

CHAPTER III

SYSTEMATIC PALEONTOLOGY

3.1 Introduction of Molluscan

The name Mollusca (from the Latin mollis meaning soft), was first used by the French zoologist Cuvier in 1798 to describe squids and cuttlefish, animals whose shell is reduced and internal, or entirely absent. It was only later that the true affinities between these species and other molluscs, such as snails and bivalvia, were fully recognised.

The molluscs are a very successful group. If success is measured in terms of number of species and variety of habitats to which they have become adapted, then molluscs are one of the three most successful groups in the animal kingdom. Over 160,000 species have been described, of which around 128,000 are living and about 35,000 are recorded as fossil species.

Molluscs are found in nearly all habitats. In the sea they occur from the deepest ocean trenches to the intertidal zone. They may be found in freshwater as well as on land where they occupy a wide range of habitats. Thus, during their evolution, they have become adapted to living in nearly all available habitats.

3.1.1 Main characters of Gastropoda

The class Gastropoda includes Mollusca with a distinct head, which in unspecialized forms has eyes and tentacles and is more or less fused with the foot, typically solelike and adapted for creeping, but much modified in pelagic and some other forms. A radula normally is present. Organs of the pallial complex are re-oriented as the result of "torsion," which in some forms is a definite episode observable in early

ontogeny, and in others it is inferred to have taken place in ancestral forms, although omitted in a condensed ontogeny. Bilateral asymmetry is present to a varying degree in all living representatives, although complete symmetry has existed in the extinct Bellerophonacea. The shell, if present, is single (univalve), calcareous, closed apically, endogastric when spiral, and not divided regularly into chambers (Moore, 1960).

The characteristics of shell are different for each species. Therefore, the characters of the shells are very important in species recognition and usually for generic and familial placement as well. Especially useful are the adult size (Figure 3.1) and general form of the shell. The shells among the various species may vary from elongate to nearly globose, depressed and discoidal. The shell may be longer than wide or wider than long (Figure 3.2). The shell may have few or many whorls, and may lack an opening (umbilicus) at its "base" or may have either a narrow or relatively wider opening (Figure 3.3). The edge of the shell aperture, *i.e.*, the peristome, may be a simple edge or it may be expanded outwardly or it may be reflected outwardly (Figure 3.4) (Panha and Burch, 2004-2005).

3.1.1.1 General External Features of Gastropoda

The gastropod shell is essentially a protective structure that permanently covers the visceral mass and provides a retreat for the head-foot mass, which is extruded from it when active. It is convenient to allude to this tube as the helicocone, the opening at its extremity being termed the aperture (Figure 3.5). In most gastropods the shell assumes a spiral form as the helicocone, during growth, coils repeatedly about an imaginary axis passing through its apex. The columella of a shell is the pillar, surrounding the axis, formed by the adaxial wall of the coiled helicocone.

3.1.1.2 Variety in Gastropoda form

The general form of a coiled gastropod shell depends on a number of interrelated factors, chief among which are the crosssectional shape of the helicocone, the degree of overlap of successive coils, and the openness of coiling of the whole spiral with respect to the axis. Not in every genus, moreover, are the mode of coiling and the rate of increase in the cross-sectional area of the helicocone constant during growth (Figure 3.6) (Moore, 1960).



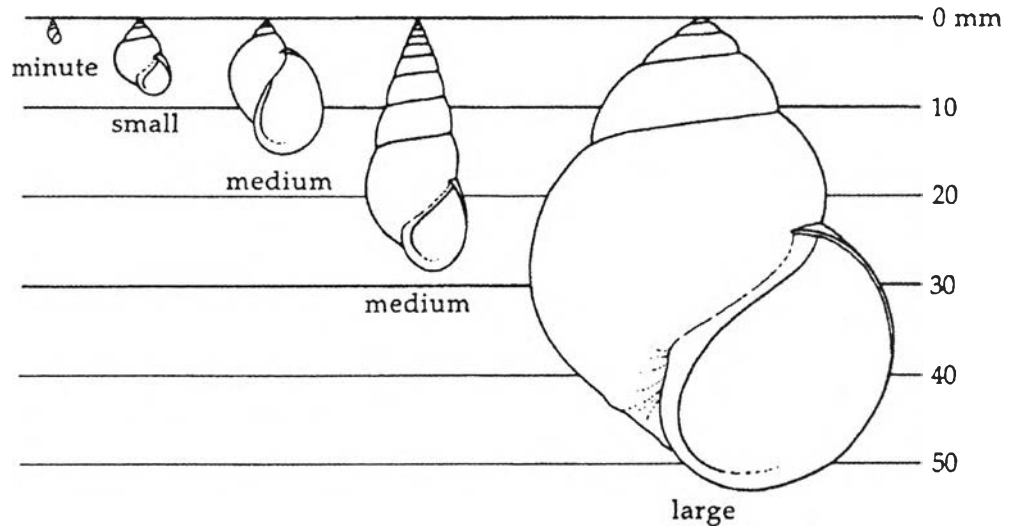


Figure 3.1 Shell sizes: up to 3 mm=minute; 3+ to 10 mm=small; 10+ to 30 mm=medium; over 30 mm=large (Panha and Burch, 2004-2005).

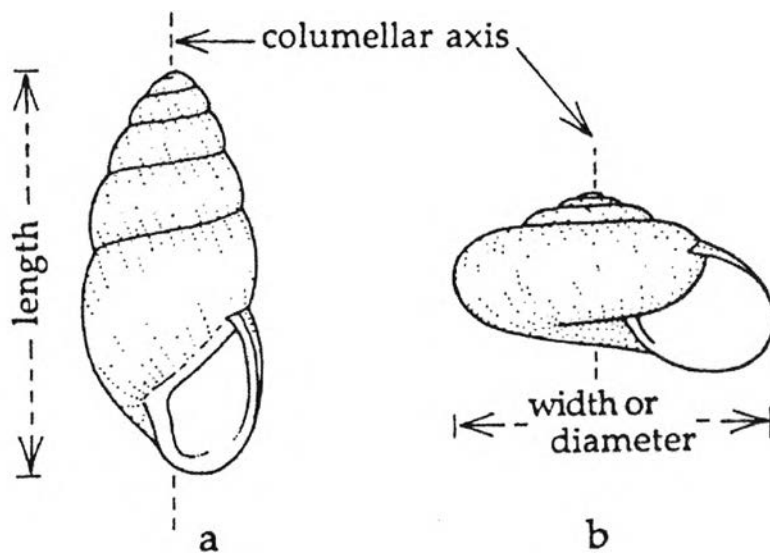


Figure 3.2 a, an elongate shell (longer than wide); b, a depressed shell (wider than long) (Panha and Burch, 2004-2005).

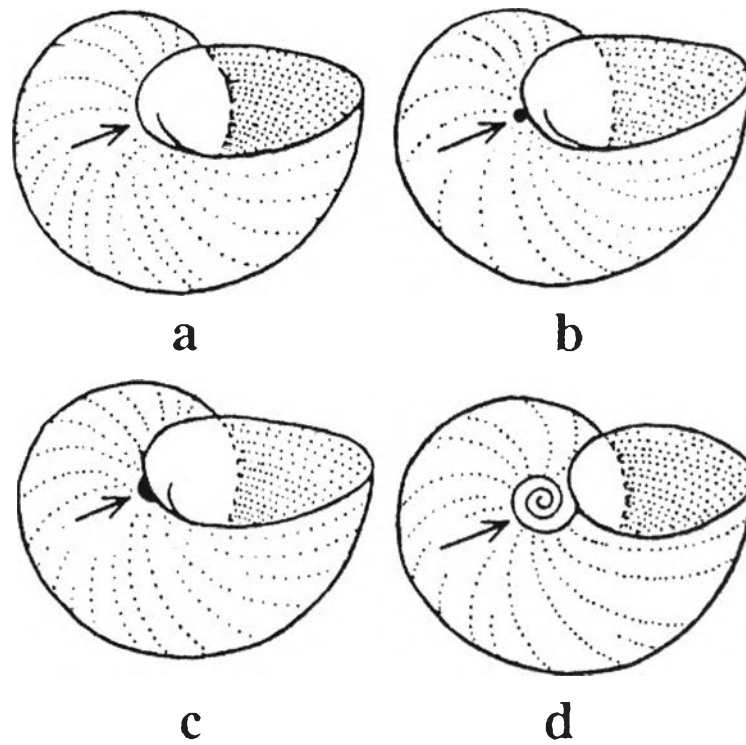


Figure 3.3 Basal shell characters. a, Imperforate shell; b, perforate shell; c, rimately perforate shell; d, umbilicate shell (Panha and Burch, 2004-2005)

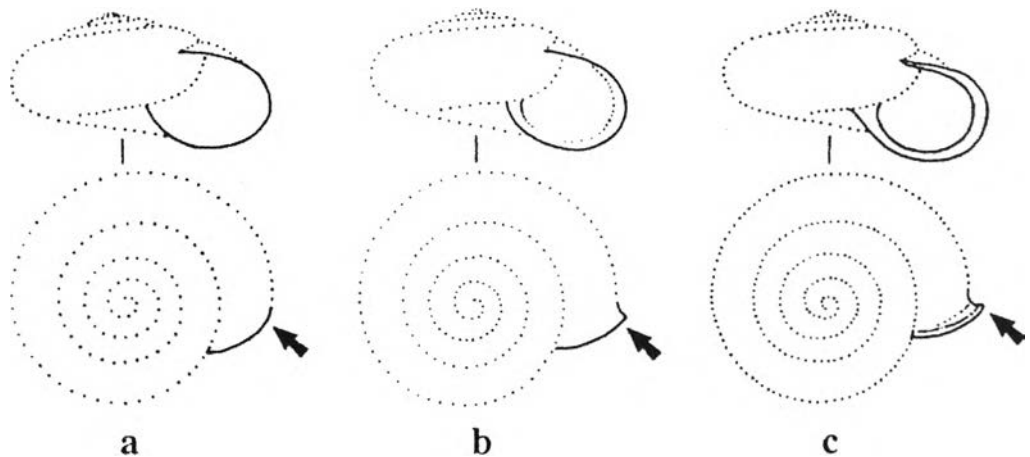


Figure 3.4 a, Shell lip neither expanded nor reflected; b, lip expanded; c, lip reflected (Panha and Burch, 2004-2005).

