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Class Bivalvia, Lamellibranchiata

by Z.A. Filatova

UNEDITED TRANSLATION
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These are bilaterally symmetrical mollusks, the body of which is laterally enclosed in a shell with two valves hinged dorsally by an elastic band called the hinge ligament; from the inside the valves are pulled together by one or two muscles. Two wide dermal folds, the mantle lobes, adjoin the valves inside the shell; these lobes are open on all sides ^{are} or fused in one or several places. The body of the mollusk itself, its internal organs, lie within the mantle cavity between the mantle folds. The posteriorly fused edges of the mantle form the exhalant (upper) and inhalant (lower) apertures which can develop into tubes of various length called siphons. The foot, which varies in shape, is directed anteriorly; it often has a byssal gland, the secretion of which enables the shell to permanently or temporarily attach itself to the substratum. The gills are paired and are present on both sides of the body; in the most primitive species they resemble rows of contracted ctenidium-type lamellae; in most species they are observed in the form of complex reticulo-lamellose, double (or four-rowed) branchial lamellae on each side of the body; a horizontal mantle septum is formed when the gills are reduced.

* The numbers in the right-hand margin are the pages of the Russian text - translator.

The head and its appendages are lacking. The mouth, which often has oral lobes, leads to the oesophagus; the stomach has the form of an intestinal thickening with a digestive gland; there is a caecum with a "crystalline style" at the entrance to the stomach.

The heart is pierced by the intestine and has two auricles. The kidneys and gonads are paired; the kidneys open into the mantle cavity by means of two pores on the sides of the body. The gonads open into the mantle cavity near the kidney outlets or into them. As a rule, these mollusks are diclinous, less frequently hermaphroditic. The central nervous system is made up of three pairs of ganglia. The mollusks develop from an individual egg, cleavage is spiral, equal, with or without metamorphosis. The larva is of the trochophore type, which later develops into a veliger larva.

The following are data on the external and internal structure of bivalve mollusks, which are of importance for the determination of the latter.

The shell consists of two halves or *v a l v e s*, for the most part symmetrical, but often varying in convexity, surface sculpturing and colour (particularly in sessile or decumbent forms). Only the siphons, foot, edges of the mantle, and sometimes the labial palps are exposed from the shell (fig. 43 A). Both valves are joined together at the upper margin by an elastic band called the hinge ligament, and pulled together from the inside by special short adductor muscles, the scars of which are quite visible on the inner surface of the shell (fig. 43 B, C, G).

The shell has an apical point called the *u m b o*, a protuberance near the upper (dorsal) margin, which is the oldest part of the shell, frequently bearing the embryonic shell. In equal-sided shells the umbo lies in the centre of the dorsum, in shells with unequal sides it is displaced anteriorly (406) (*p r o s o g y r a t e u m b o*) or less frequently posteriorly (*o p i s t h o - g y r a t e u m b o*). It is usually inclined or even curved toward the

anterior, is convex or inflated, high or low and has the form of a tubercle. We further distinguish the different margins of the shell. The upper (hinge), or dorsal margin, where we find the umbo and ligament (and on the inside the hinge teeth), may be straight (Arcidae, Pectinidae), sometimes forming "ears" of various size along the sides (Pectinidae), arcuate (Nuculidae) or slightly sloping (most bivalve mollusks). The lower or ventral margin is usually arcuate or almost straight. The anterior margin is usually rounded and narrower than the posterior one which is wider, sometimes truncated straight, frequently gaping or drawn out in the form of a rostrum or beak (fig. 43 B, C, D). The shape of the shell is important when identifying the mollusk. If we view the dorsal margin from above and direct the rounded, usually tightly locked edge (at which the foot and usually the umbo are directed) away from us and have the posterior (often gaping edge from which the siphons extend, with the ligament behind the umbones) facing us, then the right and left valves will be positioned to the right and left of the longitudinal axis of the shell respectively.

The umbones in most bivalve mollusks come in close contact with each other or, in any case, come close together; they are infrequently (Lima, Arca) separated by a flattened area between them (fig. 43, E). There is often a depressed lanceolate areola (lunula) in front of the umbo; the second areola (interarea), which corresponds to the first, is located behind the umbo (fig. 43 D). (407)

The hinge ligament is an elastic band which attaches the valves to each other on the outside (external ligament), or is inserted between the hinge lines of both valves under the umbones (internal ligament). In the first case, the ligament may resemble a short ridge, usually

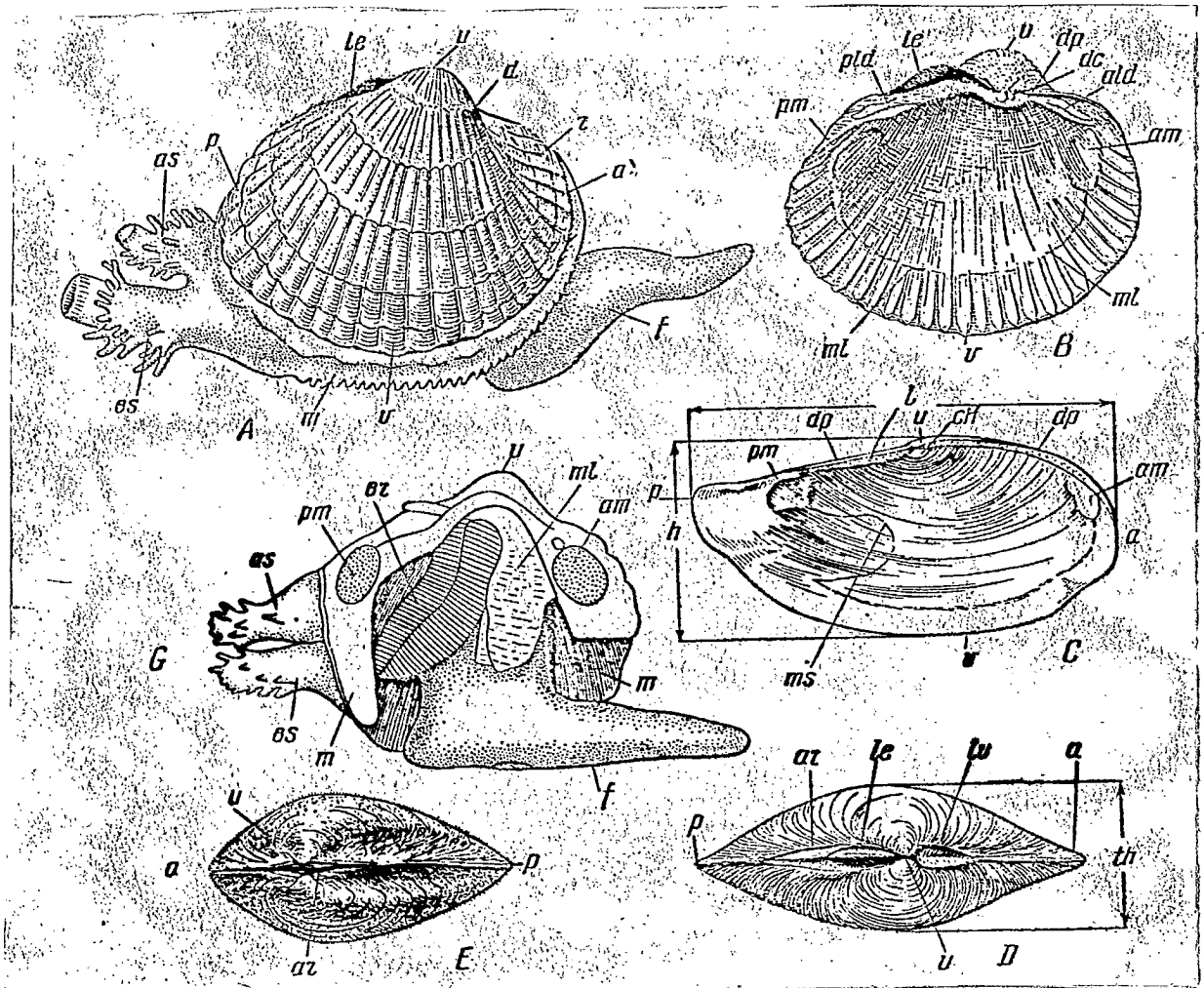


Figure 43. Structure of the body and shell of Bivalvia. A - general view of a bivalve mollusk from the right side (*Cardium*); B - view of left valve from the inside (*Cardium*); C - the same (*Joldia*); D - view of shell from the top, dorsal side (*Astarte*); E - the same (*Arca*); G - general view of the body (*Cardium*) with the shell and part of the mantle removed from the right side. Symbols: l - length, h - height, th - thickness of shell; a - anterior, p - posterior, v - ventral, d - dorsal margin of the shell; u - umbo, r - radial costae, ar - interarea, lu - lunula, le - external ligament, ch - chondrophore of internal ligament, dp - hinge plate or hinge line; dc - central, ald - anterior lateral, pld - posterior lateral hinge teeth; am - anterior, pm - posterior adductor muscles and their scars on the inner surface of the shell; m - mantle, ml - entire mantle line, sm - scar of mantle sinus; as - anal (exhalant) siphon, bs - branchial (inhalant) siphon; br - gills, ml - mouth cavities, f - foot.

located behind the umbones (opisthodontic ligament) and less frequently on both sides of them, along the dorsal margin (amphidontic ligament). The internal ligament is located on the *chondrophore* (resembles a socket, between teeth), a cochleariform cavity of the hinge line or, in the case where the latter is highly developed, peculiar cochleariform processes of the hinge line in either both valves (*Periploma*) or only one (*Mya*). The structure of the internal ligament is often complex, i.e. it separates into 2-3 parts (*Pandora*) or is combined with the external ligament. The internal ligament is usually composed of two layers: an outer rigid and entirely horny layer and an inner resilient one (resilium); the latter may consist only of cartilage or contain a calcareous component, a *lithodesma* (in most *Anomalodesmata*), apart from the cartilage. The structure of the ligament in *Bivalvia* is highly variable: some have only the external ligament (most of the *Eulamellibranchia*) or only the internal one (*Ledidae*; *Nuculidae*), or a combination of both; others have no ligament at all (*Teredo*). Because of its elasticity, the hinge ligament causes the valves to open when the adductor muscles that pull them together relax. In some cases, when the hinge is poorly developed or lacking altogether, the ligament is the only means of closing the valves (*Mytilus*, *Saxicava*).

The form of the shell and its exterior in bivalve mollusks are highly diverse and are one of the main distinctive, though at the same time the most variable features not only within families, but in genera as well.

