ends of the stalks. Note the growth lines associated with daily growth. Monthly and yearly variation can be manifest through ornamentation in many gastropods.
D - globose spire.

MOLLUSCA
CLASS - CEPHALOPODA

These are octopi, cuttlefishes and nautilus in modern terms. Nautiloid morphology is shown below. An extinct group, the Ammonoids, had elaborate setae and sutures (the junction of the outer shell and septal wall). Examples of these suture patterns are shownon the nest page..

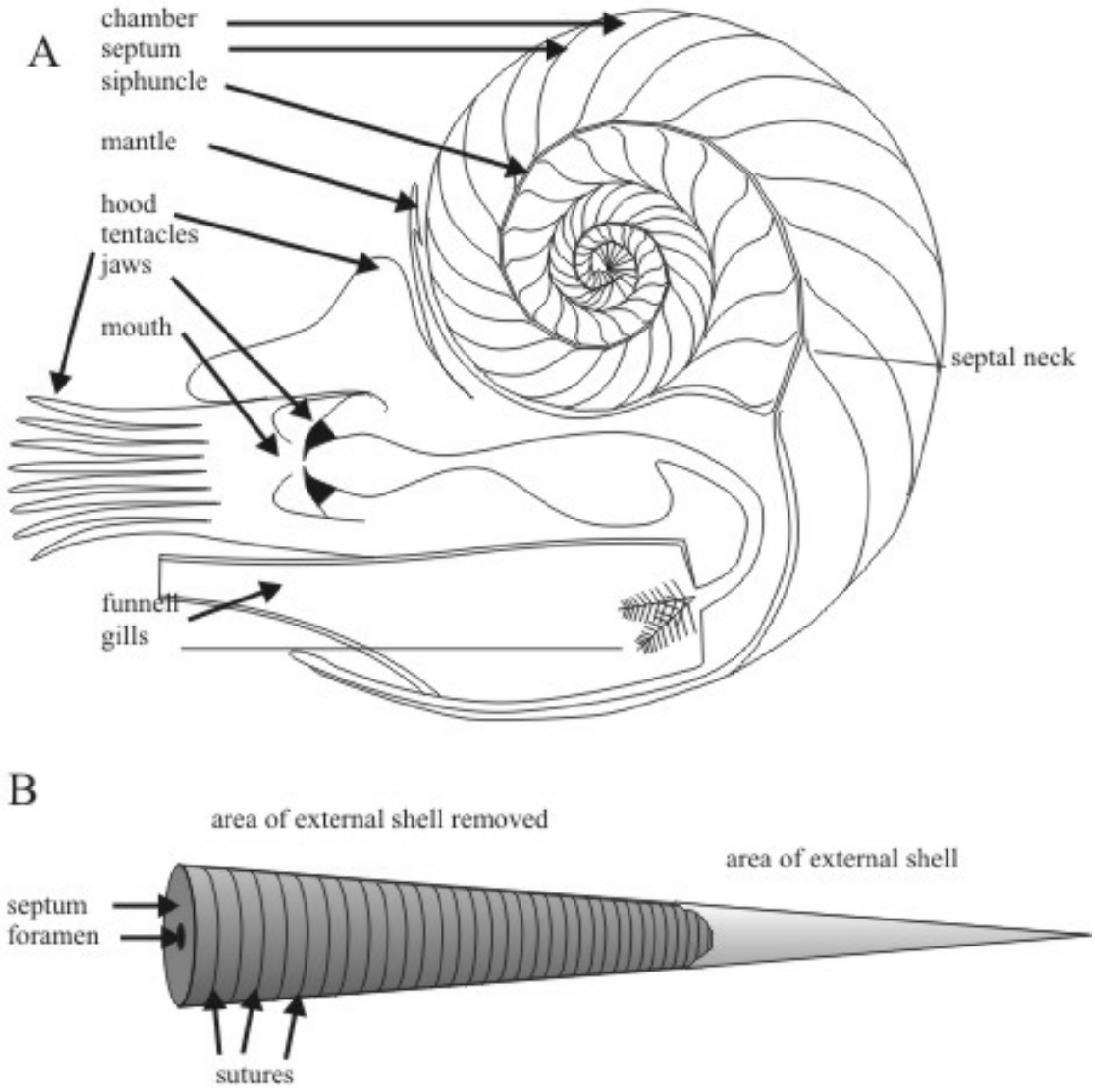


Figure p.05. Morphology of Nautiloids. A - Coiled nautiloid containing a cross-section of the animal. B - an orthocone (straight-shelled) nautiloid showing the septum, foramen and sutures. (Note the foramen is the hole through which the siphuncle passes.