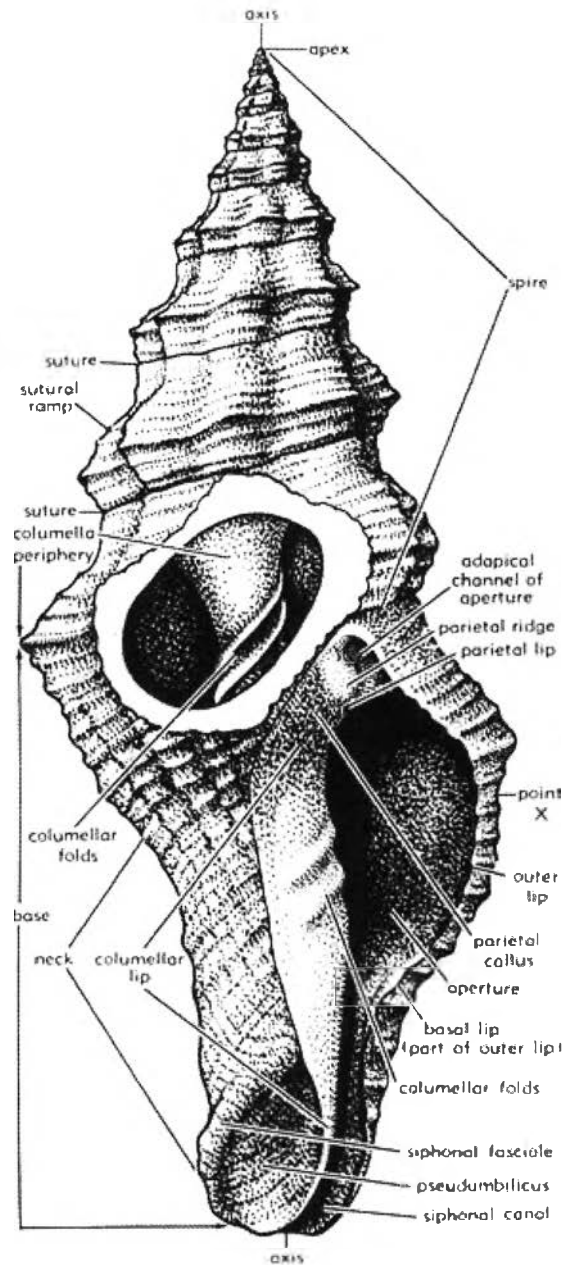


Figure 3.5 Typical gastropod shell, *Latirus lynchi* (BASTEROT), Mio., FR., showing terminology of its various parts. The columella is seen through a "window" in the last whorl (Moore, 1960).

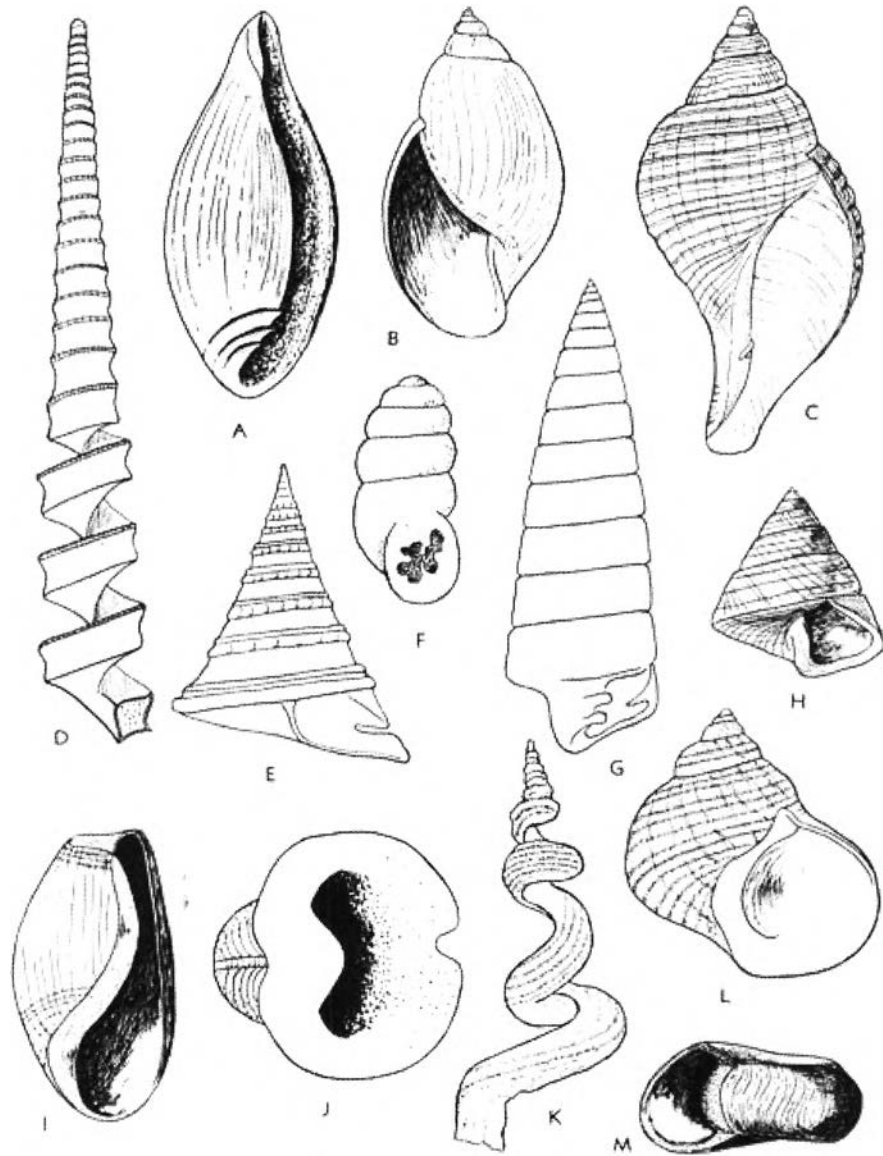


Figure 3.6 Variety in gastropod shell form (Moore, 1960).

3.1.2 Main characters of Bivalvia

The Bivalvia are aquatic mollusks which fundamentally are bilaterally symmetrical and laterally compressed. They invariably are provided with a shell consisting of two wholly or partly calcified valves lying on left and right sides of the body. The valves are connected dorsally by an only partially calcified, elastic structure (ligament) and open and close by hinging along an axis which passes through or close to this. Typically, the hinge axis has an approximately anteroposterior direction. The valves are closed by the action of muscles (adductor muscles), two or one in number, attached to the inner face of each; these muscles, by drawing the valves together, oppose the action of the ligament, which acts as a spring tending to open them (Moore, 2000).

3.1.2.1 General External Features of Bivalvia

The structures belonging to this part of the shell (ligament, hinge teeth, hinge plate, etc., described later) which function during opening and closing of the valves are collectively known as the hinge. In typical homomyarian bivalves the hinge occupies a strictly dorsal position in relation to the soft parts; on the opposite margin (along which the valves open most widely), is ventral; one end of the shell is anterior, as it lies relatively close to the mouth of the animal, and the other end is posterior, as it lies relatively close to the anus (Figure 3.7). In heteromyarian bivalves the corresponding parts of the shell do not occupy similar positions in relation to the soft parts (Moore, 2000). Usually the line of junction of the two valves (commisure) lies within a single plane, and in equivalve forms this coincides with the sagittal plane of the animal (Figure 3.8). When describing the outline of a bivalve recourse is usually made to such terms as suboval, subtrigonal, suborbicular, and the like (Figure 3.11). It is preferable wherever possible, however, to use terms such as mytiliform, pectiniform, and ensiform, which evoke the shapes of well-known genera.

In many bivalves, notably Veneridae and Lucinidae, a heart-shaped morphologically differentiated area occurs anterior to the umbones. This is termed the lunule (Figure 3.8, 3.10). The lunule corresponds to the track of growing anterodorsal hinge structures. The Pectinacea, Pteriacea and, to a less marked extent, the Limacea, comprise shells in which part of the straight hinge margin lying on either side of the beak forms the margin of a triangular, relatively compressed part of the valve known as an auricle or wing according to its length (Figure 3.9). The auricles and wings may be clearly delimited from the remainder of the valve, or their lower border may be less distinct.

3.1.2.2 Shell Sculpture

Most bivalve shells retain on their surface, as irregularly spaced lines and coarser markings, a record of interruptions in secretion of the shell at its margins during growth or of changes in the rate of secretion (Figure 3.10). These markings, termed growth lines and growth rugae, form a series of conformable curves the course of which is commonly described as "concentric" by conchologists, although commarginal would be a more appropriate term. Many bivalves have shells which are otherwise smooth, but a great number have a relief pattern, known as sculpture or surface ornament, which is of a more or less regular nature and (except for minor variations) is similar in all representatives of a species. The sculpture consists most commonly of one of two components or of a combination of these two. The first component is a concentric one and attributable to rhythmic changes in the rate of secretion of shelly matter along the mantle margins. The second component is a radial one and consists of elements diverging from the direction of the beak and crossing the concentric elements (Moore, 2000). According to their relative width and prominence, the projecting elements are termed folds, undulations, costae (or ribs), costellae (or riblets), threads, lines, etc., and the incised elements grooves, striae, etc. (Figure 3.12).

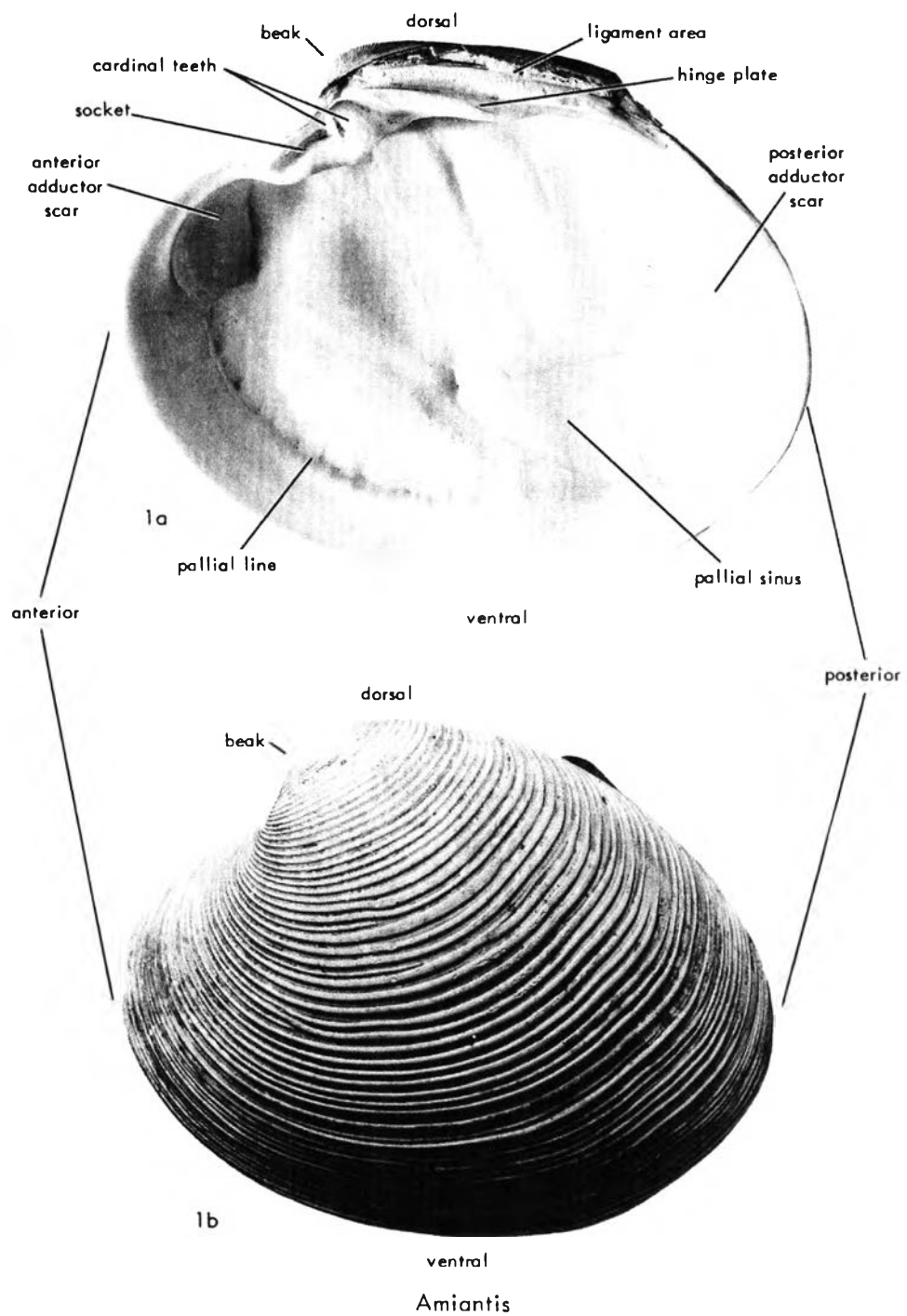


Figure 3.7 Bivalvia shell morphology. 1. *Amiantis* (*Amiantis*) *callosa* (CONRAD), equivalve, inequilateral shell of venerid; 1a, right valve interior; 1b, left valve exterior (in Moore, 2000).