We distinguish the length of the shell (the greatest being the distance from front to back - l), its height (the maximum is the distance from the umbo to the ventral margin - h) and thickness (maximum distance between the right and left valves th, c) (fig. 43, C, D). It is mainly

the ratio between these three elements that varies within a species (elongated, contracted, compressed, inflated forms). The shell is usually compressed from the sides and the length exceeds the height; the shell has a spherical - or elongated - ovate or spherical-triangular or cordate form. The height of the shell rarely exceeds its length (Lima, Grenella; plate CVII, 8; CVIII, 11). The form of the shell is determined by the mode of life of the animal: the shell is usually symmetrical in free-living mollusks, sharply asymmetrical in sessile mollusks (Anomia; plate CVIII, 1 - 3); in mytilids, which attach themselves to the substratum laterally, the umbo is displaced toward the anterior end of the shell, frequently coinciding with it, and the shell becomes cuneate-elongated (euthetic or mytilid-type shell; plate CVIII, 4-10); in the free-living forms that lie on one side the shell becomes inequivalved, the lower valve being more convex than the upper one (pleurothetic shell of Pectinidae). In burrowing or boring forms (Mya, Saxicava) the shell may vary greatly; in some there appears a sizeable gape through which the siphons (posterior gape) and often feet (anterior gape) emerge; in others the shell is greatly reduced, covering only the front part of the body (Teredo); in Saxicava the shell often acquires the form of its burrow in the rock or ground (plate CXII, 3-9). The shell exterior is highly diverse in structure and surface sculpturing, ranging from the altogether smooth and shiny ones (Joldia, Nucula, the majority of Portlandia; plate CVI, 1-8) to those covered with radial (Pectinidae, plate CVII; Cardiidae) or concentric (Astartidae, plate CIX; Liocyma) costae, or the finely striated ones (Cyprina). Sometimes the surface sculpturing (radial folds) is found only on the posterior end of the shell (Thyasira; plate CX, 12-14), or else the entire surface is rugose with rough parallel growth lines (Saxicava). The valves may be covered with leathery-scaly hairs (Arca, Limopsis; plate CVI, 9-14) or with spines and

granules (some of the Cardiidae, Poromya). The shell exterior is frequently white and calcareous with only concentric growth lines (Mya, Macoma, Periploma).

The p e r i o s t r a c u m or horny layer also varies greatly; in (408) some mollusks it is thick and highly developed (Astarte borealis), or thin but very hard (all the other Astarte and many others), or desquamatory (Macoma), or barely visible (a number of Cardiidae, etc.).

The h i n g e serves to close the valves of the shell and represents a series of projections along the edges of the shell, which are located inside the latter under the umbones, along the dorsal margin on the so-called h i n g e p l a t e. In most bivalve mollusks the latter is well-developed and bears teeth of various structure. The number, form and arrangement of the teeth are of great importance in the taxonomy of bivalves. So-called "teeth patterns" have been suggested for more accurate notation of the hinge parts; for example, the left valve is marked by the letter L, and the right one by the letter R; the teeth are marked by Arabic numerals, the indentations between them by zeros, the ligament by the letter C, the lateral teeth by the letter b and the indentations corresponding to them by the letter m or m_2 (if they are double ones). The teeth are counted from the posterior end of the valve (Doll, Bronn and others). For example, if the teeth pattern is L. b (0 1 0 1 0 1) 0 and R. 0(1 0 1 0 1 0)b, it means that there are three cardinal teeth in each valve; apart from this, there is one posterior lateral tooth in the left valve (L) and one anterior lateral tooth in the right valve (R). However, these teeth patterns are not applied extensively. There are several types of h i n g e s (fig. 44). Initially, the shell in the oldest forms of mollusks apparently had no hinge at all. The primitive type of hinge is one row of small teeth which may be the remains of the tips of the radial costae that have curved into the shell and become detached from their

main part. The connection with the costae was gradually lost and their tips developed into a useful device, i.e. teeth, which serve to fasten the valves and which now are present even in forms that have no costae at all.

The t a x o d o n t-type hinge is, therefore, the most primitive and consists of two rows of identically arranged teeth on both sides of the umbo; these teeth are either long and slightly curved (Joldia, Portlandia) or short and blunt (Arca, Limopsis; plate CVI; fig. 44 A, B). In the order Anisomyaria this hinge is reduced and substituted by a d y s o d o n t-type hinge (Mytilidae) with smooth hinge line or with small tooth-like tubercles (Lima, Mytilus), but with a highly developed ligament (fig. 44 D; plate CVIII, 4-5). A d e s m o d o n t-type hinge is also found in forms where the teeth are completely reduced and the cartilaginous internal ligament is highly developed and lies on a distinctive cochleariform protuberance under the umbones (Mya, Periploma; fig. 44 H; plate CXII, 3-4, CXIII, 5). The majority of bivalves have a h e t e r o d o n t-type hinge with a well-developed hinge plate bearing several teeth in the middle, which alternate with indentations into which the teeth of the opposite valve fit. We distinguish the cardinal (c e n t r a l) teeth which are cuneate, elongated-triangular, sometimes lacinate at the top (Macoma) and the l a t e r a l teeth which are usually lamellar (front and back). The number, form and arrangement of the teeth in Heterodonta may vary greatly (fig. 44 E, F, G).

The s c a r s of various m u s c l e s which are attached to the shell are always quite visible on the inner surface of the valves (fig. 43 B, G). One of the major elements of the shell interior is the scar of the m a n t l e s i n u s or the edges of the mantle and the muscles which pull the siphons in and out. The form and depth of the sinus may vary greatly, depending on the length of the siphons; the longer the siphons, the stronger the retractor muscles and the deeper the sinus. The forms without siphons have no sinus.

The depth of the sinus may vary greatly, sometimes extending almost to the scar of the anterior adductor muscle (certain Macoma; fig. 43 C; plate CXI). Besides a sinus, the shell also bears the scars of the adductor muscles: a large one almost in the middle of the shell (Monomyaria; plate CVII, 1 b1) or two of different size (Anisomyaria). However, most bivalves have two muscle scars of equal size (anterior and posterior) arranged symmetrically on the anterior and posterior ends of the shell.

The body of the mollusk under the shell is covered on both sides with a mantle, a leathery sheet which in form and size corresponds to that of the shell it secretes. The edges of the mantle may be free, unfused (an open mantle is observed in Nuculidae, Anomiidae, Pectinidae) or may be fused posteriorly, at first partially, and then completely (the closed mantle of numerous forms). At first, after the formation of one coalescence, there appears an anal (exhalant, upper) aperture, and after the formation of a second coalescence a branchial (inhalant, lower) aperture. Further changes consist in extension of the posterior edge of the mantle in the area of the siphon openings (after which very long and powerful siphons are often formed). In numerous bivalves the fusion of the mantle under the lower siphon progresses farther, leaving only a small pedal aperture. In some of the Bivalvia with a closed mantle we observe *offset* of the siphons (Erycinidae) where one of the siphons moves forward. Finally, we may observe the formation of a closed mantle with 4 apertures (and with 3 corresponding fusions); the fourth aperture serves as an outlet for the byssus which is often vestigial (Thracia). The size of the siphons may differ with particularly long siphons in burrowing and boring forms (Mya, Macoma, Teredo, etc.). The siphons may be separate (Macoma) or fused throughout, forming a single tube separated on the inside by a septum, but enclosed in a common membrane (Mya). The siphons are often equipped with valves. The length of the siphons is closely associated with

the mode of life of the bivalves, as feeding and respiration in deeply burrowing and boring forms can be accomplished only with the help of long siphons which they let out in order to filter the water and collect detritus. The forms which live free on the surface, as a rule, have short siphons or none at all (Astartidae, Cardiidae, Pectinidae, etc.) (fig. 43A; plate CVI, 8, CXII, 3, 6, 7).

The f o o t in Bivalvia serves as a means of locomotion and burrowing and is usually directed anteriorly. The form and size of the foot can vary considerably, depending on the mode of life of the animal: in forms moving freely over the surface the foot is usually highly extensible and has (410) on its distal end a folding s o l e (plate CVI, 8 ar) which can firmly stick to the surface of the substratum and is often edged with tiny denticles (Ledidae, Nuculidae). The foot is more often sharply cuneate, strong, soleless, geniculate (Cardium), sometimes sharply crenate along the lower edge (Serripes) or contracted (fig. 43 a; CVII, 12 a1). The development of the foot is associated with the development of the byssus by which the animal attaches itself to the substratum. The foot is usually highly reduced in attached surface dwellers which have a highly-developed byssus (Mytilidae). The b y s s u s is a tough, horny substance which is secreted by byssal glands at the base of the foot; in water it turns into thin, sturdy threads. The byssus sometimes has the form of a single tuft (Arca), often calcified (Anomia); in the second case, there is a special round aperture in the lower valve for ejection of the byssus, and the foot is reduced (plate CVIII, 1b). The forms which have a well-developed foot with a creeping sole have no byssus. The forms in which the foot loses its locomotive function and takes on the form of a finger or tongue have a highly-developed byssal gland (Pectinidae, Mytilidae, etc.). In certain bivalves the byssal mechanism is present at an