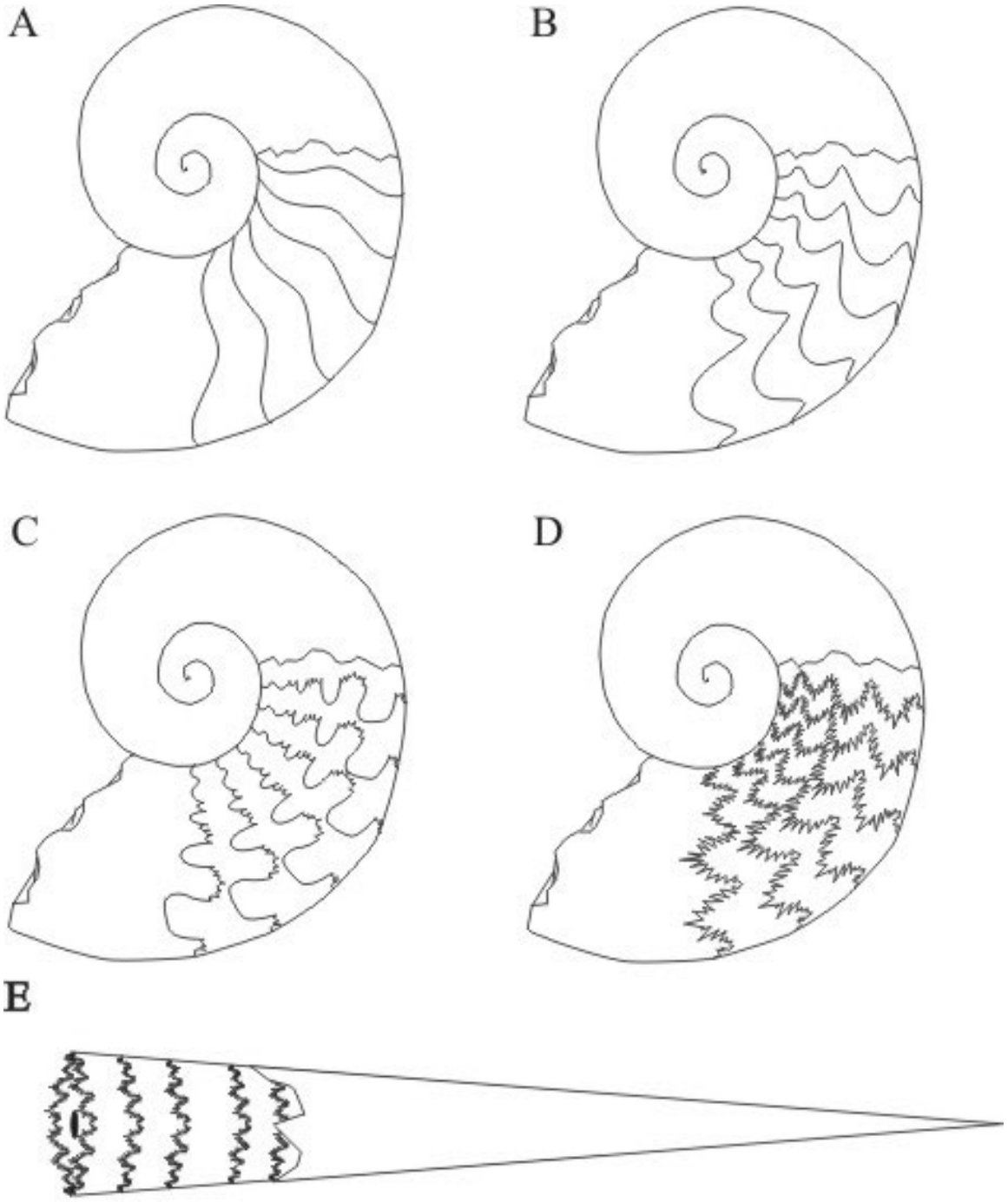


Figure p.05b. Sutures of Cephalopods. A - typical nautiloid suture. B - goniatitic suture. C - ceratitic suture. D - ammonitic suture. E - an orthocone ammonoid.

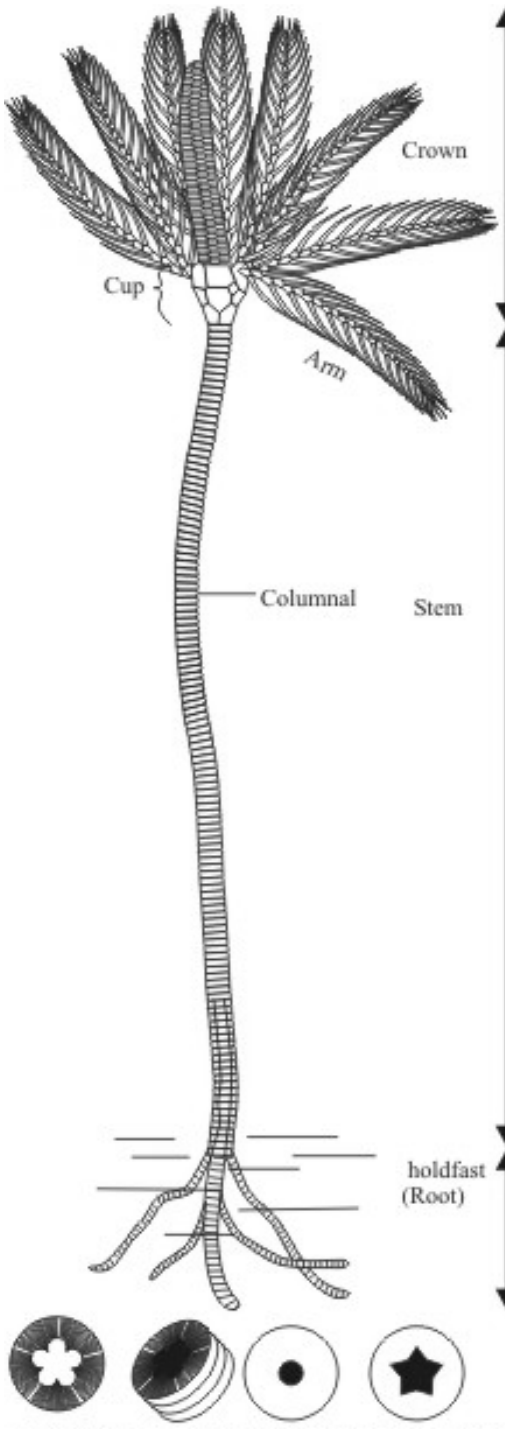


Figure p.06. Morphology and life attitude of a crinoid

ECHINODERMATA

Echinoderms posses pentameral symmetry. The phylum includes sea urchins and starfish which exemplify this radial symmetry.

CLASS - CRINOIDEA

The head part, or CROWN, of the crinoid is situated atop a stem consisting of calcareous disks called COLUMNALS. The animal is attached to the sea floor by a HOLDFAST.

The Crown is the site of attachment of arms which gather food from suspension and carry it to the mouth in the middle.

This figure p.06 shows the general morphology of crinoids as well as some detail of different columnal types.

CLASS - ECHINOIDEA

These are sea urchins and sand dollars. Some show perfect radial symmetry, while others show bilateral symmetry that distorts the pentameral aspect normally expected in the echinoderms.

Figure p.06b is a sand dollar urchin.