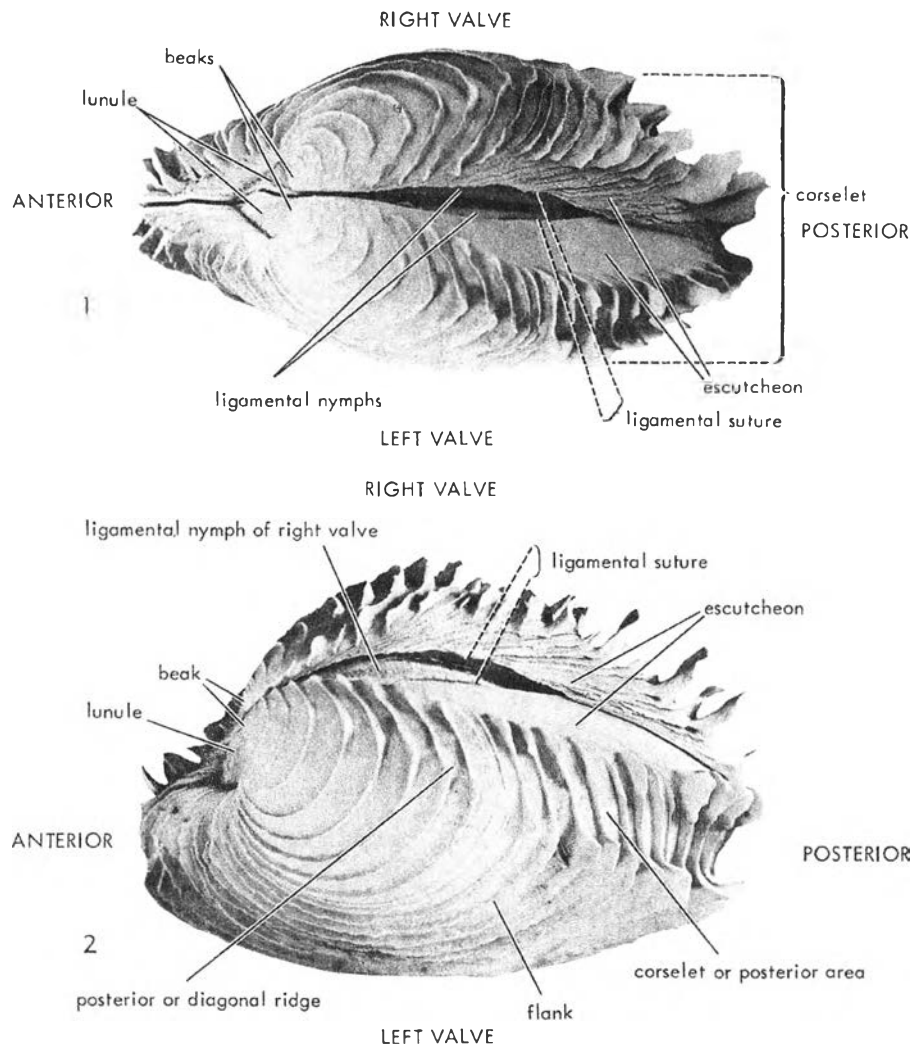


Figure 3.8 General external features of shell *Circomphalus foliaceolamellosa* (DILLWYN), 1.Dorsal view. 2. Specimen viewed obliquely from above left. Note slight size difference between LV and RV lunules and escutcheons (in Moore, 2000).

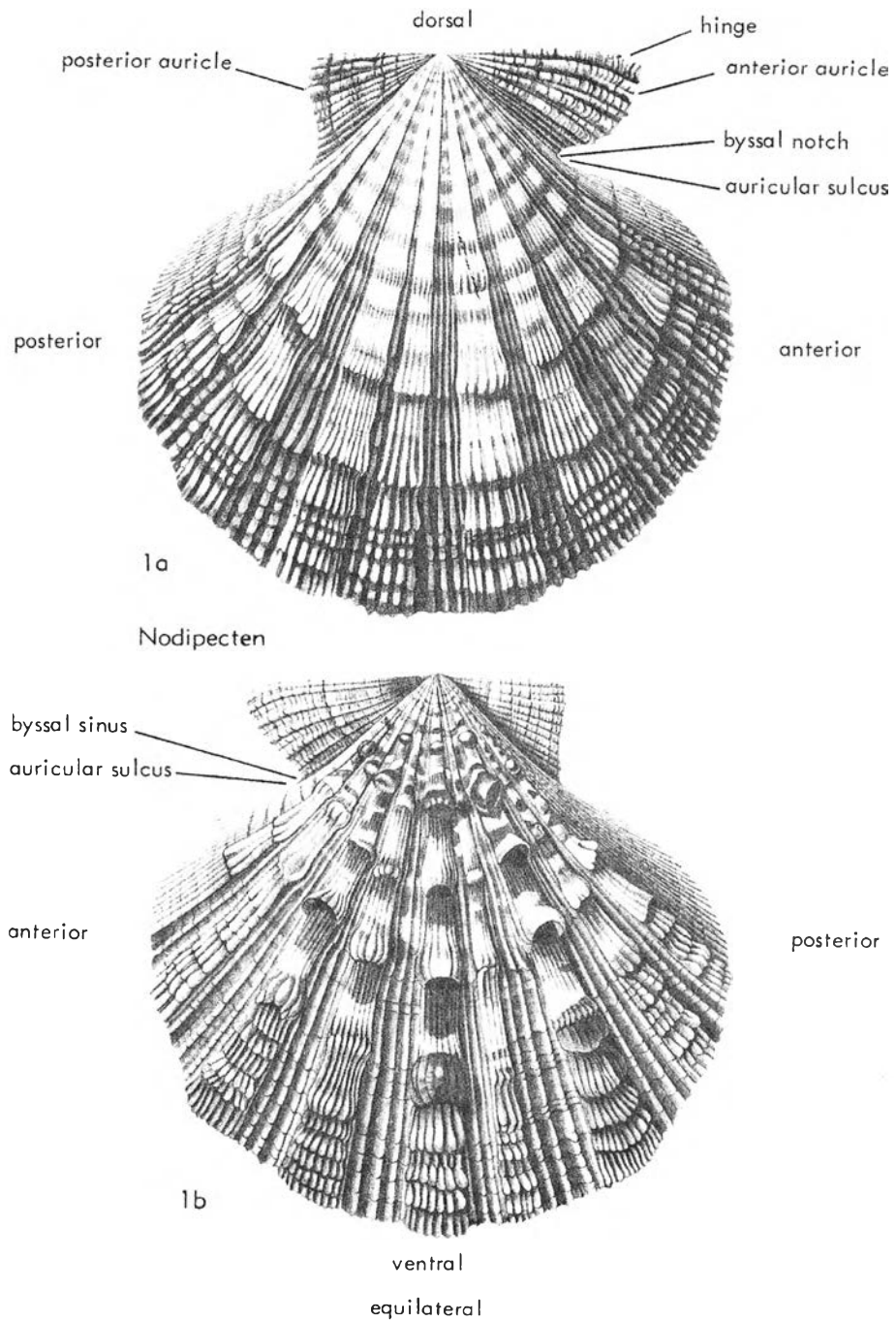


Figure 3.9 Bivalvia shell morphology. 1. *Chlamys (Nodipecten) nodusa* (LINNÉ), equivalve, equilateral pectinid; 1a, b, right and left valve exterior (in Moore, 2000).