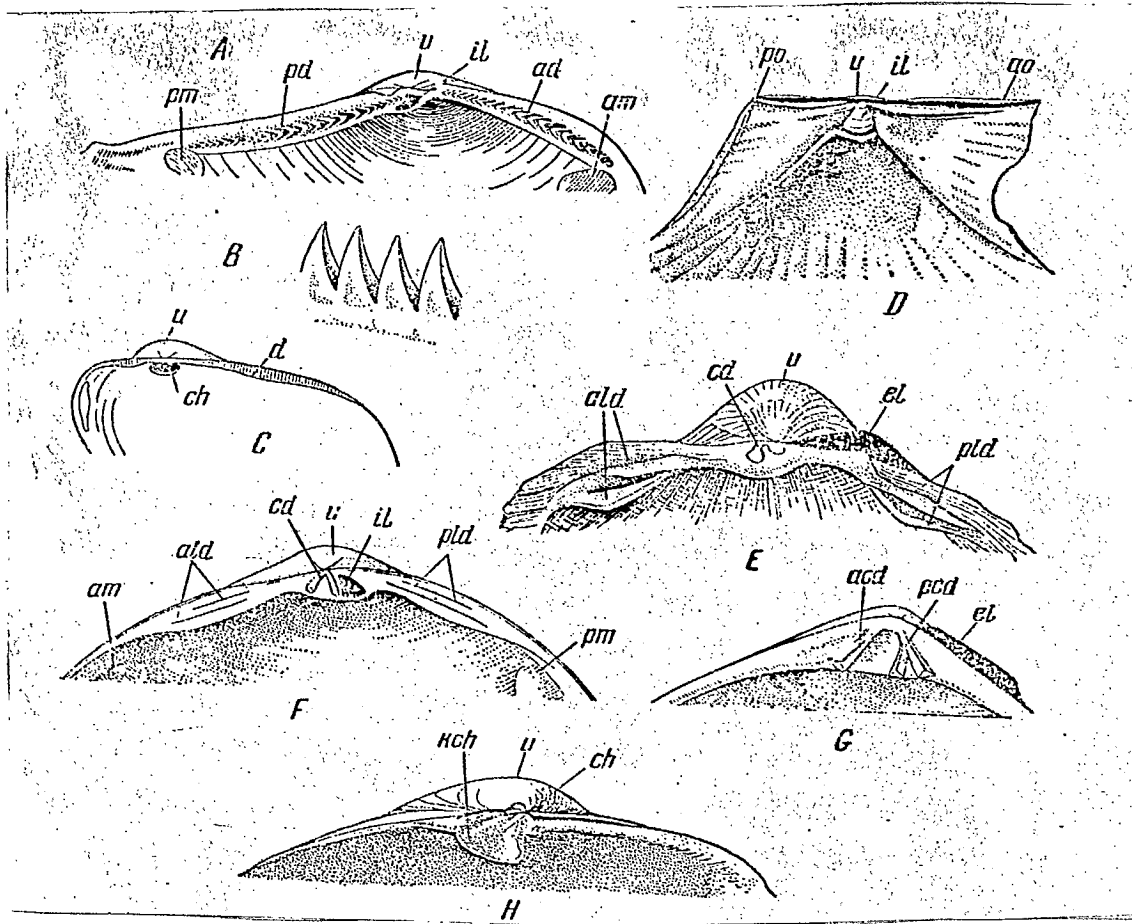


Figure 44. Structure of the hinge mechanism in Bivalvia. A - a taxodont-type hinge (*Leda*, left valve); B - the same, side view of teeth; D - a dysodont-type hinge (*Pecten*, left valve); C - hinge with an odontoidly striated edge (*Dacridium*, right valve); E - a heterodont-type hinge (*Cardium*, right valve); F - the same (*Mactra*, right valve); G - hinge with a lacinate posterior cardinal tooth (*Macoma*, right valve); H - a desmodont-type hinge (*Mya*, left valve). Symbols: u - umbo, il - internal ligament, ch - its chondrophore, el - external ligament, ad - front row of teeth, pd - back row of teeth, ao - anterior ear of upper left valve, po - posterior ear of upper left valve (*Pecten*), cd - central cardinal teeth, ald - anterior lateral teeth, pld - posterior lateral teeth, acd - anterior cardinal tooth, pcd - posterior (lacinate) cardinal tooth, kch - keel on chondrophore of left valve in *Mya*, am - anterior scar of adductor muscles, pm - posterior scar of adductor muscles.

early stage, but is reduced with age as the foot develops (certain Tellinidae, Myidae). The byssus disappears completely in forms with a highly-developed foot (Mactridae, Cardiidae). In certain forms the foot undergoes considerable change, acquiring a long, vermicular form (Ungulinidae, plate CX, 12 a1).

The b r a n c h i a l s y s t e m of bivalve mollusks is highly diverse and its structure very important for the taxonomy of this class.

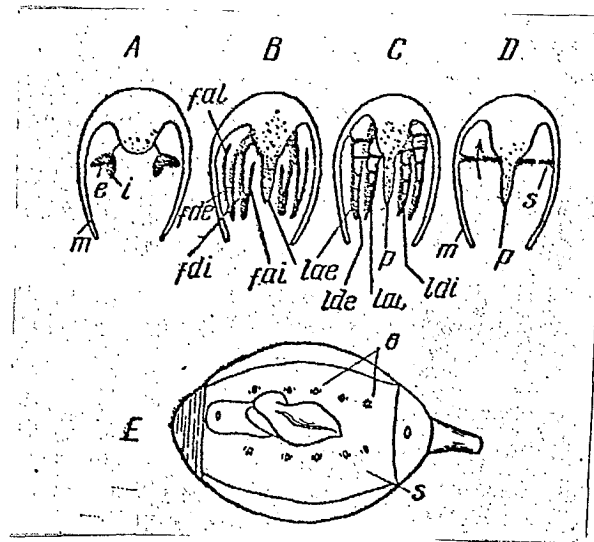


Figure 45. Structure of the branchial system in Bivalvia. A - phyllobranchiae (Protobranchiate); B - filamentous gills (Filibranchiata); C - true reticulolamellar gills (Eulamellibranchiata); D, E - gills transformed into a muscular septum (Septibranchia). Symbols: e - external gill leaflets, i - internal gill leaflets; fdi and fai - descending and ascending limbs of the internal gill filament; fde, fae - descending and ascending limbs of the external gill filament; ldi and lai - descending and ascending plates of the internal branchial lamella; ide and lae - descending and ascending plates of the external branchial lamella; s - septum, m - mantle, p - foot, b - gill slits.

The branchial system is represented in its most simple form, as ctenidia, in some of the members of the order Taxodonta (Nucula, Leda, Joldia), in which they resemble two rows of short, flat leaflets on each side of the body (which are inserted along a common longitudinal axis containing the afferent and efferent branchial vessels and located in the posterior dorsal part of the mantle cavity). Each gill leaflet has a cavity adjoined to the afferent vessel; there is no connection between it and the adjacent leaflets, except for a common base. The lower surface of the leaflets is enclosed by a ciliated epithelium which in its entirety creates a current of water along the gills (fig. 45, A).

F i l a m e n t o u s gills are somewhat complex (Filibranchia of previous classification, including Arcaceae and Anomiidae). The leaflets of these gills are longer, forming two rows of filaments on each side of the body, which freely overhang into the mantle cavity. Upon reaching the edges of the mantle below, they often turn upward, thus forming the a s c e n d i n g and d e s c e n d i n g limbs of the gill filaments (fig. 45, B). Rows of these filaments form the ascending and descending branchial "plates"; each branchial lamella consists of two of these "plates". Some of the filaments in them are quite independent, except that there may be a joining together of adjacent filaments by means of ciliated brushes and fusion below, at the bending point without any internal connection. The blood circulates through the small canals that extend the length of each gill filament which is divided in half by an internal longitudinal septum.

Further complication is observed in Heteromyaria (Pectinaceae) when the opposed descending and ascending "plates" are joined together by thin, connective-tissue membranes, interlamellar bridges; there are no blood vessels in these bridges at this point. The blood-stream in each filament flows in both directions (the blood flows in only one direction in each filament in

Eulamellibranchia).

The branchial system of Eulamellibranchia is the most complex among all the bivalves. The ascending and descending branchial plates and the adjacent filaments intergrow, forming an interlamellar adhesion when opposed plates fuse, and an interfilamentary adhesion when separate filaments fuse. All these adhesions contain blood vessels, at which stage the branchial plates resemble a continuous reticular leaf pierced by numerous openings with a whole system of afferent and efferent blood vessels. The branchial plates at this point may be smooth or plicate; in the second case the filaments are bunched dorsoventrally in fused folds and ridges. The longitudinal fusion of the ascending and descending plates occurs at regular intervals at the junction of the ridge-like groups of filaments. The water surrounding the gills can circulate freely through all the cavities and canals within each gill. The water current is created by the cilia covering each gill filament; the cilia are particularly long on the outer surface of the gills. Each external branchial lamella is attached along its entire length to the mantle. At the base of the gill both descending branchial plates fuse along the edges. The internal lamellae of the right and left gills fuse posteriorly, thus forming what appears to be a latticed septum between the mantle cavity below and the excretory chamber above which opens into the water via the upper exhalant anal siphon (fig. 45 C). In the order Anomalobranhia the branchial system is at first subjected to intense reduction (Anomalodesmata), and then the gills, as such, disappear completely (Septibranchia). In Anomalodesmata the gills are small, the external plate is curved upward, forming with the lower one a wide oval lamella; the upper plate consists of one row of rather short, thickened filaments, frequently grouped and fused by their ends only; the lower plate is more normally developed, still resembling the actual

"reticulate" gill of the Eulamellibranchia. The following stage in the reduction of the gills is the suborder Septibranchia. At this stage there appears at first a thin-filmed and then a more muscular horizontal septum pierced by rows or groups of openings through which the water passes into the upper chamber (fig. 45, D, E).

Bivalve mollusks play an extremely important role in the benthos of northern seas in the USSR and are encountered at various depths and in various substratum; they are most abundant at medium depths up to 100-150 m and on muddy, sandy bottoms, particularly in shallow, coastal waters.

The number of Bivalvia species inhabiting the northern seas is relatively small in comparison with other groups of invertebrates. However, in a number of areas they are the predominant forms, comprising the bulk of the benthic biomass.

In the B a r e n t s S e a there are approximately 80 species (not including subspecies) of bivalve mollusks; of these the most frequently encountered and abundant are Astarte crenata, A. borealis, A. montagui, Leda pernula, Arca glacialis, various species of Portlandia, Macoma and Thyasira, Nucula tenuis and Cardium ciliatum.

Many of these species of Barents Sea bivalves are highly important in the nutrition of benthophagous fish (haddock, flounders, catfish); the most important of these are Nucula tenuis, Leda pernula, Mactra elliptica, Portlandia lenticula, P. lucida, P. intermedia, Arca glacialis, Dacridium vitreum, Cardium fasciatum, Crenella decussata, the young of Macoma calcarea and Cyprina islandica, etc. Thus, the above mentioned fish feed on small, thin-walled, easily digestible mollusks. Forms over 2 cm, rarely 3 cm long with thick-walled shells are not consumed by fish.

We know of only 39 species of bivalve mollusks in the W h i t e S e a. These do not include many of the forms common to the Barents Sea, e.g. Astarte crenata, Propeamussium groenlandicum, Portlandia intermedia, P. lenticula, Cuspidaria arctica, etc.

Approximately 50 species of bivalve mollusks have been indicated for the K a r a S e a; these consist mostly of arctic and arctic-boreal species such as Leda pernula var. costigera, Propeamussium groenlandicum, Portlandia arctica, Serripes groenlandicus, Astarte borealis var. placenta, etc.

Only 23 species of bivalve mollusks have been found in the L a p t e v (412) S e a; the overwhelming majority of these belong to the high-arctic species.

We do not as yet know what species of Bivalvia inhabit the C h u k c h i S e a, but the list is apparently just as long as the one for the Kara Sea (approximately that of the Barents Sea), and is characterized by fauna of the North Pacific.

Key to the families of Bivalvia of the
northern seas of the USSR¹

1. (8) Taxodont-type hinge. Two adductor muscles of equal size (fig. 43 C; 44 A, B) (order Taxodonta) 2
2. (5) Hinge line straight. Shell surface covered with tiny, soft, leathery hairs arranged in radially-concentric rows. Ligament external. Umbones separate (fig. 43 E). Siphons lacking. (n/family Arcaceae) 3
3. (4) Shell obliquely rhomboid or trapeziform, sparsely covered with short hairs (these rub off in old individuals and the shell becomes greyish, calcareous) Arcidae (plate CVI, 10-14)
4. (3) Shell high, obliquely spherical, densely covered with fairly long hairs (particularly along lower margin) Limopsidae (plate CVI, 9)

¹The given characteristics of families refer mainly to the genera and species of bivalve mollusks inhabiting the northern seas of the USSR.