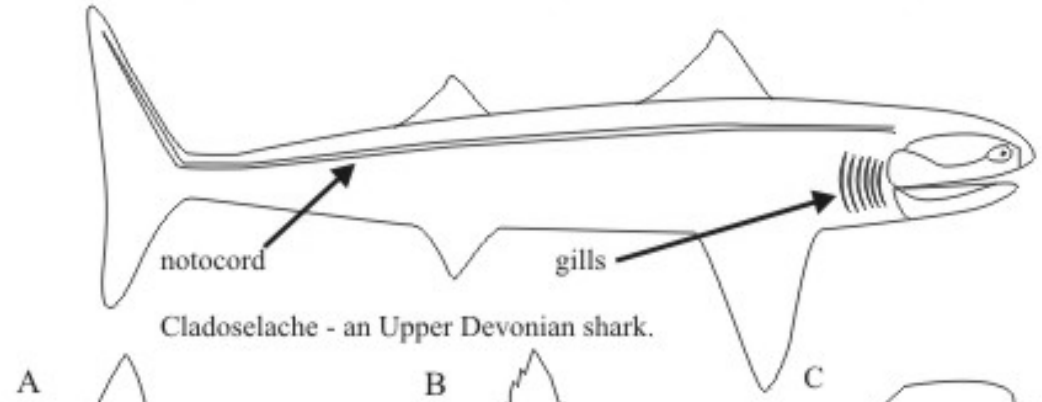
Figure p.06b A sand dollar urchin exhibiting bilateral symmetry that distorts what is pentameral in other echinoids.

CHORDATA

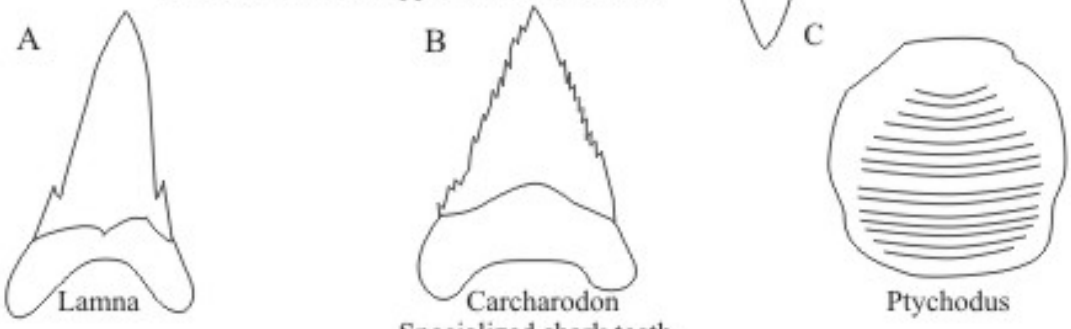
These are animals with a spine of cartilage, or bone and cartilage. They include fishes, amphibians, reptiles, birds and mammals. In this exercise, both fish and dinosaur remains will be seen.

Fishes and Sharks

Many fossil fishes have bones preserved. However, some such as sharks which have few bones are mainly represented by their teeth. In the early Paleozoic, armoured fishes are known from the amoured plates left behind. Below is a depiction of a shark, a fish and specialized teeth.

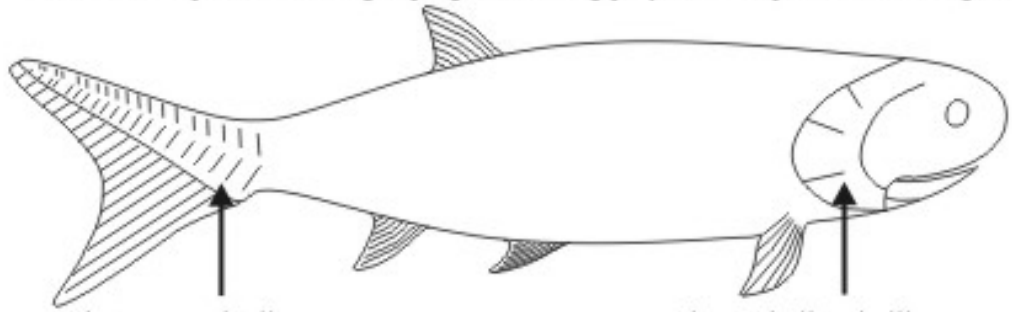


Cladoselache - an Upper Devonian shark.



