Paleontology material

Unit: II

Phyllum Mollusca

Pelecypoda.

Morphology of the pelecypoda is the Shells inequilateral, mequivalve, middlesized, varying in shape from rounded, through subtriangular to oval, cemented to the substratum by the right valve. External ornamentation consists of numerous, fine growth lines, concentrical lamellae and radial ribs. Shell margin finely denticulate. The right valve convex, the greatest convexity being recorded at 1/3 of the distance from the ventral margin. Umbo not prominent, narrow, with a small, terminally situated attachment area or wide, straight, with a large area which occupies smaller or larger subumbonal part of valve. Ribs numerous, their number increases, both by bifurcation and intercalation, SOME JURASSIC SPECIES OF PLICATULA (PELECYPODA) 225 from 12 to more than 30. The height and thickness of ribs increase with the growth of valve from 0.5 to 1.5 mm. On some valves ribs are more numerous but thinner and lower and on some others less numerous but thicker and higher. The surface of ribs is uneven and slightly knobby. Usually, thicker swellings occur at intersections of ribs with concentrical growth lines . The intervals between ribs are usually twice as wide as ribs. According to differences in ornamentation of valves, the following two types of forms may be distinguished: in one of them, valves have well-developed ribs and slightly marked growth lines, in the othe!f, valves have low, fine ribs amid thkk, ,sometimes soaly, corncentrical lamellae. Few valves have a combined, costate-lamellar ornamentation. In the latter case, both ribs and lamellae are equally developed . The left valve convex the most so at a 1/3 of a distance from the ventral margin, in the suibumbonal part slightly convex or flattened. Sometimes, the umbonal margin is narrow and rounded but, more frequently, wide and straight. Radial ribs are about 3 mm in width, low and with a smooth surface. The intercostal spaces, developed in the form of shallow furrows, do not exceed 0.5 mm in width. The number of ribs increases, mostly by bifurcation, from 12 to more than 20 . Sometimes, the ribs originate near the umbonal margin and sometimes half-way the distance from it . Growth lines are fine and densely arranged, particularly so near the ventral margin of the valve.

The external ornamentation of the left valve does not display the differentiation into two types as is the case in the right valve.

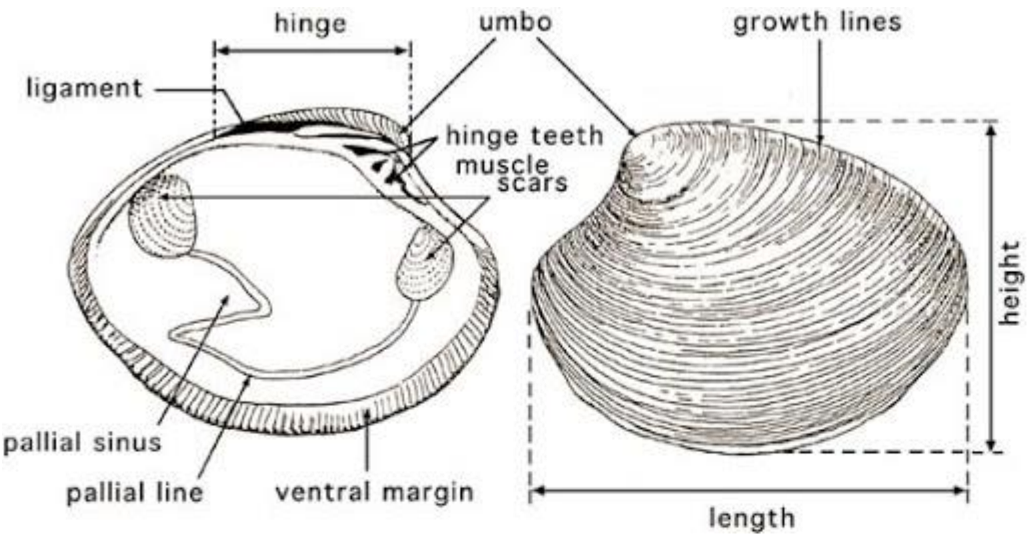


FIG :pelecypoda

Classification

Phylum *Mollusca*
Class *Pelecypoda*

Pelecypods have two shells, or bivalves, that protect the soft parts of the animal. The valves are generally of equal size (except in groups like the oysters) and shape and are hinged at the back. Some types, such as oysters, live in large groups that create beds or low-relief banks of shells, where the animals feed by filtering plankton and organic debris from the water. Other bivalves burrow through the mud or swim about in search of debris to eat. Many bivalve fossils in Delaware are preserved as steinkerns. Pelecypods are abundant in the spoils from the Mount Laurel Formation on both sides of the Canal in the vicinity of Reedy Point.