5. (2) All or anterior edge of hinge line arcuate. Shell exterior smooth. Ligament internal, lies in special depression under closely contiguous umbones (n/family Nuculaceae). . . . 6
6. (7) Shell small, high, rounded, **very** shiny, greenish, frequently iridescent. Siphons lacking Nuculidae (plate CV, 1-3)
7. (6) Shell elongated or slightly inequilateral, shiny, with a cariniform rostellum, or highly inequilateral with posterior end drawn out in the form of a rostrum, opaque, with thin, concentric striation or costation. Siphons and sinus present Ledidae (plate CV, 4-115 CVI, 1-8)
8. (1) Hinge of another structure; teeth, if present, are not pectinate, dentition varies (fig. 44, C-H) 9
9. (16) One large adductor muscle or two of different size (plate CVII, 1b1; CVIII, 4 br) (order Heteromyaria) 10
10. (15) Only one adductor muscle in centre of posterior corner of shell. Teeth lacking (suborder Monomyaria) 11
11. (14) Shell free, more or less equivalved, hinge line straight, forms projections or "ears" along sides (fig. 44 D) 12
12. (13) Shell spherical-flabellate, flattened, with radial (less frequently concentric) costae, or smooth. Umbones small, closely contiguous. Opening for byssus on lower surface of anterior ear. Ligament internal, located in depression in middle of hinge line. One of valves slightly more convex Pectinidae (plate CVII, 1-7)
13. (12) Shell high, oval-ovate with convex, considerably separated umbones, inflated, with barely noticeable median radial costae. Ears project slightly, opening for byssus lacking. Ligament external Limidae (plate CVII, 8-g)
14. (11) Shell sessile, inequivalved, of irregular spherical shape, dorsal margin uneven, lower flat valve with opening for byssal tuft ("foot") Anomiidae (plate CVIII, 1-3)
15. (10) Two adductor muscles, anterior one very small. Mytilid-type shell with umbo displaced to narrowed cuneate anterior margin; shell rarely spherical (*Crenella*). Dysodont-type hinge or hinge line with small denticulate lamellae (suborder Anisomyaria) Mytilidae (plate CVIII, 4-11) (413)
16. (9) Two adductor muscles of equal size (excluding family Ungulinidae), arranged symmetrically on anterior and posterior ends of body (fig. 43 G, B) 17
17. (40) Gills consist of two well-developed, double, smooth or plicate plates on each side, (fig. 43, G), formed as a result of the fusion of adjacent filaments and their ascending and descending limbs, representing permanent septa (fig. 45 C). Hinge teeth well-developed

- (excluding Adapedonta). Ligament without lithodesma. (Order Eulamellibranchia) 18
18. (35) Heterodont-type hinge (fig. 44 E, G, F), consists of 1-3 central teeth and lamellar lateral ones, the second type may be lacking (suborder Heterodonta) 19
19. (30) Sinus lacking, siphons short or lacking 20
20. (29) Adductor muscle scars rounded, of equal size, usual-type foot, wedge-shaped (fig. 43 A, G) 21
21. (26) Shell round, usually thick, sturdy, hinge well developed 22
22. (25) Two cardinal teeth in left valve, one, rarely 2 (or 3 poorly developed ones) in right valve 23
23. (24) Hinge plate thin. Lateral teeth well developed short, lamellar, distinctly removed from cardinal ones. Cordate shell with radial costae, less commonly smooth with ill-defined costas only on anterior-posterior margins of shell; lunula lacking
Cardiidae (plate CVIII, 12-13; CIX, 1-4)
24. (23) Hinge plate sturdy. Lateral teeth poorly developed, indistinctly separated from cardinal ones or lacking. Shell spherical-triangular, moderately convex, sturdy, with well-defined concentric costae of various width or only with fine concentric striations; lunula present (fig. 43 D) Astartidae (plate CIX, 5-11; CX, 1-8).
25. (22) Three strong, sharp, lamellar cardinal teeth in each valve, one elongated posterior lateral tooth in right valve. Shell oval-spherical, highly convex, with fine concentric striation and inflated umbo curved toward the anterior; lunula lacking
Cyprinidae (plate CX, 9)
26. (21) Shell not exceeding 3 mm, thin, fragile; hinge poorly developed 27
27. (26) Shell spherical-ovate, inflated, with thin concentric striation, umbo slightly displaced anteriorly. Two small central teeth, sometimes one lateral tooth Cyamiidae (= Kellyellidae) (plate CX, 17, 18).
28. (27) Shell oval, inequilateral, umbo displaced posteriorly; smooth or with ill-defined radial striation; one cardinal tooth
Montacutidae (plate CX, 10, 11)
29. (20) Posterior adductor muscle large and spherical, anterior one small and elongated, foot long, vermiform. Shell small, spherical, smooth or with two radial folds on posterior end. Two radially positioned teeth or one tooth, or hinge line thickened under umbo
Ungulinidae (plate CX, 12-16; CXI, 1)

30. (19) Mantle line forms sinus of varying depth, siphons long (plate CXI, 2 a1, 2 b1; CXII, 3 b1, 3 ar). Shell oval-triangular 31
31. (34) 2 - 3 cardinal teeth in each valve, one tooth laciniate; lateral teeth lacking (fig. 44 G). Ligament external 32
32. (33) Two cardinal teeth in each valve; a posterior one in the right valve and an anterior one in the left valve, both deeply laciniate. Sinus extends to $\frac{1}{2}$ length of shell or more. Siphons long, unfused. Valves smooth, calcareous or shiny . . . Tellinidae (plate CXI, 2-6) (414)
33. (32) Three cardinal teeth in each valve, median tooth in right valve, noticeably laciniate, remaining teeth weak or short and lamellar. Sinus less than $\frac{1}{2}$ length of shell; siphons long, partially fused. Valves shiny, covered with nonuniform concentric costae Veneridae (plate CXII, 1)
34. (31) One V-shaped, thin lamellar cardinal tooth in left valve, overlapped by two lamellar teeth in right valve. One lateral tooth in the anterior and one in the posterior of the left valve, and two of each in the right valve, lamellar, finely striated on the inside. External ligament weak, internal one strong, cartilaginous. Sinus not exceeding $\frac{1}{2}$ length of shell. Valves smooth Mactridae (plate CXII, 2)
35. (18) Teeth lacking or very poorly developed. Mantle fused (suborder Adapedonta) 36
36. (39) Usual shell and body; foot unreduced 37
37. (38) Ligament internal, fastened in left valve to special spoon-shaped process with central keel (fig. 44 H), and in right valve to semispherical socket under umbo. Shell gaping, elongated to oval or cut short posteriorly. Siphons very long, not fully retractable. Sinus deep and wide. Large burrowing forms Myidae (plate CXII, 3-6)
38. (37) Ligament external. Shell irregularly trapeziform, rough, thick- or thin-walled, elongated-rectangular. Gaping only posteriorly or at both ends. Siphons not long, fully retractable, sinus less than $\frac{1}{2}$ length of shell Saxicavidae (plate CXII, 9; CXIII, 1)
39. (36) Body long, vermiform, with small irregularly spherical shell only in anterior portion, shell bears rows of teeth for boring passages in wood. Foot highly reduced; siphons very long. Passages bored in wood lined with thin calcareous crust Teredinidae (plate CXII, 7, 8)

40. (17) External singular branchial lamella poorly developed, curved upward, or gills lacking, replaced by horizontal muscular septum with openings (fig. 45 D, E). Ligament internal, usually with lithodesma. Teeth lacking or poorly developed (Order Anomalobranchia, Anomalodesmata) 41
41. (48) Edges of external branchial lamellae fused with mantle, edges of internal ones well developed, fused together and with beginning of anal siphon. 42
42. (45) Shell inequilateral: umbo on anterior half or third of shell. Siphons short, sinus almost non-existent. 43
43. (44) Shell equivalved, oval-elongated, with thin radial costae fairly convex. Ligament internal, calcified Lyonsiidae (plate CXIII, 2,3)
44. (43) Shell inequivalved: right valve flat, left one cochleariform-convex, smooth. Ligament complex: external and internal (with lithodesma) Pandoridae (plate CXIII, 4)
45. (42) Shell equilateral, slightly inequivalved; right valve slightly more convex than left one. Siphons long, sinus quite deep 46
46. (47) Shell very thin, fragile, almost of regular semi-spherical shape, 1-2 ill-defined radial folds on posterior margin. Ligament internal, fastened to spoon-shaped processes in both valves Periplomatidae (plate CXIII, 5)
47. (46) Shell quite thick, oval-triangular, posterior end straight, slightly angular; slight radial convexity extends posteriorly downward from umbo. Ligament external Thraciidae (plate CXIII, 6) (415)
48. (41) Branchial septum present (fig. 45 D, E). Ligament internal (sub-order Septibranchia) 49
49. (50) Shell very small (4-6 mm), trapeziform, radially striated, highly inequilateral. Ligament with lithodesma. Branchial septum thin; branchial lamella vestigial, fuses with septum Verticordiidae (plate CXIII, 7)
50. (49) Shell larger (2-3 cm), of different shape. Branchial septum muscular, thick. Branchial plates lacking. Ligament cartilaginous 51
51. (52) Posterior end spherical-ovate, in inequilateral shell drawn out in form of narrow rostrum of various length. Valves smooth, with fine, concentric striation, calcareous. Teeth lacking Cuspidariidae (plate CXIII, 9, 10)

52. (51) Shell equilateral, triangular-spherical, inflated, posterior end obliquely truncated, short fold extends posteriorly downward from umbo. Valves opaque, semi-transparent, with microscopic granules. One small cardinal tooth in each valve Poromyidae (plate CXIII, 8)

Order TAXODONTA

Superfamily NUCULACEAE

Family N u c u l i d a e

Genus N u c u l a Lamarck (plate CV, 1-3)

Shell spherical-triangular, convex, inequilateral; umbones displaced and curved toward the posterior (opisthogyrate), located on posterior third or one-quarter length of shell, closely contiguous. Epidermis smooth, shiny. Hinge line arcuate; teeth small, long, sharp. Ligament internal, located in depression between two rows of teeth. Foot small, sole edged with denticles. Gills on each side of body resembling row of elongated-triangular, unfused lamellae inserted along common longitudinal axis (branchial artery).

The N u c u l a found in northern seas of the USSR belong to the subgenus Nucula s. str., in which the shell exterior is completely smooth or bears a fine concentric or radial striation, but without costae or lines that converge obliquely at an angle.

Key to Nucula species of the northern seas
of the USSR

1. (2) Shell moderately convex, umbones small, located on posterior third of shell. Posterior (shortened) margin even, almost straight. 10 teeth in back row, 18 in front row N. tenuis
2. (1) Shell small, inflated; umbones high, located on posterior one-quarter of shell. Posterior margin noticeably depressed medially. 4 teeth in back row, 9-10 in front row N. delphinodonta

Nucula tenuis (Montagu) (plate CV, 1 ar, br, cr, d)

Shell exterior shiny, green or greenish-grey, iridescent, nacreous inside. Length 13-14 (up to 17.5) mm.