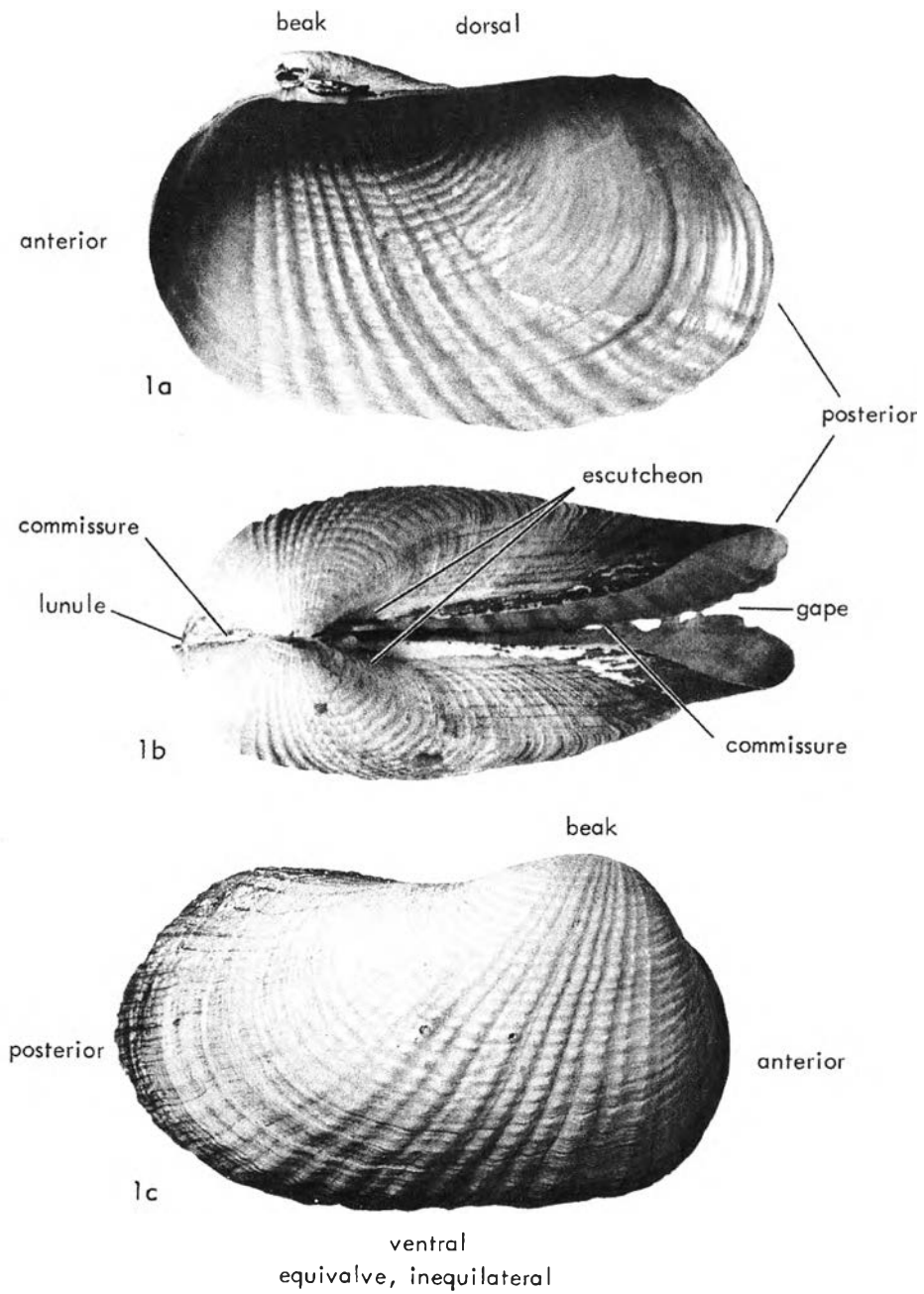


Figure 3.10 Bivalvia shell morphology. 1. *Pholadomya (Pholadomya) candida* G. B. SOWERBY, equivalent, inequilateral pholadomyid; 1a, b, right valve interior and dorsal views of both valve; 1c, right valve exterior (in Moore, 2000).

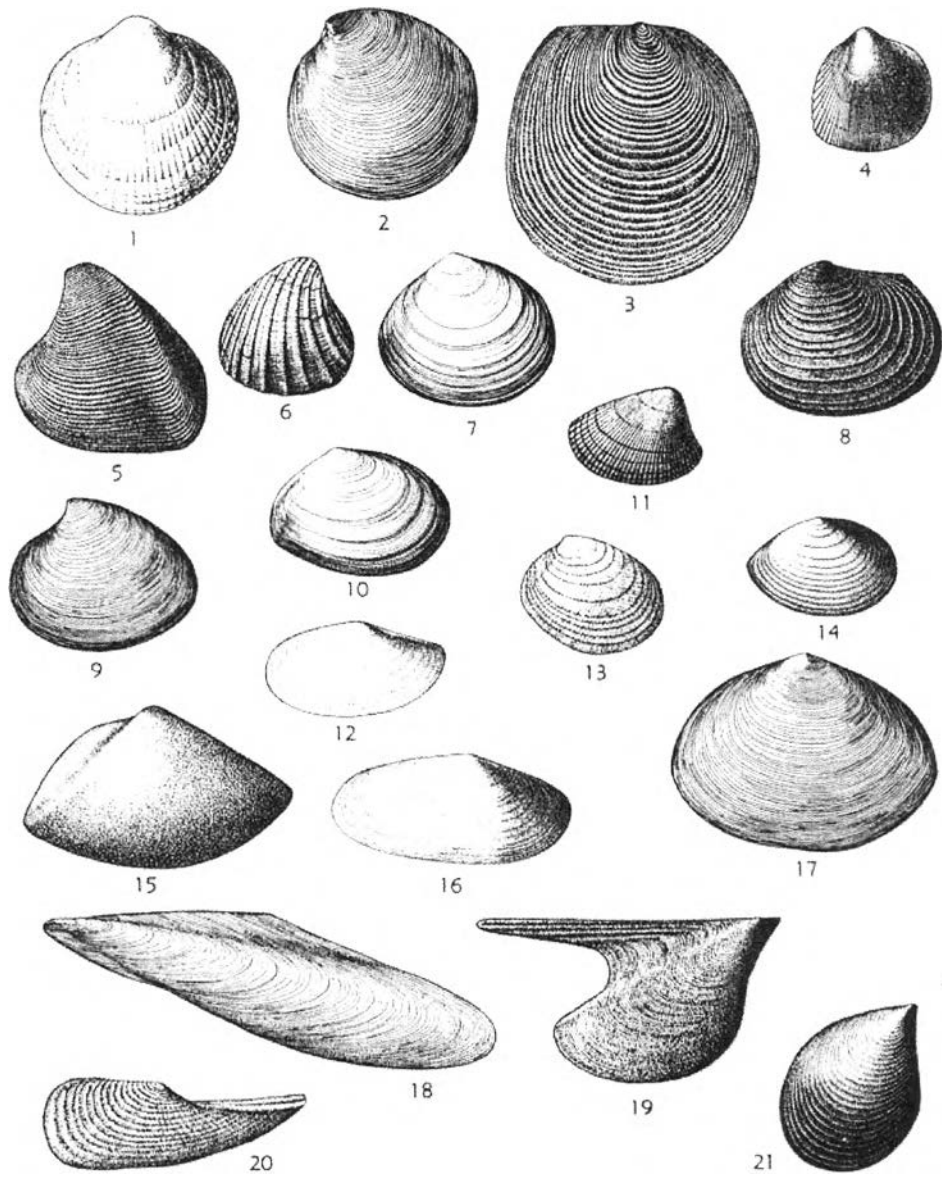


Figure 3.11 Shapes of Bivalve shells, illustrating terms commonly used to describe them (Moore, 2000).

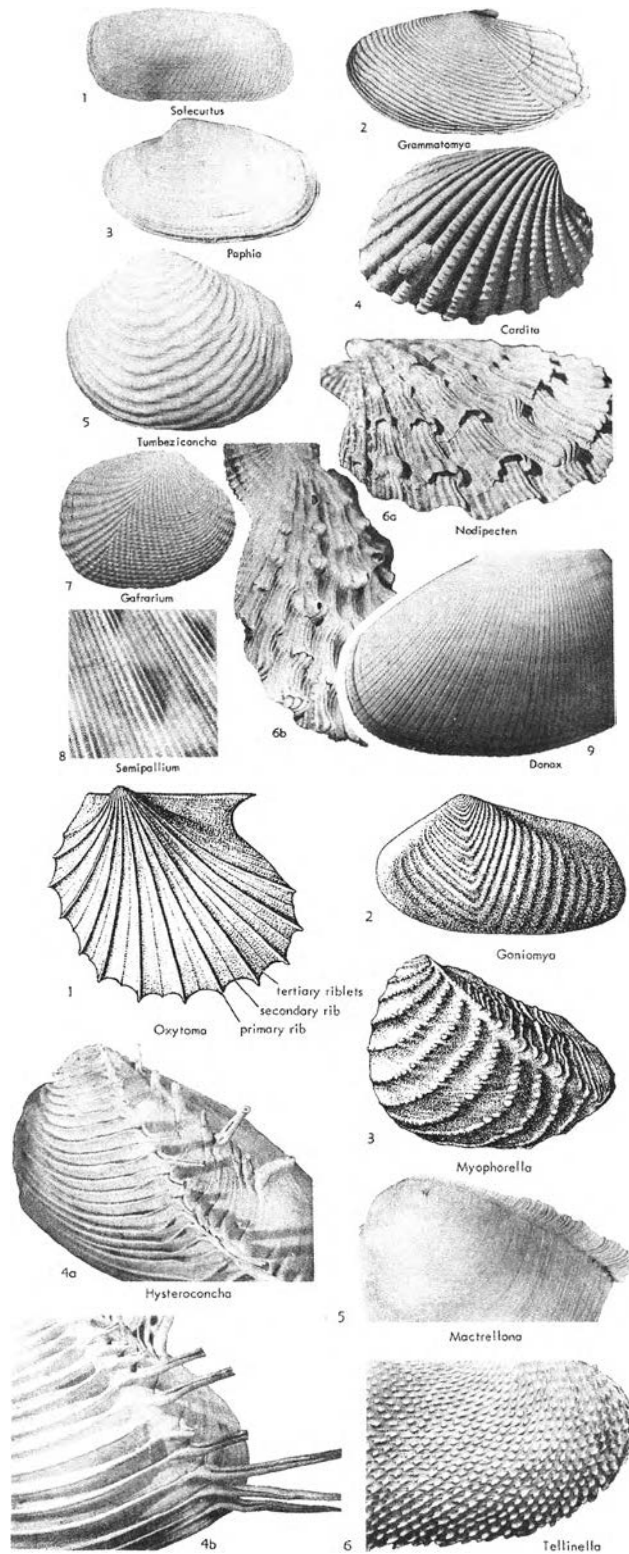


Figure 3.12 Bivalve shell sculpture (in Moore, 2000).

3.2 Systematic descriptions

Class Gastropoda Cuvier, 1797

Subclass Prosobranchia Milne Edwards, 1848

Order Archaeogastropoda Thiele, 1925

Superfamily Trochoidea Rafinesque, 1815

Family Trochidae Rafinesque, 1815

Subfamily Umboniinae H. & A. Adams, 1854

Genus *Umbonium* Link, 1807

Umbonium vestiarium (Linnaeus, 1758)

Pl. 1, Figs. 1 (a, b)

Description: Shell diameter to 8 mm, small sizes. A depressed shell, turbiniform, shell coiled to the right (dextral), basal shell character is imperforate shell and shell lip neither expanded nor reflected. Colors are very variable.

Habitat: Sand or muddy in intertidal to 4 m.

Distribution: Indo-Pacific, East Africa, Indonesia, Philippines, Taiwan and Thailand.

Fossil Records: Pliocene of Indonesia, Philippines, Taiwan and Japan; Pleistocene of Indonesia and Philippines; Holocene of Thailand.

Superorder Caenogastropoda Cox, 1959

Order Mesogastropoda Thiele, 1925

Superfamily Cerithioidea Férussac, 1819

Family Potamididae H. & A. Adams, 1854

Genus *Cerithidea* Swainson, 1840

Subgenus *Cerithidea* (*Cerithideopsilla*) Thiele, 1929

Cerithidea (Cerithideopsilla) cingulata (Gmelin, 1791)

Pl. 1, Figs. 2 (a-d)

Description: Shell height to 39 mm, large sizes. An elongate shell, turreted, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip is reflected, shell surface have collabral riblets and 3 spiral bands forming low nodes on crossing the riblets. Colors are brown with black.

Habitat: Mud flat in mangrove swamps.

Distribution: Indian Ocean, the Western Pacific, Gulf of Oman, Indonesia, Japan, China and Thailand.