Geological and stratigraphic importance

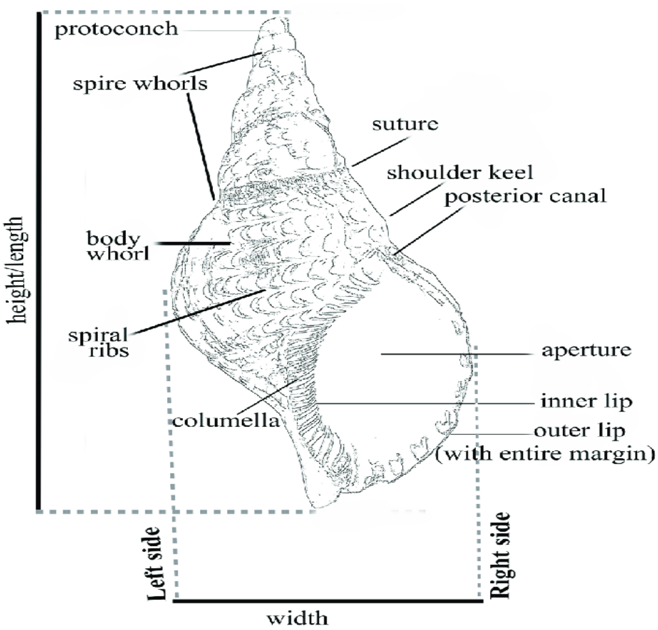
Pelecypods or Lamellibranchia or Acephala.The approximately15,000 species are found in marine and freshwater habitats throughout theworld.2nd largest Mollusca class.Bivalves appear in the fossil record first in theearly Cambrian more than 500 million years ago.Inequivalve but each valve issymmetrically equal.Animal is covered up by these 2 shells.aclassof marineand freshwatermolluscsthat have laterally compressed bodies enclosed by a shellconsisting of two hinged parts. They have no head, and they alsoaradula.Bivalvesincludeclams,oysters,cockles,mussels,scallops, and numerousotherfamiliesthat live in saltwater, and well as a number of families that live infreshwater. The majority arefilter feeders. Thegillshave evolved intoctenidia,specialised organs for feeding and breathing. Most bivalves bury themselves insediment, where they are relatively safe frompredation. Others lie on the sea floor .

Gastropods

Morphology.

Gastropods are characterised by the possession of a single (often coiled) shell, although this is lost in some slug groups, and a body that has undergone torsion so that the pallial cavity faces forwards. They have a well-developed head that bears eyes and a pair of tentacles (cephalic tentacles) and a muscular foot used for "creeping" in most species while in some it is modified for swimming or burrowing. The foot typically bears an operculum that seals the shell opening (aperture) when the head-foot is retracted into the shell. While this structure is present in all

gastropod veliger larvae, it is absent in the embryos of some direct developing taxa and in the juveniles and adults of many heterobranchs. The nervous and circulatory systems are well developed with the concentration of nerve ganglia being a common evolutionary theme.



The shell is typically coiled, usually dextrally, the axis of coiling being around a central columella to which a large retractor muscle is attached. The opening of the shell (aperture), into which the animal can typically retract, is often sealed with a horny (sometimes calcareous) operculum. The uppermost part of the shell is formed from the larval shell (the protoconch). The shell is partly or entirely lost in the juveniles or adults of some groups - with total loss occurring in several groups of land slugs and sea slugs (nudibranchs). Externally, gastropods appear to be bilaterally symmetrical. However, they are one of the most successful clades of asymmetric organisms known. The ancestral state of this group is clearly bilateral symmetry (e.g., chitons, cephalopods, bivalves, see above), but gastropod molluscs twist their organ systems into figure-eights, differentially develop or lose organs on either side of their midline, and generate shells that coil to the right or left. The best documented source of gastropod asymmetry is the developmental process known as torsion.

Classification.