Arctic-boreal species, widely distributed in the Barents, White and Kara seas and farther eastward; found at various depths (mostly up to 100 m) and on various types of bottoms, preferring muddy-sandy bottoms. Eurythermal form. Frequently forms mass colonies, e.g. in the shallow waters of the southeastern part of the Barents Sea; often found in large quantities in the stomachs of benthophagous fishes. (416)

N. tenuis var. expansa Reeve (plate CV 2 ar) is also widely distributed in the Barents, White and Kara seas and farther eastward. It has a more elongated and flattened shell than the major species, up to 16 mm long, yellowish green; the thickness: length ratio $\frac{c}{l}$ is 40-45%, the height: length ratio $\frac{h}{l}$ approximately 75%. Mass accumulations of N. tenuis var. inflata Hancock with a convex $\frac{c}{l}$ = 60% and high $\frac{h}{l}$ = 80-90%, dark-olive or brownish shell up to 16-17 mm long are frequently encountered in Siberian seas (e.g. Chukchi Sea). There is usually a number of imperceptible intergradations between all the indicated forms.

Nucula delphinodonta Mighels et Adams (plate CV, 3 ar, d, cr)

Shell small, spherical-triangular or obliquely oval, high, inflated. Teeth very thin, long, sharp, slightly curved. Surface of thin valves yellowish green. Length 4-5 mm.

Boreal species inhabiting southwestern part of the Barents Sea and waters off the Murman Coast, muddy and muddy-sandy bottoms.

Family L e d i d a e

Shell elongated with posterior end drawn out in the form of a rostrum, or lanceolate, or almost ovate with only a clearly defined keeled or smooth,

more or less pointed beak posteriorly. Elongated hinge line bears numerous pointed, basally V-shaped teeth. Mantle forms siphons of various length and small sinus. Gills "pinnate"; lamellae distinctly bilobed or rounded.

Key to genera of the family Ledidae of the
northern seas of the USSR

1. (2) Shell elongated, posterior end narrowed and drawn out in form of rostrum. Shell exterior opaque, with fine concentric striation, lamellar and costate, or with fine radial striation Leda
2. (1) Posterior end of shell does not form rostrum, but resembles pointed or blunt, frequently keeled rostellum. Exterior usually smooth, shiny, with growth lines 3
3. (4) Shell large, up to 5 cm long, oval-lanceolate, rather flattened, slightly gaping in the anterior, noticeably gaping in the posterior, sinus deep. Umbo small. Epidermis shiny, surface smooth, less commonly with obliquely concentric lines. More than 20 teeth in each row of hinge Joldia*
4. (3) Shell small (4-10 mm) or medium-sized (not more than 25 mm long), elongated- or spherical-oval, convex, less frequently inflated or flattened. Posterior margin not gaping, forms more or less sharply defined smooth or keeled rostellum. Sinus poorly developed. Umbo convex, rarely small. Epidermis shiny or opaque. Less than 20 teeth in each row Portlandia

Genus L e d a (= Nuculana Link, partim) Schumacher (plate CV, 4-8)

Posterior end of shell narrowed and drawn out in form of straight or more or less upwardly curved rostrum. Shell exterior with fine concentric striation, finely costate or lamellose and costate. Epidermis smooth or with fine radial striation, well distinguishable only when magnified. Siphons long, partially fused, sinus not very deep (usually not exceeding inner edge of posterior adductor muscle). Umbo small, located between third and halfway (417) point of shell.

*usually spelt Yoldia

Key to species and varieties of Leda of
the northern seas of the USSR

1. (6) Epidermis smooth, without radial striation 2
2. (5) Rostrum straight or almost straight 3
3. (4) Valves of contracted, inflated shell evenly covered with uniform, fine, concentric costation. Interspaces of equal size. Valve edges noticeably depressed just before end of rostrum
L. minuta
4. (3) Valves of oblong, moderately convex shell covered with fine unevenly spaced concentric costae. Interspaces of different size. Depression at end of rostrum lacking L. pernula pernula
5. (2) Highly elongated rostrum noticeably curved upward
L. pernula var. costigera
6. (1) Epidermis of shell with radial linear striation 7
7. (8) Rostrum of shell straight, shell high. Concentric striation very fine, radial, resembling lines with herring-bone ridges along sides and between them L. radiata radiata
8. (7) Rostrum curved upward considerably, shell elongated, low. Shell exterior with sharply-defined concentric lamellose costae. Radial striation in form of dark, thin, dichotomously branching lines
L. radiata var. lamellosa

Leda pernula (Muller) (plate CV, 4-5)

Shell with straight or slightly curved rostrum, covered with fine, unevenly spaced concentric costae, frequently passing into striation, usually converging completely on the rostrum. Epidermis smooth, flaking around the umbo. Interarea slightly depressed, sloping in both directions from dorsal margin. 18 teeth in front row, 24 in back row. Greyish yellow to greenish brown in colour. Length up to 25-27 mm, height up to 13-14 mm, thickness up to 7.5-8 mm. Arctic-boreal (North Atlantic) species, widely distributed in northern seas of USSR. Highly variable form with a number of varieties. Main form inhabits southern half of Barents and White seas; encountered singly in Kara Sea (plate CV, 4 ar, br, cr, d t); L. pernula var. costigera Leche, with elongated and flattened (particularly at posterior end) shell with long,

upwardly curved rostrum, with more distinct striation than in f. typica and a more sharply defined longitudinal costa on inner surface of rostrum. Up to 22 teeth in front row, up to 26 in back row. Length up to 42 mm, height up to 18.5 mm, thickness approximately 10 mm (plate CV, 5 ar, br, d). L. pernula var. costigera - an arctic form, widely distributed in the northern part of the Barents Sea and in the Kara Sea and farther eastward, though not observed in the Chukchi Sea. Inhabiting the White Sea together with f. typica is var. elongata Derjugin with a low shell, a very indistinct umbo, an altogether straight rostrum, with delicate, fine striation on light-yellow valves. Length up to 32 mm. Widely distributed in the White Sea, encountered at the lowermost depths.

Leda minuta (Muller) (plate CV, 6 ar, cl, d, t)

Shell small, inflated, drop-shaped, with contracted straight rostrum. Compact valves covered with fine, but uniform concentric costation, interspaces equal. Interarea flattened, even depressed, clearly confined by the upper of the two radial folds extending from umbo to corners of rather thick rostrum at the very end of which there is always a depression. 14-16 teeth in front row, up to 20-22 teeth in back row. Length 12-15 (up to 17) mm, height 6-9 mm, thickness 5-5.5 (up to 8) mm.

Arctic-boreal species found mostly along the coast and in shallow waters (418) of the Barents, White, Kara and Chukchi seas. Encountered most frequently on muddy-sandy bottoms at depths up to 100 m. Does not form mass accumulations as does Leda.

Leda radiata (Krause) [=L. pernula (Muller) var. radiata Krause] (plate CV, 7 ar, f)

Shell contracted, rather high, moderately convex, with straight wide rostrum, with fine concentric striation. Epidermis with darker radial lines and herring-bone ridges between them. Up to 18-20 teeth in front row, 20-25

teeth in back row. Dark-olive, greyish green in colour. Length up to 30 mm, height up to 15 mm, thickness up to 10 mm.

Arctic-boreal (North Pacific) form inhabiting the Chukchi and Bering seas. Widely distributed in the East Siberian and Chukchi seas and a little farther westward is the Arctic variety *L. radiata* var. *lamellosa* (Leche) [= *pernula* (Mull) var. *lamellosa* Leche] (plate CV, 8 ar, f) with a large shell and long, noticeably curved rostrum, with clearly-defined concentric lamellose costae. Epidermis with dark, ridge-like radial lines, usually dichotomously branched. From dark-olive to brownish green in colour. Length 27-30 mm and more, height 14-15 mm.

Genus Portlandia Mörch (plate CV, 9-11; CVI, 1-7)

Shell medium-sized (up to 25 mm) or small (about 5 mm), oval-ovate, slightly inequilateral, fairly convex, less commonly inflated or flattened, shiny or opaque. Posterior margin forms more or less clearly-defined, pointed, rounded or almost rectangular rostellum with dorsal margin. Two radial folds (more often a single, poorly-defined one in small species) extend posteriorly from umbo on posterior end of shell. Siphons short, half-fused, sinus shallow. Not more than 20 teeth in each row.

Umbo convex, sometimes small, located on anterior half of shell, less commonly in middle. Most of the members of the genus Portlandia, that inhabit northern seas of the USSR, belong to the subgenus Joldiella Verrill et Bush, which for the most part consists of small forms without a beak, with a smooth, often iridescent epidermis.

Key to Portlandia species of the northern
seas of the USSR

1. (12) Entire anterior margin of shell completely even, rounded. Length exceeds 5 mm 2
2. (3) Valves of opaque shell with two radial folds in the posterior, extending posteriorly from umbo, perceptible depression along edge of shell between folds. Rostellum on posterior end of shell pointed

or slightly obtuse. 7-8 teeth in front row, 9-11 in back row. Shell sturdy. Epidermis slightly rough, greenish brown or olive in colour
 P. arctica

3. (2) Posterior margin even, one poorly defined radial fold or lacking altogether. Rostellum on posterior end spherical or angular. Valves shiny 4
4. (9) Shell convex, sometimes even inflated; umbo convex, displaced anteriorly, valves quite compact 5
5. (8) Ventral margin lacking depression posteriorly. Epidermis greyish green, usually with darker concentric stripes. 6
6. (7) Ventral margin even, elongated, almost straight, posterior margin obliquely truncated, forming pointed rostellum with dorsal one. 15-17 teeth in front row, 16-18 in back row. Shell convex, elongated-oval P. intermedia
7. (6) Ventral margin convex, almost arcuate, posterior margin rises upward at a slope, forming a uniformly rounded, blunt rostellum with dorsal margin. 12 teeth in front row, 12-16 in back row. Shell inflated, oval-ovate P. lenticula
8. (5) Ventral margin of oval-ovate shell clearly depressed posteriorly. Rostellum rounded. Epidermis greenish yellow P. persei (419)
9. (4) Shell flattened, spherical-ovate or almost semi-spherical; umbo low, resembling a tubercle located almost at midlength of hinge line. Valves thin. Epidermis light-coloured 8
10. (11) Shell spherical-ovate. Valves iridescent, fragile, yellowish grey, pale. Straight posterior margin forms almost rectangular, pointed rostellum with dorsal margin. 9-12 teeth in each row P. lucida
11. (12) Shell almost equilateral, semispherical, anterior and posterior margins proportionally drawn out to both sides, ventral margin somewhat widened on posterior half. Valves thin, flattened, particularly toward edges. Posterior margin obliquely truncated from below, forming a slightly rounded rostellum with dorsal margin. 7-8 teeth in front row, 9-11 in back row P. frigida
12. (1) Anterior margin of very small inflated shell somewhat obliquely truncated at the top, due to which entire anterior margin becomes spherically prominent medially. Posterior margin forms blunt, somewhat distally curved rostellum with dorsal margin. 6 teeth in front row and about 10 teeth in back row. Length less than 5 mm. P. fraterna

Portlandia (Portlandia) arctica (Gray), (= Joldia arctica Gray)

The largest of all *Portlandia* species, high-arctic, almost circumpolar, encountered primarily in shallow waters of coastal zone and open waters of all northern seas of the USSR. Highly variable species, forming a number of varieties and forms.