Fossil Records: Miocene of Japan; Late Miocene of India and Indonesia; Pliocene of India, Indonesia, Taiwan and Japan; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Family Turritellidae Lovén, 1847

Subfamily Turritellinae Lovén, 1847

Genus *Turritella* Lamarck, 1799

Turritella terebra (Linnaeus, 1758)

Pl. 1, Figs. 3 (a, b)

Description: Shell height to 140 mm, large sizes. An elongate shell, turriculate, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip neither expanded nor reflected and shell surface decorated by 6 strong spiral ribs.

Habitat: Sandy mud in 12-22 m.

Distribution: Indo-West Pacific, Malaysia and Thailand.

Fossil Records: Middle Miocene of Indonesia; Late Miocene of India, Indonesia, Philippines and Taiwan; Pliocene of India, Indonesia, Philippines, Taiwan and Japan; Quaternary of Indonesia and Taiwan.

Superfamily Stromboidea Rafinesque, 1815

Family Strombidae Rafinesque, 1815

Genus *Strombus* Linnaeus, 1758

Strombus canarium Linnaeus, 1758

Pl. 1, Figs. 4 (a, b)

Description: Shell height to 67 mm, large sizes. An elongate shell, fusiform, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip is reflected and body whorl long.

Habitat: Sand in intertidal to 10 m.

Distribution: Philippines, India, Australia, Japan and Thailand.

Strombus robustus Sowerby, 1874

Pl. 1, Figs. 5 (a, b)

Description: Shell height to 36 mm, large sizes. An elongate shell, fusiform, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip neither expanded nor reflected, aperture have slightly ribs, shell surface have spiral ribs and body whorl long. Colors are light brown with white.

Habitat: Sandy in 10 m.

Distribution: West-Pacific, Japan and Thailand.

Subgenus *Strombus (Doxander)* Iredale, 1931

Strombus (Doxander) vittatus Linnaeus, 1758

Pl. 1, Figs. 6 (a, b)



Description: Shell height to 77 mm, large sizes. An elongate shell, fusiform-tall, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip neither expanded nor reflected and shell surface have axial ribs.

Habitat: Sandy mud to subtidal to 50 m.

Distribution: Philippines, China Sea, Fiji, Indonesia, Malaysia, Vietnam and Thailand.

Superfamily Cypreoidea Rafinesque, 1815

Family Cypraeidae Rafinesque, 1815

Subfamily Cypraeinae Gray, 1824

Genus *Cypraea* Linnaeus, 1758

Cypraea talpa Linnaeus, 1758

Pl. 1, Figs. 7 (a-d)

Description: Shell height to 45 mm, large sizes. Convolute, basal shell character is imperforate shell and shell lip neither expanded nor reflected.

Habitat: coral reef in intertidal.

Distribution: Australia, Queensland, Indo-West Pacific, New South Wales, Red Sea, Cambodia, Philippines, Indian Ocean and Thailand.

Superfamily Naticoidea Forbes, 1838

Family Naticidae Forbes, 1838

Subfamily Polinicinae Gray, 1847

Genus *Polinices* Montfort, 1810

Subgenus *Polinices* (*Polinices*) Montfort, 1810

Polinices (*Polinices*) *mammilla* (Linnaeus, 1758)

Pl. 2, Figs. 1 (a, b)

Description: Shell height to 29 mm, medium sizes. An elongate shell, elongate-ovate, shell coiled to the right (dextral), basal shell character is imperforate shell and shell lip neither expanded nor reflected. Color is white.

Habitat: Sand flats in low tide.

Distribution: China, Australia, Japan, Indo-West Pacific and Thailand.

Subgenus *Polinices* (*Glossaulax*) Pilsbry, 1929

Polinices (*Glossaulax*) *didyma* (Röding, 1798)

Pl. 2, Figs. 2 (a, b)

Description: Shell height to 29 mm diameter to 32 mm, medium sizes. A depressed shell, globoseconical, shell coiled to the right (dextral), basal shell character is rimately perforate shell and shell lip neither expanded nor reflected. Color is brown.

Habitat: Fine sandy and muddy intertidal and subtidal to 100 m.

Distribution: India, Western Pacific Oceans, South Africa, Australia Malaysia, Singapore, Japan and Thailand.

Fossil Records: Late Miocene of Indonesia, Philippines and Japan; Pliocene of Indonesia, Taiwan and Japan; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Subfamily Naticinae Forbes, 1838

Genus *Natica* Scopoli, 1777

Natica tigrina (Röding, 1798)

Pl. 2, Figs. 3 (a, b)

Description: Shell height to 29 mm diameter to 23 mm, medium sizes. An elongate shell, elongate-ovate, shell coiled to the right (dextral), basal shell character is rimately

perforate shell and shell lip neither expanded nor reflected. Colors are reddish-brown spots on a white background.

Habitat: Muddy sand to mud flats in mangrove forest, intertidal and shallow subtidal to 30 m.

Distribution: India, Japan, Malaysia, Singapore and Thailand.

Fossil Records: Late Miocene to Quaternary of Indonesia; Quaternary of Thailand.

Subfamily Sininae Woodring, 1928

Genus *Sinum* Röding, 1798

Sinum eximium (Reeve, 1864)

Pl. 2, Figs. 4 (a, b)

Description: Shell height to 24 mm width 31 mm, medium sizes. A depressed shell, globoseconical, shell coiled to the right (dextral), basal shell character is rimately perforate shell, shell lip neither expanded nor reflected and shell surface have spiral ribs.

Habitat: Fine sediment.

Distribution: Indo-Pacific and Thailand.

Superfamily Tonnoidea Suter, 1913

Family Bursidae Thiele, 1925

Genus *Bursa* Röding, 1798

Bursa rana (Linnaeus, 1758)

Pl. 2, Figs. 5 (a, b)

Description: Shell height to 58 mm, large sizes. An elongate shell, fusiform, shell coiled to the right (dextral), basal shell character is rimately perforate shell, shell lip is reflected,

aperture have slightly ribs and shell surface have peripheral spines and a second row of smaller spines.

Habitat: Fine sandy in intertidal and sublittoral to 100 m.

Distribution: Indo-Pacific, Red Sea, Australia, Japan, Malaya and Thailand.

Fossil Records: Miocene of Indonesia; Pliocene of Indonesia, Philippines, Taiwan, Okinawa, Japan; Quaternary of the Southwest Pacific area.

Order Neogastropoda Thiele, 1929

Superfamily Muricoidea de Costa, 1776

Family Muricidae Fleming, 1828

Subfamily Muricinae Rafinesque, 1815

Genus *Murex* Linnaeus, 1758

Murex trapa Röding, 1798

Pl. 2, Figs. 6 (a, b)

Description: Shell height to 81 mm, large sizes. An elongate shell, fusiform, shell coiled to the right (dextral), basal shell character is rimately perforate shell, shell lip is reflected and shell surface have collabral ribs overridden by spiral cords; 3 varices per whorl bearing recurved, moderately long spines.

Habitat: Fine sandy and muddy in intertidal and subtidal to 60 m.

Distribution: Madagascar, Fiji, China, Ryukyu Islands, Malaysia and Thailand.

Fossil Records: Middle and Late Miocene of Indonesia; Pliocene of Indonesia, Philippines and Taiwan; Quaternary of Indonesia; Holocene of Thailand.

Subfamily Muricopsinae Radwin & D'Attilio, 1971

Genus *Lataxiena* Joussemaume, 1883

Lataxiena fimbriata (Hinds, 1844)

Pl. 2, Figs. 7 (a, b)

Description: Shell height to 25 mm, medium sizes. An elongate shell, elongate-ovate, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip neither expanded nor reflected, aperture have slightly ribs. Shell surface have low axial ribs and raised fimbriate lamella-like growth ridges.

Habitat: Rocks shallow water to 10 m.

Distribution: Philippines, Queensland, Australia, Japan and Thailand.

Subfamily Thaidinae Jousseaume, 1888**Genus** *Thais* Röding, 1798*Thais lacera* (Born, 1778)

Pl. 2, Figs. 8 (a, b)

Description: Shell height to 43 mm, large sizes. An elongate shell, elongate-ovate, shell coiled to the right (dextral), basal shell character is rimately perforate shell, shell lip neither expanded nor reflected and shell surface have more prominent peripheral spiny tubercles.

Habitat: Muddy rocks in intertidal and shallow subtidal.

Distribution: Indo-Pacific, South Africa, Philippines, Taiwan, Mediterranean, via Suez Canal, Malaya, Singapore and Thailand.

Fossil Records: Pliocene and Quaternary of Indonesia; Holocene of Thailand.

Family Buccinidae Rafinesque, 1815**Subfamily Buccininae** Rafinesque, 1815**Genus** *Babylonia* Schluter, 1838

Babylonia areolata (Link, 1807)

Pl. 2, Figs. 9 (a, b)

Description: Shell height to 53 mm, large sizes. An elongate shell, turbiniform, shell coiled to the right (dextral), basal shell character is perforate shell and shell lip neither expanded nor reflected. Color spots are brown.

Habitat: sand in subtidal to continental shelf

Distribution: Sri Lanka, China, Hong Kong, Philippines, Nicobar Islands, Vietnam, Taiwan, Japan and Thailand.

Genus *Pseudoneptunea* Kobelt, 1882*Pseudoneptunea varicosa* (Kiener, 1840)

Pl. 2, Figs. 10 (a, b)

Description: Shell height to 31 mm, large sizes. An elongate shell, elongate-ovate, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip neither expanded nor reflected and shell surface have with axial ribs which are crossed by spiral cords.

Habitat: 10-15 m.

Distribution: Indonesia, Malaysia and Thailand.

Fossil Records: Pliocene and Quaternary of Indonesia; Holocene of Thailand.

Subfamily Photinae Gray, 1857**Genus** *Phos* Montfort, 1810*Phos senticosus* (Linnaeus, 1758)

Pl. 2, Figs. 11 (a, b)

Description: Shell height to 34 mm, large sizes. An elongate shell, fusiform, shell coiled to the right (dextral), basal shell character is rimately perforate shell, shell lip is reflected, aperture have slightly ribs and shell surface have strong axial ribs which are crossed by spiral cords.

Habitat: Sand in intertidal to 50 m.

Distribution: Indo-Pacific, Australia and Thailand.

Genus *Nassaria* Link, 1807

Nassaria pusilla (Röding, 1798)

Pl. 3, Figs. 1 (a, b)

Description: Shell height to 25 mm, medium sizes. An elongate shell, elongate-ovate, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip neither expanded nor reflected, aperture have slightly ribs and shell surface have with axial ribs which are crossed by spiral cords.

Habitat: mud and coarse sand in 1-165 m.

Distribution: Persian Gulf, Indonesia, China Sea and Thailand

Fossil Records: Miocene of India; Pliocene of Indonesia.

Family Nassariidae Iredale, 1916

Subfamily Nassariinae Iredale, 1916

Genus *Nassarius* Dumeril, 1806

Nassarius nodiferus (Powys, 1835)

Pl. 3, Figs. 2 (a, b)

Description: Shell height to 25 mm, medium sizes. An elongate shell, elongate-ovate, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip is reflected and shell surface have axial ribs.

Habitat: Sandy and silt in intertidal and subtidal.