Specialized shark teeth

A and B are specialized for grasping and cutting prey. C is adapted for crushing shells.



Palaeoniscus - a Permian ray-finned fish.

Figure p.07. Sharks and fishes. Sharks have a cartilaginous spine or notocord whereas true fishes and most other vetebrates have a spine consisting of alternating bone and cartilage disks.

DINOSAURS

Dinosaurs are the most glamourous of the vertebrates.Their habits are known from trackways as well as skeletons. In your assignment, you will see permineralized bone and a coprolite.

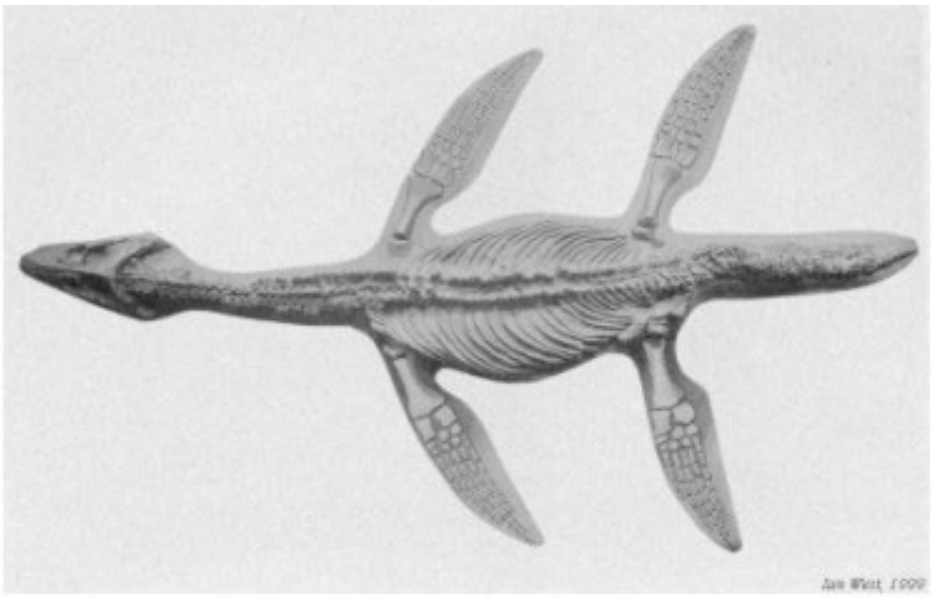


Fig p. 07c Remains of a pliosaur - a marine reptile of the Mesozoic Era.

Fig p. 07d Remains of a bird - probably *Archeopteryx* (which was only recognized as a bird due to the presence of feathers).