P. arctica arctica (Gray) (plate CV, 9 ar, cr).

Shell moderately convex, somewhat inequilateral. Posterior margin sloped at the bottom, forming a depression confined by two radial, well-defined folds extending posteriorly from the umbo, one to the end of the "beak", the other to the lower edge of the depression. Umbones convex, directed posteriorly. Surface with fine concentric striation, opaque or with a dull shine. Greenish yellow or greenish brown in colour with darker concentric stripes and often with black spots formed by ferromanganese residue as well (observed in all the forms of this species). Length up to 26 mm. Height: length ratio $\frac{h}{l}$ 60-65%, thickness: length ratio $\frac{c}{l}$ 40-42%.

High~~er~~arctic form inhabiting shallow waters, less commonly at depths up to 100 m, in open waters, with salinity not less than 32%.

P. arctica var. portlandica Hancock, a low, highly elongated form. "Beak" often slightly raised, more so than in major form; radial folds well defined (plate CV, 10 ar).

$$\frac{h}{l} = 50-55\%, \frac{c}{l} = 37-40\%.$$

Found in open areas of the sea with salinity not less than 28%, often at considerable depths; prolific form of the White Sea.

P. arctica var. siliqua Reeve still preserves basic features of surface sculpturing of typical form, but has a more contracted and convex shell with a rougher surface sculpturing. Umbo rather high. Posterior end of shell resembles an isosceles triangle. $\frac{h}{l} = 63-75\%$, $\frac{c}{l} = 40-52\%$ (plate CV, 11 ar).

Apparently encountered rarely at high salinity and in open waters.

P. arctica var aestuariorum Mossewitsch, a moderately elongated, moderately inflated, almost oval shell, with an almost spherical, slightly drawn out posterior end, smooth or with barely noticeable radial folds on it. Umbo small, low. $\frac{h}{l} = 65\%$, $\frac{c}{l} = 43\%$. Epidermis yellowish-olive (plate CVI, 1 ar).

Inhabits highly freshwater areas, pro-estuarine areas and estuaries of the Pechora, Ob, Yenisei and Lena rivers where salinity does not exceed 1%.

Portlandia (Joldiella) intermedia (M. Sars) (plate CVI, 2 ar, c1) (420)

Shell convex, elongated-oval (length almost twice greater than height). Posterior margin noticeably sloped, forming pointed rostellum with dorsal margin; valves on posterior half of shell smooth, with no depression or folds, or, less commonly (in forms with an extremely pronounced rostellum), a second, indistinct (lower) fold beginning to show. Valves very shiny, as if lacquered, light-green or yellowish green. Length 12-16 mm.

Arctic, circumpolar species, widely distributed in all northern seas except White Sea. Not found in Kanin-Pechora area of Barents Sea; highest density of populations in northern, central and western parts of sea. Found on soft muddy bottoms, in middle and lower layers of sublittoral and deeper, at low above-zero and subzero temperatures. Frequently encountered in the stomachs of benthophagous fishes.

Portlandia (Joldiella) lenticula (Møller) (plate CVI, 3 ar, c1, d)

Shell small, ovate-elongated, inequilateral; convex umbo located on anterior third of shell. Posterior margin even, forms uniformly spherical rostellum with dorsal margin. Valves highly convex in centre, smooth, shiny, greenish grey in colour, sometimes with lighter concentric stripes. Length 6-7 mm.

Arctic, almost circumpolar species, widely distributed in all northern seas (except White Sea). Not found in Barents Sea only in southeastern shallows; found on soft muddy and muddy sandy bottoms in middle and lower layers of sublittoral. Encountered in masses in stomachs of haddock and flounders.

Portlandia (Joldiella) persei Messjatzev (plate CVI, 4 ar)

Very similar to P. lenticula, distinguished from latter by contracted posterior end which has a noticeable depression from ventral side. Lighter in colour than P. lenticula. Length up to 6 mm.

Arctic, deep-sea species, encountered in northern parts of Barents and Kara seas on brown muds with concretions at depths from 160 to 800 m, apparently finding its way to these areas from the Polar basin.

Portlandia (Joldiella) lucida (Lovén) (plate CVI, 5 ar, d)

Shell small, oval-ovate, highly flattened, slightly inequilateral: low umbo resembling tubercle located almost in middle of shell. Posterior margin converges with slightly sloped dorsal margin almost at a right angle, forming angular rostellum on upper part of posterior margin. Valves thin, fragile, semitransparent; light-coloured, whitish. Length 6 mm.

Boreal species, distributed in southwestern and southern parts of Barents Sea and along Murman Coast, not encountered in northern and eastern half of sea; sometimes encountered in northern part of Kara Sea. Found on soft muddy bottoms in middle and lower sublittoral zone at constant above-zero temperatures. Not encountered in White Sea and farther eastward.

Portlandia (Joldiella) frigida (Torell) (plate CVI, 6 ar, cl, d)

Shell of characteristic, almost semispherical form, highly flattened, equilateral: umbones low, located in middle of bilaterally, slightly sloped hinge line; anterior and posterior ends of shell uniformly drawn out. Valves highly flattened, particularly toward edges. Posterior and dorsal margins form

indistinct, slightly-rounded rostellum obliquely truncated at the bottom and posteriorly. Middle of ventral margin noticeably drawn out toward the bottom and somewhat laterally. Yellowish- or greyish-green in colour. Length 5.5 mm, height 4.1 mm, thickness 2.1 mm (maximum length up to 6.5 mm).

Arctic, circumpolar species, avoids warm currents. Not encountered in (421) Kanin-Pechora area and Novaya Zemlya bays in the Barents Sea, or in the White Sea. Found on soft muddy bottoms in lower layers of sublittoral at temperatures from 1 to 0°C and lower.

Portlandia (Joldiella) fraterna (Verrill et Bush) (plate CVI, 7 ar, cl, d)

Shell very small, convex, even inflated. Umbo located almost at midlength of shell. Posterior margin forms blunt, slightly curved rostellum with dorsal margin. Upper half of posterior margin slightly sloped, as is lower half; sometimes even slightly concave right under the rostellum. Anterior margin somewhat obliquely truncated at the top; hinge line almost straight. 5-6 small teeth in front row; 8-10 teeth in back row, of which 1-2 lateral ones are undistinguishable. Length 3-4 mm, height 2-2.3 mm, thickness 1.6-2 mm.

Arctic, circumpolar, widely distributed species (previously often confused with P. frigida). Barents, Kara, East Siberian and Chukchi seas, not indicated for the White Sea. Encountered everywhere in the Barents Sea except for Kanin-Pechora area and Novaya Zemlya bays. Inhabits muddy-stony bottoms at depths of approximately 100 m and less.

*
Genus J o l d i a Möller

Joldia hyperborea (Loveen) Torell

(plate CVI, 8 ar, c)

Shell elongated-lanceolate, posterior margin of flattened valves forms almost a right angle with dorsal margin posteriorly, gaping slightly. Posterior end somewhat narrower than anterior one which is obtuse-spherical, slightly

* Usually spelt Yoldia

gaping at the bottom where the foot protrudes. Ventral margin slightly arcuate. Shell equilateral. Umbo low, hinge line long, somewhat arcuate, with numerous denticles. Ligament located in spoon-shaped depression, almost at midlength of hinge line. Siphons long, sinus extends almost to midlength of shell. Slight radial depression extends posteriorly (sometimes anteriorly as well) from umbo on surface of valves. Valves shiny, greenish, olive-coloured, with darker concentric stripes. Up to 28 teeth in front row, up to 30 in back row. Length up to 4 cm, less commonly 5 cm; height approximately $\frac{1}{2}$ of shell length. Highly variable species. A number of authors associates it with Joldia limatula (Say), in which posterior end of shell is noticeably narrowed and slanted from the ventral side and there are fewer teeth, up to 22, in each row. The authors indicate that there is a number of imperceptible intergradations between J. limatula and the extreme forms of J. hyperborea (with almost the same width of the anterior and posterior ends of the shell).

High-arctic species, characteristic of cold shallow waters of northern seas where it lives on soft, muddy bottoms of the upper sublittoral. Abounds in southeastern shallows and the bays of Novaya Zemlya and Spitsbergen on the Barents Sea, and in southern part of the Kara Sea and farther eastward. Forms similar to the "limatula" type are encountered in northern seas of the USSR in low-arctic waters and areas bordering on the boreal zone. Another two large (up to 4 cm) Joldia, apart from J. hyperborea, are encountered in the Chukchi Sea. They are J. myalis Couthouy with a rather convex elongated-oval shell, with a slightly posteriorly displaced umbo, with a dark-olive epidermis and numerous growth lines; and J. (Cnesterium) scissurata Dall with a flattened oval shell, with a posteriorly displaced umbo, with obliquely concentric, depressed lines on the surface (absent on the posterior one-quarter of the shell) and with a very shiny epidermis; upper corner of posterior end of shell

is pointed and slightly raised, posterior dorsal edges of valves form small vertical ridges. Shell gapes noticeably at the front and back.

Superfamily ARCACEAE

Family Arcidae

Genus Arca Linne

Surface of rhomboid or spherical-trapeziform shell covered with a thin leathery, hairy epidermis. Ligament external, elongated, attached to folds of narrowly rhomboid ligament field between convex, highly separated umbones. Hinge line long, with sharp, lamellar teeth. Foot with byssus. Gills on both sides resemble two rows of free, upwardly curved filaments, each of which is joined to the adjacent one at the bending point and ends. (422)

We have encountered members of the subgenus Bathyarca Kobelt in northern seas of the USSR; this subgenus includes rather small, for the most part deep-sea forms in which the nearly straight hinge line under the umbones is devoid of teeth, while the latter become larger and oblique toward the ends of the rows. The shell is fairly thin, with no costae.

Key to Arca species of the northern seas of
the USSR

1. (2) Shell up to 30 mm long, elongated-rhomboid. 7-10 teeth in front row, 10-14 teeth in back row A. glacialis
2. (1) Shell small (up to 10-12 mm), spherical-trapeziform. Fewer teeth. 3
3. (4) Shell highly convex, with obliquely spherical ventral margin. Anterior margin slightly narrower than posterior one A. pectunculoides
4. (3) Shell moderately convex, with sharply sloped ventral margin. Anterior margin several times narrower than posterior margin which widens in the shape of an ear A. frielei

Arca (Bathyarca) glacialis Gray (plate CVI, 10 ar, cr, d)

Shell moderately convex, slightly inequilateral; rather convex umbones located between anterior third and halfway point of the shell. Posterior margin obliquely truncated from front to back. Short pubescence. Length up to 22-25 mm. 7-10 teeth in front row, 10-14 in back row.