Classification of gastropods based on different morphological and anatomical features of their bodies and shells has come across several problems. During the 19th century, researchers were proposed several different classifications of the Gastropoda based on the place of the mantle cavity or on the array of various organs and shape of the shells. By and large, all these classification methods used only a restricted number of distinctive characters. At the start of the 20th century, the German researcher, Johannes Thiele (1929 - 1935), put together earlier classifications and proposed Thiele's system of classifications which was used by zoologists for most of the century. He divided the gastropods into three subclasses: Prosobranchia, Opisthobranchia and Pulmonata. Besides, the Prosobranchia were divided into three orders: Archaeogastropoda, Mesogastropoda and Neogastropoda. In the current decades, there is a need for the revision of existing classification because of the following reasonsons

1. Accumulation of numerous new data on the morphology and anatomy of various gastropod groups due to the application of new methods for instance, transmission electron microscopy etc.

2. Finding of new gastropod groups with strange anatomical features in the deep sea region associated with hydrothermal vents. Recent analyses of these

characters of existing gastropods have led to a new classification method, which have been supported by outcome from molecular phylogenetics.

Orthogastropoda as one of two subclasses of the Gastropoda, the other subclass being the Eogastropoda.

This subclass, which one could call the **true snails**, is defined most briefly as all those gastropods that are not members of Patellogastropoda, the **true limpets**, or its ancestors. Included are abalone, snails, whelks, cowries, sea slugs (nudibranches), winkels, cones, and so forth, as well as keyhole limpets.

Orthogastropods form a clade, supported by unambiguous synapomorphies. These synapomorphies (a series of characteristics that appear in its members, but not in the other forms it diverged from) are the identifying characteristics of the clade.

Patellogstropoda

True limpets are marine gastropods with flattened, cone-shaped shells in the order Patellogastropoda in the subclass Eogastropoda, the other subclass of Gastropoda, along with Orthogastropoda.

Limpets live throughout the intertidal zone, from the high zone (upper littoral) to the shallow subtidal on the rocky coasts of most oceans. Limpets can be commonly found attached to rocks, looking like little disks or bumps on the rock surface. They attach themselves to the substratum using pedal mucus and a muscular "foot," which enables them to remain attached through dangerous wave action and which also seals against the rock to protect from desiccation during low tide.

Limpets forage by grazing on algae found on rock surfaces. They scrape films of algae from the rock with a radula. Limpets move by rippling the muscles of their foot in a wave-like motion.

Some limpets have a hole at the top, through which gaseous exchange can occur. Most limpets are less than 3 inches (8 centimeters) long, but a West Mexican Limpet grows to be 8 inches (20 centimeters).

Geological and stratigraphic importance.

The first gastropods are considered to have been exclusively marine, with the earliest representatives of the group appearing in the Late Cambrian (*Chippewaella*, *Strepsodiscus*). Early Cambrian forms like *Helcionella* and *Scenella* are no longer considered gastropods, and the tiny coiled *Aldanella* of earliest Cambrian time is probably not even a mollusk.Certain trail-like markings preserved in ancient sedimentary rocks are thought to have been made by gastropods crawling over the soft mud and sand. Although these trails are of debatable origin, some of them do resemble the trails made by living gastropods today.

By the Ordovician period, the gastropods were a varied group present in a range of aquatic habitats. Commonly, fossil gastropods from the rocks of the early Paleozoic era are too poorly preserved for accurate identification. Still, the Silurian genus *Poleumita* contains 15 identified species. Fossil gastropods are less common during the Paleozoic era than bivalves. Most of the gastropods of the Paleozoic era belong to primitive groups, a few of which still survive today. By the Carboniferous period, many of the shapes we see in living gastropods can be matched in the fossil record, but despite these similarities in appearance the majority of these older forms are considered not to be directly related to living forms. It was during the Mesozoic era that the ancestors of many of the living gastropods evolved.

Rocks of the Cenozoic era yield very large numbers of gastropod fossils, many of these fossils being closely related to modern living forms. The diversity of the gastropods increased markedly at the beginning of this era, along with that of the bivalves.Gastropod fossils may sometimes be confused with ammonites or other shelled cephalopods. An example of this is *Bellerophon* from the limestones of the Carboniferous period in Europe, which may be mistaken for a cephalopod.Gastropods are one of the groups that record the changes in fauna caused by the advance and retreat of the Ice Sheets during the Pleistocene epoch.