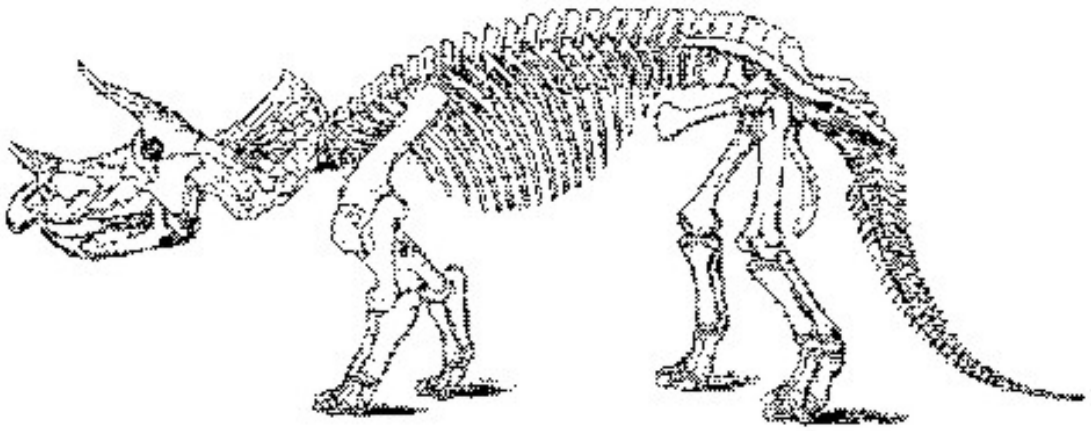


Figure p.08. Triceratops is an example of a land dwelling vertebrate of the Mesozoic era. This posture has been established by studying tracks left by these animals.

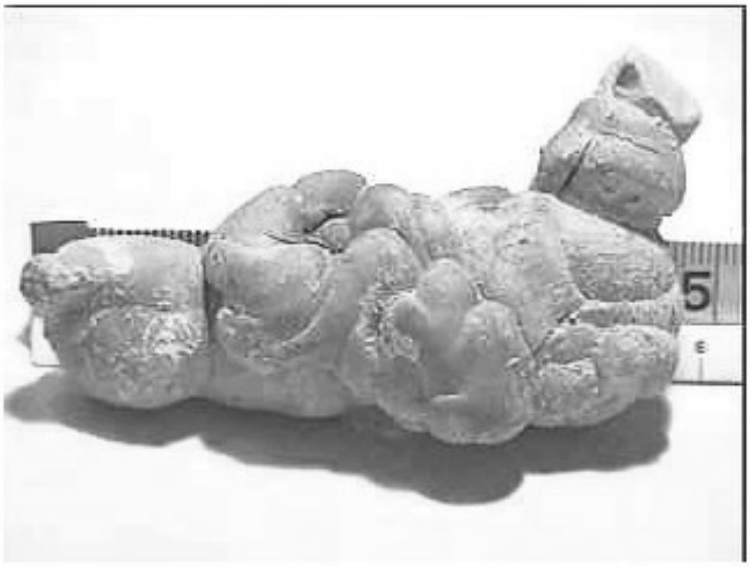


Fig. P.08b. A coprolite. Most recognised coprolites are associated with vertebrates: fish, amphibians, reptiles, birds and mammals.

ARTHROPODA
CLASS - TRILOBITA

These are an extinct group of arthropods which are segmented and lived in a variety of life styles: some burrowed into the sea bed, others were free swimming and others were roamed the sea floor. They are bilaterally symmetrical, having one axial lobe and two pleural lobes. They can also be divided length-wise into three sections: a head or CEPHALON, a segmented THORAX, and a tail or PYGIDIUM. Figure 86 illustrates this general anatomy.