Arctic, circumpolar species, widely distributed in northern seas on mixed muddy and stony bottoms, primarily in middle and lower layers of sublittoral. Not encountered in Barents Sea only in Pechora and Kanin areas.

Fjords of Novaya Zemlya and Spitsbergen and southern part of Kara Sea abound in high-arctic variety A. glacialis Messjatzev with large, high and inflated shell and slightly flaking epidermis due to which valves are for the most part grey, calcareous (plate CVI, 11 ar, cr, d).

Arca (Bathyarca) pectunculoides Scacchi (plate CVI, 12 ar, cr, d; 13 ar)

Shell spherical-trapeziform, highly convex, length only slightly exceeds height, covered with rows of short velvety hairs. Ventral margin spherical-arcuate, slightly sloped from front to back. Anterior margin only slightly narrower than posterior one. Length up to 13.5 mm.

Arctic-boreal (North Atlantic), deep-sea species; f. typica (12 ar, cr, d) prefers warmer waters, encountered along the coast of northern Norway, off the Murman Coast and southwestern part of Barents Sea, has shorter spherical shell, 3-4 teeth in front row, 4-6 teeth in back row; farther east- and northward we encounter its coldwater form, var. septentrionalis G. Sars (13 ar) with larger, elongated shell (up to 13.5 mm) with slight depression on anterior portion of ventral margin; 4-6 teeth in front row, up to 8 teeth in back row. On the whole, species inhabits all northern seas, including Chukchi Sea, primarily lower layers of sublittoral, soft muddy-stony bottoms.

Arca (Bathyarca) frielei Jeffreys (plate CVI, 14 ar, cr)

Distinguished from A. pectunculoides by highly sloped and narrowed shell anteriorly, often becoming triangular, with more sharply-defined rows of rather coarse hairs arranged radially. Hinge with three teeth in front, 4-6 in back. Length up to 10-11 mm (usually less).

Deep-sea ocean species found in deep-water areas of northern part of Barents and Kara seas, apparently penetrating from Polar basin. Found on soft, brown muds mixed with stones at depths from 150 to 200 and more metres. (423)

Family L i m o p s i d a e

Genus L i m o p s i s Sasso

Shell high (height equal to or exceeds length); asymmetrical: posterior end somewhat expanded and displaced posteriorly with respect to short hinge line, due to which entire shell seems slightly distorted. Umbones small, separated, on first one-quarter of shell. External ligament short, located in special triangular depression that opens outward. Ligament field broad, rhomboid. Hinge line short. Teeth short, inserted at right angle to dorsal margin. Foot narrow, long. Filaments of ascending branchial plate equal in length to those of descending plate.

Limopsis minuta Philippi (plate CVI, 9 al, cr)

Only species encountered in northern seas of USSR.

Shell moderately convex. Valves with distinct radial and less distinct concentric striation, densely covered with hairs which lengthen at ventral margin, becoming a rather thick border. Teeth small, short, obtuse, 5-6 teeth in both front and back rows. Length 8-12 mm.

Boreal species found in southwestern part of Barents Sea, on soft muddy bottoms, in middle and lower layers of sublittoral, at above-zero temperatures.

Order HETEROMYARIA

Suborder Monomyaria

Family P e c t i n i d a e

Species of this family, which inhabit the northern seas of the USSR, are small in size, less commonly large. The shell is free, flattened, spherical, with a straight hinge line forming more or less developed projections ("ears") on both sides (in front and back); there is a small opening for the byssus on the front ear of the right (lower) valve. The shell is either equivalved or inequivalved. The hinge line is smooth, with no teeth. The ligament is internal, sturdy, located in the middle of the hinge line under low, closely contiguous umbones. The adductor muscle is spherical, powerful, and located in the centre of the shell. The foot is small and reduced. The gills on each side consist of two rows of genuflexed, free gill filaments joined only at the bending point and at the ends (rarely in the middle). The ascending and descending plates are often interconnected by thin, connective-tissue membranes. The thickened edges of the mantle bear eyes and slender tentacles. There are no siphons. Many of the members of this family can move along the bottom by leaps or jumps, snapping their valves and ejecting a jet of water.

Key to genera of the family Pectinidae ofthe northern seas of the USSR

1. (2) Shell compact, sturdy, opaque, slightly inequivalved and almost equilateral (excluding well-developed ears, frequently varying in shape), 3-10 cm diameter. Valves with small, sharply-defined, narrow radial costae, often bifurcate or bunched, scaly or with delicate reticulate ornament or costae almost thread-like, branching. Ligament triangular at slit Pecten

2. (1) Shell thin, fragile, semitransparent, equivalved, or inequivalved, sometimes slightly asymmetrical, 10-35 mm in diameter. Valve surface smooth, more often with concentric lines or costae, or radially arranged rows of scales or spines; surface sculpturing of upper and lower valves usually differs Propeamusium

Genus P e c t e n Osbeck

(424)

Key to Pecten species of the northern seas
of the USSR

1. (4) Costae sharply defined, numerous, well-developed on entire surface of shell, with scales inserted on top; interspaces narrow. Shell slightly inequivalved: upper valve slightly more flattened, lower valve more convex. Ears approximately of same size (subgenus Chlamys Bolten) 2
2. (3) Costae alike, narrow, scaly, uniformly covering valves of large shell; narrow interspaces also lined with tiny scales. Height of shell slightly exceeds length P. (Chlamys) islandicus
3. (2) Costae vary in thickness, bunched in 4-5 smaller costae. Interspaces[†] completely smooth. Shell height considerably exceeds length P. (Chlamys) aratus
4. (1) Costae very poorly developed, small, almost thread-like, dichotomously branching, well-defined only along edges of shell. Shell equivalved. Ears differ: front ear about 3 times shorter than back ear (subgenus Camptonectes Agassiz) P. (Camptonectes) tigrinus

Pecten (Chlamys) islandicus (Müller) (plate CVII, 1 ar, bl, e)

Shell large, compact, spherical; upper valve brighter pink than lower one (often white). Length 75-77 mm, height up to 80 mm, thickness approximately 20 mm, rarely larger, up to 10 cm in diameter. Up to 35 main, rounded, slightly flattened, narrow costae, bifurcate toward edges of shell. Front ears somewhat larger. Byssal depression not exceeding one-third of ear bearing 5-6 tiny radial costellae. (For detailed description see "Bol'shoi praktikum po zoologii bespozvonochnykh", part II, Edited by Yu.I. Polyansky).

Arctic-boreal species, widely distributed in Barents and White seas; in Kara Sea only in southwestern shallow part, coming from warmer waters of Barents Sea. Found on muddy-sandy and sandy bottoms of upper and middle sublittoral. Chukchi Sea.

Pecten (Chlamys) aratus Gmelin (plate CVII, 2 al, cr, e)

Shell exterior bears 10-12 complex costae consisting of smaller bundles of costae. Ears of different size; posterior ear larger with reticulate surface due to crossing of longitudinal and transverse folds. Pale pink or light-brick in colour. Length 24 mm, height 27 mm.

Boreal species encountered in the Barents Sea only along the shores of northern Norway and western Murman (not beyond Varanger Fjord eastward) at temperatures not less than 3-4°C on mixed sandy-stony and sandy bottoms of sublittoral.

Pecten (Camptonectes) tigerinus Müller (plate CVII, 3 al, cr, e)

Shell rather high, noticeably narrowed in upper half. Both valves dark-red or deep-pink with indistinct, lighter spots. Length 22 mm, height 24 mm.

Boreal species found in coastal areas of southwestern part of Barents Sea and off the coast of western Murman, on clean sandy-shelly bottoms in upper sublittoral at constant above-zero temperatures.

Genus Propeamusium Gregorio

(425)

Key to Propeamusium species of northern seas of the USSR

1. (4) Shell exterior smooth, without costae or scales 2
2. (3) Shell flattened, slightly inequilateral: lower, slightly flatter valve overlapped by upper, larger and more convex one. Length of shell slightly exceeds height. Ears obtuse, almost identical. Lower valve may bear thin concentric striation Pr. (Actinula) groenlandicum
3. (2) Shell almost round, both valves equally convex, smooth. Length of shell almost equal to height. Ears differ: front ear short, obtuse, barely separated from shell disc, posterior ear well developed. Tiny, slender spines present on anterior and posterior margins of shell under ears Pr. (Palliolum) abyssorum

4. (1) Surface sculpturing of very thin, fragile valves diverse . . . 5
5. (6) Shell inequivalved: upper, more convex valve bears radial rows of very thin, fragile vesicular formations which resemble tile fragments when broken off. Lower valve smooth or with fine concentric striation. Front ear pointed, about half the size of posterior ear. Inner surface of valves smooth Pr. (Cyclopecten) hoskynsi
6. (5) Shell equivalved, but often slightly inequilateral, somewhat sloped. Both valves have 12-16 spherically concentric, low, undulate costae and extremely fine, radial striation. Posterior ear three times smaller than anterior one Pr. (Hyalopecten) frigidus

Propeamussium (Actinula) groenlandicum (Sowerby) (plate CVII, 4 ar, cl)

Shell semitransparent, iridescent in living specimens; length up to 34 mm, height 24-26 mm.

Two forms distinguished in northern seas: f. major, encountered in northern and northeastern regions of Barents Sea and in Kara Sea, length up to 34 mm, and f. minor, preferring warmer, southwestern regions of Barents Sea, length up to 15 mm.

Arctic, circumpolar species, found on soft, muddy bottoms with mixture of stones in lower sublittoral and deeper, at low above-zero, but more often at constant sub-zero, near-bottom temperatures.

Propeamussium (Palliolum) abyssorum (Lovén) [=Pr. (P.) vitreum (Chemnitz)] (plate CVII, 5 al, cr)

Shell thin, white, almost nontransparent, opaque or slightly shiny. Length 11 mm, height 11.5 mm.

Boreal, deep-sea species encountered in southwestern, less frequently in northwestern part of Barents Sea on soft muds of lower sublittoral and deeper at above-zero temperatures.

Propeamussium (Cyclopecten) hoskynsi (Forbes) [=Pr. (C.) imbriferum (Loven)] (plate CVII, 6 al, ar, e)

Valves colourless, semitransparent, fragile along edges. Length 15 mm, height 16 mm.

Arctic-boreal, deep-sea species found on soft muddy bottoms of southwestern, southern and central parts of Barents Sea. Sometimes encountered in troughs of northwestern part of Kara Sea where near-bottom temperatures approximate 0°C. Novosibirsk shallows.

Propeamussium (Hyalopecten) frigidus (Jensen) (plate CVII, 7 al, cr, e) (426)

Shell exterior has silky shine due to most delicate radial striation. Concentric costae low, rounded, rather wide. Silvery-white in colour, valves very thin, fragile, semitransparent. Length 26 mm, height 29 mm.

High-arctic, deep-sea species encountered in northern part of Kara Sea (apparently coming from the North Polar basin), on soft brown muds at low sub-zero temperatures. Novosibirsk shallows.