Cephalopods

Morophological characters.

Cephalopods are the most complex and motile of the non-vertebrate metazoans, and show numerous modifications of the general molluscan body plan. The chambered nautilus has an external shell, but all other living cephalopods have either a reduced and internalized shell or none at all. The calcareous shell of cuttlefish (the cuttlebone) is internal, as is that of the rams horn squid, but other squid have the shell reduced to a horny pen and octopuses lack a shell completely. The shells of cephalopods (other than the very reduced "pen" in squids) have gas-filled chambers that assist with buoyancy.

Their highly developed, efficient circulatory system differs from that of other molluscs in being closed and including a pair of accessory hearts (except in Nautilus). Some cephalopods have paired fins at the distal end of the mantle for swimming. Tentacles (cephalic in origin) surround the mouth on the head for capturing prey. They often bear suckers, sometimes hooks and, in some groups, a pair of retractile tentacles (arms) are found. Cephalopods have powerful, modified jaws (beaks) and a small radulae. There are large salivary glands in some squids and octopuses that can produce highly toxic venoms for capturing prey.

The nervous system is highly advanced with three major ganglia concentrated to form a large, efficient brain. Coleoid cephalopods also have two large stellate ganglia on the mantle that control both respiratory and locomotory functions of the mantle.

Classification:

In fossil cephalopods, reliance is placed upon shell details (general shape, type of coiling, external sculpture, and sutures). In living forms, except for the Sepioidea, the shell is strongly degenerate or missing and the characters used consist of details of the soft parts: presence or absence of an eyelid, tentacles retractile or contractile or both, shape and size of fins, number of arms, number of sucker rows, presence or absence of teeth and hooks on arm and tentacular suckers, radular dentition, structure of funnel organ, spermatophores, details of the hectocotyles, number of gill lamellae, and the presence, patterns, and types of photophores.

- Subclass Nautiloidea (nautiloids)

    Cambrian to present; now living only in the Indo-Pacific region, particularly East Indies; external coiled or straight chambered shell present, chambers connected by median siphuncle; smooth septa; sutures simple, little or no external sculpture; tentacles suckerless,

> adhesive; living and supposedly fossil forms with 4 gills; funnel formed of 2 nonfused flaps; about 5 living species, in genus *Nautilus*.

- Subclass Ammonoidea (ammonites)

  > Devonian to Cretaceous; fossils only; external, coiled or straight chambered shell with marginal siphuncle, last chamber protected by single horny plate or 2 calcareous plates; septa wrinkled; complex sutures; external sculpture.

- Subclass Coleoidea (octopuses, squids, belemnites, cuttlefishes)

  > Triassic to present; shell internal, reduced, vestigial, or lacking; 2 sets of gills; 8 or 10 arms, having suckers or hooks.

Recent system divides all cephalopods into two clades. One includes nautilus and most fossil nautiloids. The other clade (Neocephalopoda or Angusteradulata) is closer to modern coleoids, and includes belemnoids, ammonoids, and many orthocerid families. There are also stem group cephalopods of the traditional Ellesmerocerida .

Geology and stratigraphy

Cephalopoda is an ancient and successful group, including some of the dominant large marine predators during various periods in geological history (Young et al. 1996). Cephalopods appeared 500 million years ago during the late Cambrian and were dominant and diverse during the Paleozoic and Mesozoic eras. *Tommotia*, a basal cephalopod, had squid-like tentacles but also a snail-like foot it used to move across the seabed. Early cephalopods were at the top of the food chain.

The ancient (cohort Belemnoidea) and modern (cohort Neocoleoidea) coleoids, as well as the ammonoids, all seemed to have diverged from the external shelled nautiloid during the middle Paleozoic era, between 450 and 300 million years ago. While Nautiloid was dominant in the Paleozoic, ammonites were dominant during the Mesozoic.

Unlike most modern cephalopods, most ancient varieties had protective shells. These shells at first were conical but later developed into curved nautiloid shapes seen in modern nautilus species. Internal shells still exist in many non-shelled living cephalopod groups but most truly shelled cephalopods, such as the ammonites, became extinct at the end of the Cretaceous.

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