Distribution: Indo-Pacific, Malaysia, Indonesia, Singapore, India, Taiwan, Japan, China and Thailand.

Nassarius pullus (Linnaeus, 1758)

Pl. 3, Figs. 3 (a, b)

Description: Shell height to 20 mm, medium sizes. An elongate shell, elongate-ovate, shell coiled to the right (dextral), basal shell character is rimately perforate shell, shell lip is reflected, aperture have slightly ribs and shell surface have axial ribs.

Habitat: Sands, rocks, corals, rocky and mud flats in mangroves to intertidal and subtidal.

Distribution: Indo-West Pacific, Mauritius, New Caledonia, Japan, Malaysia, Singapore and Thailand.

Fossil Records: Pliocene of Indonesia; Quaternary of the Red Sea area.

Nassarius siquijorensis (Adams, 1852)

Pl. 3, Figs. 4 (a, b)

Description: Shell height to 26 mm, medium sizes. An elongate shell, elongate-ovate, shell coiled to the right (dextral), basal shell character is rimately perforate shell, shell lip is reflected and aperture have slightly ribs. Shell surface have slender ribs and of spiral grooves in the furrows between ribs.

Habitat: Fine sandy and muddy in sublittoral and upper bathyal zones

Distribution: Indo-Pacific, New Caledonia, Red Sea, Japan, Tolo Channel, Hong Kong and Thailand.

Fossil Records: Late Middle Miocene to Quaternary of Indonesia; Holocene of Thailand.

Family Melongenidae Gill, 1867

Genus *Pugilina* Schumacher, 1817

Subgenus *Pugilina (Hemifusus)* Swainson, 1840

Pugilina (Hemifusus) tuba (Gmelin, 1731)

Pl. 3, Figs. 5 (a, b)

Description: Shell height to 120 mm, large sizes. An elongate shell, elongate-fusiform, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip neither expanded nor reflected and shell surface have with axial ribs which are crossed by spiral cords.

Habitat: sandy and muddy in 10 - 70 m.

Distribution: China, Japan and Thailand.

Family Olividae Latreille, 1825

Subfamily Olivinae Latreille, 1825

Genus *Oliva* Bruguière, 1789

Oliva miniacea Röding, 1798

Pl. 3, Figs. 6 (a, b)

Description: Shell height to 34 mm, large sizes. An elongate shell, cylindrical, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip neither expanded nor reflected and spire short and body whorl long. Colors are brown zigzag lines.

Habitat: Sand and muddy.

Distribution: Southwest-Pacific, Queensland, Philippines and Thailand.

Family Costellariidae MacDonald, 1860

Genus *Vexillum* Röding, 1798

Vexillum curviliratum (Sowerby II, 1874)

Pl. 3, Figs. 7 (a, b)

Description: Shell height to 21 mm, medium sizes. An elongate shell, fusiform, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip neither expanded nor reflected and shell surface have with axial ribs which are crossed by spiral cords.

Habitat: Sand in intertidal to depth 20 m.

Distribution: Queensland, Vietnam, Papua New Guinea, Indonesia, Philippines, Japan and Thailand.

Superfamily Cancellarioidea Gray, 1853

Family Cancellariidae Gray, 1853

Subfamily Cancellariinae Forbes & Hanley, 1851

Genus *Scalptia* Jousseaume, 1887

Scalptia scalariformis (Lamarck, 1822)

Pl. 3, Figs. 8 (a, b)

Description: Shell height to 24 mm, medium sizes. An elongate shell, ovate, shell coiled to the right (dextral), basal shell character is rimately perforate shell, shell lip is reflected and aperture have slightly ribs and shell surface have with axial ribs which are crossed by low spiral cords.

Habitat: Find sand and under rocks in intertidal and infralittoral.

Distribution: Mozambique, Australia, Japan, Malaysia, Tolo Channel, Hong Kong and Thailand.

Superfamily Conoidea Rafinesque, 1815

Family Turridae Swainson, 1840

Subfamily Drilliinae Olsson, 1964

Genus *Tomopleura* Casey, 1904

Tomopleura pouloensis Jousseau, 1883

Pl. 3, Figs. 9 (a, b)

Description: Shell height to 27 mm, medium sizes. An elongate shell, fusiform, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip neither expanded nor reflected and shell surface have spiral ribs.

Habitat: Sand in 5m-70m.

Distribution: Japan, West Pacific and Thailand.

Subfamily Turriculinae Blainville, 1824

Genus *Turricula* Schumacher, 1817

Turricula javana (Linnaeus, 1767)

Pl. 3, Figs. 10 (a, b)

Description: Shell height to 62 mm, large shell. An elongate shell, elongate-fusiform, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip neither expanded nor reflected shell, surface have spiral ribs and siphonal canal long.

Habitat: Sands, rocks and muddy in intertidal and sublittoral.

Distribution: Indo-Pacific, Mozambique, Queensland, Japan and Thailand.

Fossil Records: Late Miocene of Indonesia; Pliocene of India and Indonesia; Quaternary of Indonesia; Holocene of Thailand.

Subfamily Zonulispirinae MacLean, 1971

Genus *Ptychobela* Thiele, 1925

Ptychobela nodulosa (Gmelin, 1791)

Pl. 3, Figs. 11 (a, b)

Description: Shell height to 40 mm, large shell. An elongate shell, elongate-fusiform, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip neither expanded nor reflected. Shell surface have tubercles and spiral ribs.

Habitat: 10-20 m.

Distribution: India, Australia and Thailand.

Family Terebridae Mörch, 1852

Genus *Terebra* Bruguière, 1789

Terebra evoluta Deshayes, 1859

Pl. 3, Figs. 12 (a, b)

Description: Shell height to 43 mm, large shell. An elongate shell, turreted-elongate, shell coiled to the right (dextral), basal shell character is imperforate shell, shell lip neither expanded nor reflected and shell surface have axial ribs.

Habitat: Sand.

Distribution: West Pacific, Red Sea, Japan and Thailand.

Subclass Heterobranchia Gray, 1840

Superorder Allogastropoda Haszprunar, 1985

Superfamily Architectonicoidea Gray, 1840

Family Architectonicidae Gray, 1840

Genus *Architectonica* Röding, 1798

Architectonica perdix (Hinds, 1844)

Pl. 3, Figs. 13 (a-d)

Description: Shell diameter to 43 mm, large shell. An elongate shell, conical-depressed, shell coiled to the right (dextral), basal shell character is umbilicate shell, shell lip neither expanded nor reflected and shell surface have axial ribs.

Habitat: Sandy in 15-50 m.

Distribution: Eastern India, west-central Pacific Oceans, Australia, Polynesia, Hong Kong and Thailand.

Fossil Records: Holocene of Thailand.

Class Bivalvia Linnaeus, 1758
 Subclass Pteriomorpha Beurlen, 1944
 Order Arcoida Stoliczka, 1871
 Superfamily Arcoidea Lamarck, 1809
 Family Arcidae Lamarck, 1809
 Subfamily Arcinae Lamarck, 1809
 Genus *Barbatia* Gray, 1842

Barbatia signata (Dunker, 1868)

Pl. 4, Figs. 1 (a, b)

Description: Shell length to 57 mm. Subrectangular-elongate in length, shells is thick and moderately convex. Hinge teeth are taxodont and shell surface have radial ribs. Anterior is round and posterior is subtriangular.

Habitat: Rock in intertidal to 54m.

Distribution: Indian Ocean, China Sea and Thailand.

Subfamily Anadarinae Reinhart, 1935
 Genus *Anadara* Gray, 1847

Anadara granosa (Linnaeus, 1758)

Pl. 4, Figs. 2 (a, b)

Description: Shell length to 88 mm. Ovate-rectangular, shells is thick and convex. Hinge teeth are taxodont and shell surface have about 19-20 strongly noded radial ribs. Anterior is round and posterior is subtriangular.

Habitat: Embayment mud bottom in mangrove forest, intertidal zone to 10 m.

Distribution: India, southern Japan, Malaysia and Thailand.

Fossil Records: Late Miocene of Indonesia and Philippines; Pliocene of Indonesia, Philippines, Taiwan and Japan; Quaternary of Southeast Asia, Taiwan and Japan; Holocene of Thailand.

Anadara oblonga (Philippi, 1849)

Pl. 4, Figs. 3 (a, b)

Description: Shell length to 35 mm. Ovate-elongate, shells is thick and moderately convex. Hinge teeth are taxodont and shell surface have about 21-22 narrow, minutely noded ribs. Anterior is round and posterior is slightly sharp.

Habitat: Mud and sand in intertidal to 10 m.

Distribution: Philippines, Taiwan, West Pacific and Thailand.

Fossil Records: Late Miocene of Indonesia; Pliocene of Indonesia and Taiwan; Quaternary of Indonesia, Thailand and Taiwan; Holocene of Thailand.

Anadara sp.

Pl. 4, Figs. 4 (a, b)

Description: Shell length to 53 mm. Ovate-rectangular, shells is thick and convex. Hinge teeth are taxodont and shell surface have about 35-39 radial ribs. Anterior and posterior are round.

Subgenus *Anadara* (*Cunearca*) Dall, 1898

Anadara (*Potiarca*) *pilula* (Reeve, 1843)

Pl. 4, Figs. 5 (a, b)

Description: Shell length to 29 mm. Subtrigonal, shells is thick and convex. Hinge teeth are taxodont and shell surface have about 25-26 radiating ribs. Anterior and posterior are round.

Habitat: Fine muddy sand in 8-12 m.

Distribution: Australia, Philippines and Thailand.

Subgenus *Anadara* (*Scapharca*) Gray, 1847

Anadara (*Scapharca*) *inaequivalvis* (Bruguiere, 1789)

Pl. 4, Figs. 6 (a, b)

Description: Shell length to 86 mm. Ovate-rectangular, shell is thick and convex. Hinge teeth are taxodont and shell surface have about 34-37 radial ribs. Anterior is round and posterior is subtriangular.

Habitat: Sandy and muddy in intertidal and upper infralittoral zones.

Distribution: Indo-Pacific, Red Sea, Australia, Japan, Mediterranean and Thailand.

Fossil Records: Late Miocene and Pliocene of Indonesia; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Family Noetiidae Stewart, 1930

Subfamily Striarcinae MacNeil, 1938

Genus *Scelidionarca* Oliver, 1987

Scelidionarca *pectunculiformis* (Dunker, 1866)

Pl. 5, Figs. 1 (a, b)

Description: Shell length to 33 mm. Roundly-trapezoidal, shells is thick and moderately convex. Hinge teeth are taxodont. Shell surface have low radial ribs and commarginal lines. Anterior is slightly sharp and posterior is round.

Habitat: Mud flats seaward of the mangrove Forest.

Distribution: India, Southwest Pacific and Thailand.

Fossil Records: Holocene of Thailand.