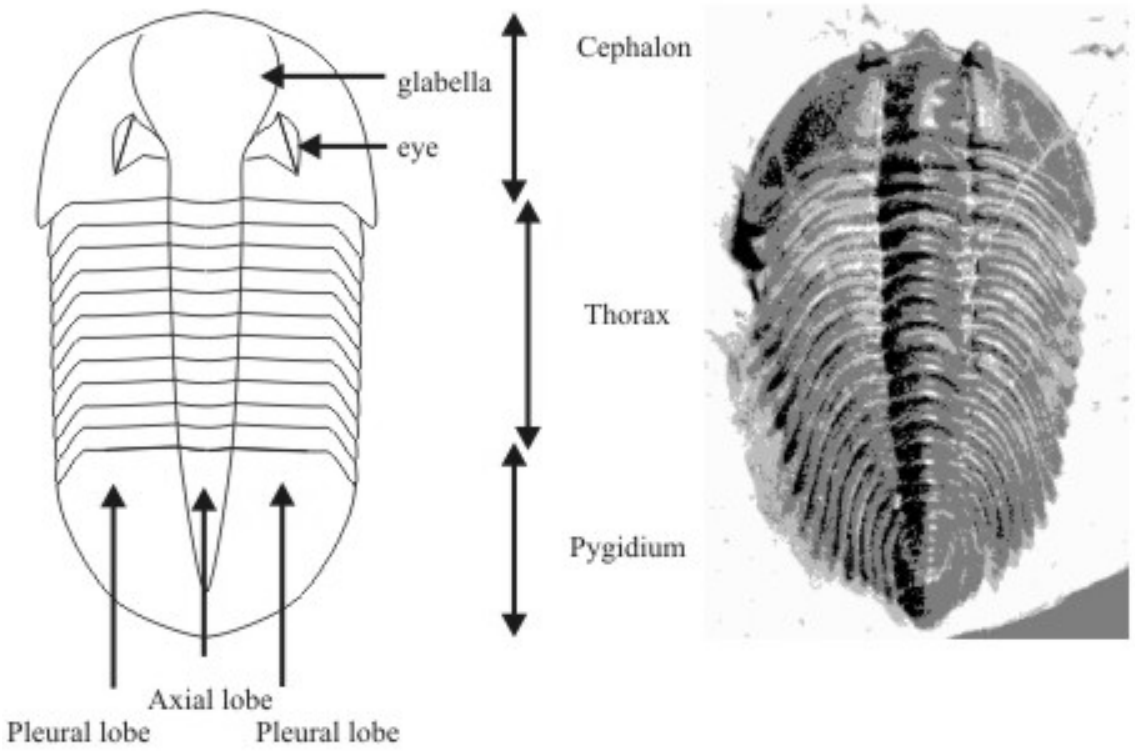


Figure p.09. General Morphology of Trilobites and an example: ***Pseudocybele nasuta***

CLASS - CRUSTACEA

These are crab, lobsters, and shrimp and have a wide variety of life styles, from free swimming to burrowing.

Fig p.09b A fossilized shrimp.

ES089 Paleontology Exercises **NAME** _____

STUDENT #_____

1) The Pahvant Ute tribe of Western North America, used necklaces with this fossil (*Elrathia*) as a means of warding off bullets.

Elrathia belongs in which phylum? _____ (2)

What class within this phylum does it represent? _____ (2)

2) Legend has it that when St. Hilda of England (614-680 AD.) took up residency within the local abbey at Whitby; she found that it was over run with snakes. So she cast a spell over snakes and by severing their heads with a whip, she then threw the remains over the cliff edge. This is purported to be why you find so many of these "Snakestones" in the rocks around Whitby. Snakestones have been recorded from at least Viking times and in Medieval England and were prized for their medical uses and as charms of luck. These shells have chambers within them

This is not a snake, but a fossil named *Dactyloceras,* with a head carved into the adjacent rock.

This fossil belongs in which phylum? _____ (2)

What class within this phylum does it represent? _____ (2)

3) The pharmacology of ancient China included reference to “stone swallows” which were believed to fly during thunderstorms. These are calcite-shelled fossils were ground up and consumed – an excellent source of calcium in the dairy-free culture of the Chinese.

Mucrospirifer is an example of a “stone swallow”.

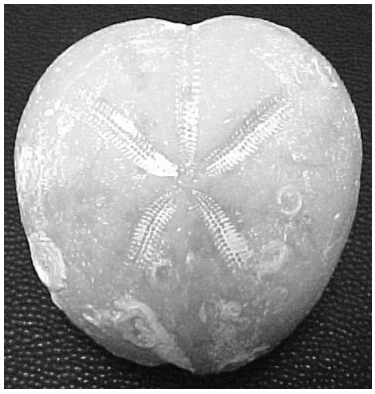
This fossil belongs in which phylum? _____ (2)

4) In England, a very common Jurassic oyster *Gryphaea* was used to treat arthritis and related diseases because of its appearance..

This fossil belongs in which phylum? _____ (2)

What class within this phylum does it represent? _____ (2)

5) In England, clalcite-shelled, fossil sea urchins, such as *Micraster* shown below, were sold as chalk eggs to cure "acid humours" of the stomach (indigestion) or seasickness.



This fossil belongs in which phylum? _____ (2)