Order Mytiloidea Férussac, 1822

Superfamily Mytiloidea Rafinesque, 1815

Family Mytilidae Rafinesque, 1815

Subfamily Modiolinae Keen, 1958

Genus *Modiolus* Lamarck, 1799

Modiolus philipinarum (Hanley, 1844)

Pl. 5, Figs. 2 (a, b)

Description: Shell length to 60 mm. Elongate-subtriangular, shells is thin and moderately convex. Hinge teeth are taxodont, shell surface have commarginal lines. Anterior is round and posterior is subtriangular.

Habitat: Muddy and sandy in intertidal to 54 m.

Distribution: Indo-Pacific, Mozambique, Red Sea, Australia, Japan, Hong Kong and Thailand

Fossil Records: Early Miocene of Mozambique; Middle Miocene of the Philippines; Quaternary of South Africa; Holocene of Thailand.

Order Ostreoida Férussac, 1822

Suborder Ostreina Férussac, 1822

Superfamily Plicatuloidea Watson, 1930

Family Plicatulidae Watson, 1930

Genus *Plicatula* Lamarck, 1801

Plicatula chinensis Mörch, 1853

Pl. 5, Figs. 3 (a, b)

Description: Shell length to 54 mm. Ovate-triangular, shells is thick and flat. Hinge teeth are isodonta. Shell surface have commarginal lines and radial tubercles. Anterior is round and posterior is extensive.

Habitat: Rock in intertidal to subtidal.

Distribution: Queensland, Australia, Australia, Indo-China, Japan, East China Sea, Taiwan and Thailand.

Fossil Records: Holocene of Thailand.

Suborder Pectinina Waller, 1978

Superfamily Pectinoidea Rafinesque, 1815

Family Pectinidae Rafinesque, 1815

Subfamily Chlamydinae Von Teppner, 1922

Genus *Chlamys* Röding, 1798

Chlamys cloacata (Reeve, 1853)

Pl. 5, Figs. 4 (a, b)

Description: Shell height to 26 mm. Suborbicular, shells is thin and flat. Hinge teeth are isodonta, shell surface have about 20 radiating ribs. Anterior and posterior are round. Colors are brown and black.

Habitat: Mud and sand in intertidal to subtidal.

Distribution: Indo-China, Queensland, Malaysia and Thailand.

Subfamily Patinopectininae Masuda, 1962

Genus *Minnivola* Iredale, 1939

Minnivola pyxidata (Born, 1778)

Pl. 5, Figs. 5 (a, b)

Description: Shell length to 40 mm. Suborbicular, shells is thin, right valve is moderately convex and left valve is flat. Hinge teeth are isodonta. Shell surface have radial ribs. Anterior and posterior are round. Colors right valve are white and left valve are white spot on brown background.

Habitat: Sand in the 5-100 m.

Distribution: Red Sea, Australia, South China Sea and Thailand.

Fossil Records: Pliocene and Quaternary of Indonesia; Holocene of Thailand.

Family Propeamussidae Abbott, 1954

Genus *Amusium* Röding, 1798

Amusium pleuronectes (Linnaeus, 1758)

Pl. 5, Figs. 6 (a, b)

Description: The sample collected only left valve. Shell height to 59 mm. Suborbicular, shells is thin and rather flat with smooth. Inner sides the shells have distinct radiating ribs. Hinge teeth are isodonta. Anterior and posterior are round. Color is white.

Habitat: Sand in 5-80 m.

Distribution: Indian Ocean, West Pacific and Thailand.

Superfamily Anomioidea Rafinesque, 1815

Family Placunidae Gray, 1842

Genus *Placuna* Lightfoot, 1786

Placuna placenta (Linnaeus, 1758)

Pl. 6, Figs. 1 (a, b)

Description: Shell length to 150 mm. Flat orbicular, shells is thin, fragile, long and widely. Shell surface have commarginal lines. Anterior and posterior are round.

Habitat: Sand and mud in mangrove swamps, intertidal to 20 m.

Distribution: Indo-Pacific, Red Sea, Australia, China, Japan, Malaysia, Singapore, Hong Kong and Thailand.

Fossil Records: Late Miocene of Indonesia and Philippines; Pliocene of Indonesia, Philippines, Taiwan and Japan; Quaternary of Indonesia; Holocene of Thailand.

Subclass Heterodonta Neumayr, 1884

Order Veneroida H. & A. Adams, 1856

Superfamily Lucinoidea Fleming, 1828

Family Ungulinidae H. & A. Adams, 1857

Genus *Cycladicama* Valenciennes in Rousseau, 1854

Cycladicama oblonga (Hanley, 1856)

Pl. 7, Figs. 1 (a, b)

Description: Shell length to 50 mm. Ovate-triangular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior is round and posterior is subtriangular.

Habitat: Fine sandy and muddy in 10-50 m.

Distribution: Japan and Thailand.

Fossil Records: Middle Miocene to Quaternary of Indonesia, Philippines, Taiwan and Japan; Holocene of Thailand.

Superfamily Chamoidea Lamarck, 1809

Family Chamidae Lamarck, 1809

Genus *Chama* Linnaeus, 1758

Chama brassica Reeve, 1847

Pl. 7, Figs. 2 (a, b)

Description: Shell length to 37 mm. Ovate, shells is thick and moderately convex. Hinge teeth are pachyodont, shell surface have many pores. Anterior and posterior are round. Muscle scars and pallial line can be seen clearly.

Habitat: Coral in littoral.

Distribution: Red Sea, Philippines and Thailand.

Superfamily Cardioidea Lamarck, 1809

Family Cardiidae Lamarck, 1809

Subfamily Cardiinae Lamarck, 1809

Genus *Vepricardium* Iredale, 1929

Vepricardium coronatum (Spengler, 1799)

Pl. 7, Figs. 3 (a, b)

Description: Shell length to 39 mm. Subcircular, shells is thick and convex. Hinge teeth are heterodont, shell surface have about 33-39 radiating ribs. Anterior is round and posterior is subtriangular. Colors are light pink.

Habitat: Muddy, sandy or mixed bottoms in intertidal and infralittoral.

Distribution: Indo-Pacific, South Africa, Indonesia, Japan

Fossil Records: Pliocene of Malaysia and Indonesia Quaternary of the Indo-Pacific area; Holocene of Thailand.

Superfamily Mactroidea Lamarck, 1809

Family Mactridae Lamarck, 1809

Subfamily Mactrinae Lamarck, 1809

Genus *Mactra* Linnaeus, 1767

Mactra cumingii Reeve, 1854

Pl. 7, Figs. 4 (a, b)

Description: Shell length to 89 mm. Ovate-triangular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior and posterior are round. Pallial sinus is short and contiguous posterior adductor scar.

Habitat: 10 and 15 m.

Distribution: Australia and Thailand.

Mactra luzonica Reeve, 1854

Pl. 7, Figs. 5 (a-d)

Description: Shell length to 29 mm. Ovate-triangular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior and posterior are round. Pallial sinus is short and contiguous posterior adductor scar.

Habitat: Muddy and sand in infralittoral.

Distribution: Pakistan, Australia, South China Sea and Thailand.

Fossil Records: Holocene of Thailand.

Subgenus *Mactra* (*Coelomactra*) Dall, 1895

Mactra (*Coelomactra*) *antiquata* (Spengler, 1802)

Pl. 7, Figs. 6 (a, b)

Description: Shell length to 67 mm. Ovate-triangular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior and posterior are round. Pallial sinus is short and contiguous posterior adductor scar.

Habitat: Sandy mud in intertidal to 20m.

Distribution: Korea, Hong Kong, Japan and Thailand.

Superfamily Solenoidea Lamarck, 1809

Family Solenidae Lamarck, 1809

Genus *Solen* Linnaeus, 1758

Solen curtus Des Moulins, 1832

Pl. 8, Figs. 1 (a, b)

Description: Shell length to 92 mm. Elongate, shells is straight, cylindrical and thin. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior and posterior are rectangular. Anterior adductor muscle scar is elongate.

Habitat: Sandy and muddy in intertidal.

Distribution: India, Southwest Pacific oceans, South Africa, Japan and Thailand.

Fossil Records: Holocene of Thailand.

Family Cultellidae Davies, 1935

Genus *Cultellus* Schumacher, 1817

Cultellus lacteus (Spengler, 1794)

Pl. 8, Figs. 2 (a, b)

Description: Shell length to 113 mm. Oblong-elliptical, shells is thin and flat. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior and posterior are round. Pallial sinus is wide and shallow.

Habitat: Mud in mangrove forest.

Distribution: Indo-Pacific, Malaysia, Singapore and Thailand.

Fossil Records: Holocene of Thailand.

Superfamily Tellinoidea de Blainville, 1814

Family Tellinidae de Blainville, 1814

Subfamily Tellininae de Blainville, 1814

Genus *Tellina* Linnaeus, 1758

Tellina capsoides Lamarck, 1818

Pl. 8, Figs. 3 (a, b)

Description: Shell length to 32 mm. Subtriangular, shells is thin and flat. Hinge teeth are heterodont, shell surface have low commarginal ribs. Anterior is subtriangular and posterior is round. Pallial sinus is deep and wide.

Habitat: Sand and mud in mangrove forest and intertidal to 60 m.

Distribution: Indo-Pacific, South Africa, Queensland, Fiji, Japan and Thailand.

Tellina cygnus (Hanley, 1844)

Pl. 8, Figs. 4 (a, b)

Description: Shell length to 18 mm. Ovate-oblong, shells is thin and flat. Hinge teeth are heterodont, shell surface have low commarginal ribs. Anterior is subtriangular and posterior is round.

Habitat: Sandy and muddy in intertidal to subtidal.

Distribution: China Sea, Hong Kong, Indonesia and Thailand.

Fossil Records: Pliocene of Indonesia; Quaternary of the southwest Pacific area; Holocene of Thailand.

Tellina timorensis (Lamarck, 1818)

Pl. 8, Figs. 5 (a, b)

Description: Shell length to 26 mm. Elongate-subquadrangular, shells is thin and flat. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior is round and posterior is subtriangular.

Habitat: Sand in intertidal to 25 m.

Distribution: Indo-Pacific, Red Sea, Japan, Indonesia and Thailand.

Fossil Records: Upper Miocene of Indonesia, Philippines and Japan; Pliocene and Quaternary of Indonesia; Holocene of Thailand.

Tellina spengleri (Gmelin, 1791)

Pl. 8, Figs. 6 (a, b)

Description: Shell length to 32 mm. Suboval, shells is thin and flat. Hinge teeth are heterodont. Shell surface have 2 dorsal rows of small spines and respectively commarginal ribs. Anterior and posterior are slightly oblique.

Habitat: Sand in intertidal to 20 m.

Distribution: Indian Ocean, Southwest Pacific, Red Sea, Indonesia, China Sea. Malaysia, Singapore and Thailand.

Fossil Records: Pliocene of Indonesia; Holocene of Thailand.

Tellina sp.

Pl. 8, Figs. 7 (a, b)

Description: Shell length to 50 mm. Ovate-triangular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have low commarginal ribs. Anterior is rectangular and posterior is round.

Subfamily Macominae Olsson, 1961

Genus *Psammotreta* Dall, 1900

Subgenus *Psammotreta* (*Tellinimactra*) Lamy, 1918

Psammotreta (Tellinimactra) edentula (Spengler, 1798)

Pl. 8, Figs. 8 (a, b)

Description: Shell length to 73 mm. Ovate-triangular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior is subtriangular and posterior is round. Pallial sinus is deep and wide.

Habitat: Mud and sand, mangroves and intertidal to 10 m.

Distribution: Red Sea, Australia, China Sea, Java and Thailand.

Fossil Records: Holocene of Thailand.

Family Psammobiidae Fleming, 1828

Subfamily Psammobiinae Fleming, 1828

Genus *Gari* Schumacher, 1817

Gari truncata (Linnaeus, 1767)

Pl. 9, Figs. 1 (a, b)

Description: Shell length to 39 mm. Elongate-subquadrangular, shells is thin and flat. Hinge teeth are heterodont, shell surface have low commarginal ribs. Anterior is rectangular and posterior is round.

Habitat: Sand in intertidal to subtidal.

Distribution: Queensland, Indian Ocean, China, Malaysia, Hong Kong and Thailand.

Family Solecurtidae d'Orbigny, 1846

Subfamily Solecurtinae d'Orbigny, 1846

Genus *Solecurtus* de Blainville, 1824

Solecurtus exaratus (Philippi, 1849)

Pl. 9, Figs. 2 (a, b)

Description: Shell length to 150 mm. Elongate-subrectangular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have uneven commarginal lines crossed by fine ridges that are subvertical posteriorly, oblique on the middle part. Anterior and posterior are round. Pallial sinus is very deep.

Habitat: sand and mud in 5 to 30 m.

Distribution: Philippines, South China Sea and Thailand.

Fossil Records: Late Miocene and Pliocene of Indonesia; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Genus *Azorinus* Récluz, 1869

Azorinus abbreviatus (Gould, 1861)

Pl. 9, Figs. 3 (a, b)

Description: Shell length to 79 mm. Elongate-subrectangular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have commarginal lines on the middle part. Anterior and posterior are round. Pallial sinus is rounded.

Habitat: Sandy and muddy in intertidal and infralittoral.

Distribution: Indo-Pacific, Red Sea, Torres Strait, Japan, China and Thailand.

Fossil Records: Early Miocene of India; Middle Miocene of India and Myanmar; Upper Miocene of India and Indonesia; Pliocene of India, Indonesia, Philippines, Taiwan, Japan, New Hebrides and Fiji; Quaternary of Indo-Pacific area; Holocene of Thailand.

Superfamily Veneroidea Rafinesque, 1815

Family Veneridae Rafinesque, 1815

Subfamily Circinae Dall, 1896

Genus *Circe* Schumacher, 1817

Circe scripta (Linnaeus, 1758)

Pl. 9, Figs. 4 (a, b)

Description: Shell length to 51 mm. Subtrigonal-ovate, shells is thick and flat. Hinge teeth are heterodont, shell surface have low commarginal ribs. Anterior is round and posterior is rectangular. Muscle scars and pallial line can be seen clearly.

Habitat: Sand in lower intertidal zone to 20 m.

Distribution: Japan, Indo-West Pacific and Thailand.

Subfamily Chioninae Frizzell, 1939

Genus *Anomalocardia* Schumacher, 1817

Anomalocardia squamosa (Linnaeus, 1758)

Pl. 9, Figs. 5 (a, b)

Description: Shell length to 37 mm. Subtrigonal, shells is thick and moderately convex. Hinge teeth are heterodont, shell surface have radial ribs and low commarginal ribs. Anterior is rounded and posterior is sharp.

Habitat: Mud in mangrove and intertidal.

Distribution: Australia, Japan and Thailand.

Fossil Records: Late Miocene and Pliocene of Indonesia.

Genus *Placamen* Iredale, 1925

Placamen calophylla (Philippi, 1846)

Pl. 9, Figs. 6 (a, b)

Description: Shell length to 31 mm. Subtrigonal-ovate, shells is thick and moderately convex. Hinge teeth are heterodont, shell surface have distant raised commarginal high ridges. Anterior is rounded and posterior is rectangular. Lunule is convex.

Habitat: Muddy sand, sand or shell gravel in intertidal zone to 100 m.

Distribution: Indo-Pacific, Madagascar, Australia, East China Sea and Thailand.

Fossil Records: Late Miocene of Indonesia and Philippines; Pliocene of India, Indonesia, Fiji, Philippines, Taiwan and Japan; Quaternary of Southeast Asia; Holocene of Thailand.

Placamen chloroticum (Philippi, 1849)

Pl. 9, Figs. 7 (a, b)

Description: Shell length to 31 mm. Subtrigonal-ovate, shells is thick and moderately convex. Hinge teeth are heterodont, shell surface have distant raised commarginal high ridges. Anterior is rounded and posterior is subtriangular. Lunule is convex.

Habitat: Muddy sand, sand or shell gravel in intertidal zone to 100 m

Distribution: Indo-Pacific, Madagascar, Australia, East China Sea and Thailand.

Fossil Records: Middle and Upper Miocene of Indonesia; Pliocene of Indonesia, Philippines, Taiwan and Japan; Quaternary of Indonesia; Holocene of Thailand.

Subfamily Meretricinae Gray, 1847

Genus *Meretrix* Lamarck, 1799

Meretrix meretrix (Linnaeus, 1758)

Pl. 9, Figs. 8 (a, b)

Description: Shell length to 68 mm. Trigonal to ovate-trigonal, shells is thick and moderately convex. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior is rounded and posterior is subtriangular. Pallial sinus is small. Colors are very variable.

Habitat: Sand and mud in mangrove forest, intertidal to 20 m.

Distribution: Indo-Pacific, South Africa, Indonesia, Japan and Thailand.

Fossil Records: Upper Miocene of Japan; Pliocene of Indonesia, Philippines, Taiwan, China and Japan; Quaternary of West Pacific area; Holocene of Thailand.

Subfamily Pitarinae Stewart, 1930

Genus Pitar Römer, 1857

Pitar sp.

Pl. 10, Figs. 1 (a, b)

Description: Shell length to 26 mm. Ovate-triangular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior is subtriangular and posterior is rounded.

Subfamily Tapetinae H. & A. Adams, 1857

Genus *Marcia* H. & A. Adams, 1857

Marcia hiantina (Lamarck, 1818)

Pl. 10, Figs. 2 (a, b)

Description: Shell length to 51 mm. Ovate-quadrangular, shells is thick and moderately convex. Hinge teeth are heterodont, shell surface have low commarginal ribs. Anterior and posterior are round. Pallial sinus is oval. Lunule is convex.

Habitat: Mud and sand in intertidal zone to 20 m.

Distribution: Indo-Pacific, Red Sea, Queensland, Japan and Thailand.

Fossil Records: Quaternary of Indonesia; Holocene of Thailand.

Genus *Paphia* Röding, 1798

Paphia undulata (Born, 1778)

Pl. 10, Figs. 3 (a, b)

Description: Shell length to 44 mm. Elongate-oval, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have low commarginal lines. Anterior and posterior are round. Pallial sinus is oval.

Habitat: Muddy in intertidal to 50 m.

Distribution: Indo-Pacific, Red Sea, Australia, Japan, Malaysia and Thailand.

Fossil Records: Upper Miocene of Indonesia and Japan; Pliocene of Indonesia, Philippines, Taiwan and Japan; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Subgenus *Paphia* (*Protapes*) Dall, 1902

Paphia (*Protapes*) *gallus* (Gmelin, 1791)

Pl. 10, Figs. 4 (a, b)

Description: Shell length to 45 mm. Ovate, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have low commarginal ribs. Anterior and posterior are round. Pallial sinus is deep.

Habitat: Sand and mud in intertidal.

Distribution: Indo-Pacific, Aden, Torres Strait, South China Sea and Thailand.

Fossil Records: undetermined Miocene of Indonesia; Pliocene of Madagascar and Mozambique; Quaternary of Japan; Holocene of Thailand.

Subfamily Dosiniinae Deshayes, 1853

Genus *Dosinia* Scopoli, 1777

Dosinia cretacea (Reeve, 1851)

Pl. 10, Figs. 5 (a, b)

Description: Shell length to 18 mm. suborbicular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have low commarginal lines. Anterior and posterior are round. Pallial sinus is deep. Lunule is small.

Habitat: Mangrove.

Distribution: India, Red Sea, Indonesia, Malaysia, Philippines, Papua New Guinea and Thailand.

Fossil Records: Middle and Upper Miocene of Indonesia; Pliocene of Indonesia and Philippines; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Dosinia dilecta Adams, 1856

Pl. 10, Figs. 6 (a, b)

Description: Shell length to 36 mm. Orbicular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have low commarginal lines. Anterior and posterior are round. Pallial sinus is deep. Lunule is small and deeply.

Habitat: Coarse loose sand at low water mark in sheltered bays.

Distribution: Andaman Sea, Indonesia, Malaysia and Thailand.

Fossil Records: Holocene of Thailand.

Dosinia trailli Adams, 1855

Pl. 10, Figs. 7 (a, b)

Description: Shell length to 46 mm. Roundly quadrangular, shells is thin, moderately convex and shield-shaped. Hinge teeth are heterodont, shell surface have low commarginal lines. Anterior and posterior are round. Pallial sinus is deep. Lunule is small and deeply.

Habitat: Intertidal.

Distribution: Indonesia, Japan and Thailand.

Fossil Records: Holocene of Thailand.

Dosinia tumida (Gray, 1838)

Pl. 10, Figs. 8 (a, b)

Description: Shell length to 40 mm. Orbicular, shells is thin, moderately convex and shield-shaped. Hinge teeth are heterodont, shell surface have low commarginal lines. Anterior and posterior are round. Pallial sinus is moderately deep. Lunule is small.

Habitat: Sand and mud in intertidal to 100 m.

Distribution: Indo-Pacific and Thailand.

Fossil Records: Middle Miocene of Indonesia; Late Miocene of Indonesia and Japan; Pliocene of Japan and Korea; Quaternary of Japan; Holocene of Thailand.

Order Myoida Stoliczka 1870

Suborder Myina Stoliczka, 1870

Superfamily Myoidea Lamarck, 1809

Family Corbulidae Lamarck, 1818

Subfamily Corbulinae Lamarck, 1823

Genus *Corbula* Bruguière, 1797

Subgenus *Corbula* (*Notocorbula*) Iredale, 1930

Corbula (*Notocorbula*) *fortisulcata* Smith, 1879

Pl. 10, Figs. 9 (a, b)

Description: Shell length to 17 mm. Subtrigonal-ovate, inequivalve and almost equilateral, shells is thick. Hinge teeth are heterodont. Shell surface right valve have coarse commarginal ribs and left valve with faint, sparse, concentric ribs.

Habitat: Fine sandy and muddy in intertidal zone to 70 m.

Distribution: Southwest Pacific, Taiwan and Thailand.

Fossil Records: Upper Miocene and Pliocene of the Philippines; Holocene of Thailand.