Family L i m i d a e

Genus L i m a (Brugière) Cuvier

The only genus manifesting family characteristics in northern seas of the USSR.

Shell high, oval-ovate, equivalved, for the most part with fine radial costation. Ears poorly developed, opening for byssus lacking. Ligament external, extended along dorsal margin of shell. Umbones convex, separated. Adductor muscle displaced to upper, posterior corner of shell. Eyes lacking along mantle edges, only thick glandular tentacles present. Two double branchial plates on each side of body: ascending plate extends to very top where it concretes with base of descending plate. Filaments join together at bending points and at the top, often in the middle as well.

Key to Lima species of the northern

seas of the USSR

1. (2) Shell equilateral, inflated. Dorsal margin almost equal to width of shell. Costae fine, sharp L. hyperborea
2. (1) Shell slightly inequilateral, moderately convex. Dorsal margin considerably shorter than width of shell. Costae larger and coarser L. subauriculata

Lima hyperborea Jensen (plate CVII, 8a, b, c1, e)

Shell oval. Ears symmetrical, imperceptibly passing into anterior-posterior margins of shell. Ventral margin sharply convex, slightly narrowed. Umbones inflated, high, often almost pointed. Valves quite compact, white. Height 16 mm, length 9.5 mm, thickness 10 mm. 24-36 costae, well-defined ones on middle portion of shell where two larger, central costae are often distinguished.

High-arctic species encountered in northern regions of Barents (not below 76° S latitude) and Kara seas in lower sublittoral at low above-zero and sub-zero temperatures.

Lima (Limatula) subauriculata (Montagu) (plate CVII, 9a, e)

Shell ovate. Ventral margin broadly spherical, in width almost equal to middle of shell. Ears at the bottom clearly separated from anterior and posterior margins by noticeable depressions. Umbones convex, but rather obtuse. Valves thin, often semitransparent. Height 6.5 mm. 24-30 costae with interspaces differing in size.

Boreal, deep-sea species encountered in southwestern part of Barents Sea, not farther east than 33° E longitude, on soft muds in lower sublittoral.

Family A n o m i i d a e

Genus A n o m i a Linne

Shell inequivalved; right (lower), flat valve grows around byssus, leaving opening for latter, less commonly opening lacking. Byssus highly

developed, resembles small foot, frequently calcified, attaches firmly to substratum. Left (upper) valve quite convex, slightly larger than right one. (427)
 Hinge teeth lacking. Foot small, reduced. Adductor muscle rounded, small, located in middle of shell. On each side of the body there are two rows of free gill filaments, unfused or joined only at the ends, which hang downward or bend upward, forming the beginning of the ascending plate. Surface without radial costae. Two or one byssal muscle scars.

Key to Anomia species of the northern
seas of the USSR

1. (4) Two muscle scars on inner surface of shell (upper valve): a larger one in upper part of shell (almost under umbo) from the byssal muscle, and the smaller one under it from the adductor muscle 2
2. (3) External surface of a rather thin upper valve almost smooth, opaque, with only delicate concentric striation A. squamula
3. (2) External surface of a rather thick upper valve covered with radial-concentric rows of small scales and spines A. squamula var. aculeata
4. (1) Three muscle scars on inner surface of upper valve: two (one of them larger) from byssal muscles, and the third, small one from the adductor muscle. Shell exterior smooth; hinge line noticeably straight A. ephippium

Anomia (Heteranomia) squamula Linné (plate CVIII, 1a, ai, b)

Shell flattened, upper valve spherical or irregularly distorted. Umbo small, usually displaced to upper margin of shell. Edges of shell fragile, scaly. Opening for byssus small, oval. Diameter 18-20 (up to 23) mm.

Arctic-boreal species: Barents, White, Kara (southern part) seas.

Primarily on mixed stony bottoms of upper and middle sublittoral.

A. (H.) squamula L. var. aculeata Muller (plate CVIII, 2a, e) distinguished from f. typica by presence of radial rows of spines on surface of upper valve and by smaller size. Distributed in warmer waters: southwestern part of Barents Sea, coast of northern Norway and Murman, White Sea (not observed in Kara Sea). Considered as independent species by numerous authors.

Anomia (Anomia) ephippium Linné (plate CVIII, 3 ai)

Similar in appearance to A. squamula squamula, distinguished from it by smoother and more even shell and by straighter hinge line.

Boreal species, encountered in southwestern part of Barents Sea, along shores of northern Norway and western Murman.

Suborder ANISOMYARIA

Family M y t i l i d a e

Shell equivalved, more or less cuneiform or oval, with umbo displaced toward anterior, narrowed margin of shell, or spherical and equilateral. Hinge line without teeth, with narrow, long ligament, or with weak teeth and internal ligament. Foot small, digitate, with well-developed byssus. Two double branchial plates on each side of body. Adjacent filaments interconnected by ciliate discs and connective-tissue septa in several places: at bending points, at the ends and in the middle. Resulting "false reticulate gills" differ from gills of Eulamellibranchia in that each filament is separated and blood vessels between them are lacking.

Mantle fuses posteriorly, forming small exhalant siphon.

Key to genera of the family Mytilidae

(428)

of northern seas of the USSR

1. (6) Large forms, up to 10-12 cm long, dark-brown or black in colour. Shell cuneiform or elongated-fabiform. Ligament external. Hinge line usually smooth 2
2. (3) Shell cuneiform: anterior margin narrowed, posterior margin expanded, umbones small, pointed, right on anterior margin of shell. Exterior smooth, usually bluish-black. Several small denticles may be present under umbo Mytilus

3. (2) Shell elongated-oval, fabiform, with obtuse-rounded anterior margin. Umbones obtuse, located slightly off rounded anterior margin 4
4. (5) Surface of large shell without radial costation, only with concentric growth lines. Umbones convex, anterior margin barely overlaps umbones. Noticeable longitudinal convexity extends down middle of valves from umbo posteriorly along shell. Dark- or rich-brown in colour Modiolus
5. (4) Valves have well distinguishable anterior, central and posterior fields, usually separated from each other by folds or differing in surface sculpturing: with radial costation, smooth or rugose. Umbones obtuse, quite above lower margin Musculus
6. (1) Small forms, 3-6 mm. Shell oval or spherical-trapeziform. Ligament internal. Hinge consists of small denticles along edge or of denticulate plates serrated at the top 7
7. (8) Shell high and spherical, inflated, with radial costation, equilateral. Umbones high, curved anteriorly. Valves compact, brown in colour Crenella
8. (7) Shell contracted, spherical-trapeziform, smooth, very shiny. Umbones, as in typical mytilids, displaced anteriorly, but located high above anterior margin. Valves thin, light-coloured, semitransparent, shiny. Dacridium

Genus M y t i l u s Linne

Mytilus edulis Linné (plate CVIII, 4 ar, br, cl)

Only species encountered in northern seas of USSR. Byssus highly developed, forming tufts of filaments which enable mussels to attach to substratum and each other, often forming entire clusters of shells. Shell usually slightly depressed at point where byssus emerges. Posterior end expanded, spatulate. Odontoid processes, if present, located right under umbo. Length 50-70 (less commonly up to 100-80) mm; mussels in White Sea smaller than in Barents Sea.

Arctic-boreal, almost cosmopolitan species, encountered in the littoral zone and uppermost layers of sublittoral. Sometimes descends to great depths in Barents Sea. Abounds in innermost parts of bays and inlets off the Coast of Murman and in the White Sea where it often forms dense accumulations (beds) as, for example, in Chesha Bay and off the Coast of Murman, where its biomass

can amount to as much as 20 kg/m². Encountered in Baidarata Bay in the Kara Sea, but does not form beds. Chukchi Sea.

Genus M o d i o l u s Lamcarck
(= V o l s e l l a Scopoli)

Modiolus modiolus (Linné) (plate CVIII, 5 ar, cl, k)

The only species encountered in northern seas of the USSR. Shell large, elongated, slightly narrowed anteriorly, uniformly expanding posteriorly: both ends of shell rounded. In young specimens exterior of light-brown shell sometimes covered with thin hairs which are outgrowths of the integument. Length up to 10-12 cm.

Amphiboreal species, distributed along the coast and in shallow southwestern and southern part of Barents Sea and along the Coast of Murman, penetrating into the White Sea as well.

Encountered on sandy-stony and mixed bottoms of upper sublittoral at constant above-zero temperatures. Predominant form of entire biocoenosis off the Coast of Murman. (429)

Genus M u s c u l u s Bolten

[= M o d i o l a r i a (Beck) Loven]

Shell oval-elongated or contracted. Anterior field of shell usually bears 5-6 radial costellae. Central field smooth or rugose, separated by radial fold or imperceptibly passes into broad posterior field which is smooth or with fine radial costae. Anterior margin noticeably overlaps umbō anteriorly.

Key to Musculus species of northern seas
of the USSR

1. (6) Valves bear perceptible radial fold which clearly separates central field of shell from posterior field 2
2. (5) Posterior field with radial striation or costation 3

3. (4) Central field, as entire surface of fabiform-contracted, fairly thick shell is shagreen-rugose. Costae on posterior field rather coarse, rough M. corrugatus
4. (3) Central field of shell smooth, shiny, with very fine longitudinal striation. Costae on posterior field smooth, not rugose M. discors
5. (2) Posterior field of shell completely smooth, separated from central field by low, thin, radial fold. Central field shiny, completely smooth M. laevigatus
6. (1) Radial fold on valves lacking and smooth central field passes directly into posterior one which is covered with numerous very fine, radial costellae numbering more than 50 M. discrepans

Musculus corrugatus (Stimpson) (plate CVIII, 6 ar, e)

Shell small, slightly convex, contracted, irregularly fabiform: posterior end slightly drawn out in a downward direction and somewhat wider than middle portion of shell. Posterior field carries 30-32 rough costae. Length 10-15 (up to 20) mm.

Arctic species, distributed in all northern seas. Encountered on muddy-sandy bottoms with mixture of stones in middle and lower layers of sublittoral. In Barents Sea most frequently encountered in Pechora area, fjords of Novaya Zemlya and Spitsbergen. Rare in southwestern part of Barents Sea.

Musculus discors (Linne) (plate CVIII, 8 ar)

Shell of medium size, convex, irregularly oval, posterior end slightly drawn out. Approximately 35 smooth costae on posterior field. Lower margin in region of central field slightly convex. Length 30-32 (up to 40) mm.

Arctic-boreal species, widely distributed in all northern seas of USSR: In Barents Sea exclusively in coastal and shallow areas, fjords of Novaya Zemlya and shallows of Spitsbergen, on muddy-sandy bottoms in middle layers of sublittoral.

Musculus laevigatus (Gray) (=M. discors var. laevigata Gray) (plate CVIII, 7 ar)

Shell contracted, moderately convex, irregularly oval; posterior margin considerably expanded, anterior margin slightly narrowed. Valves smooth, light-brown, costellae present only on anterior field. Length 27-28 (up to 30)mm.

Arctic-boreal form, encountered in Barents, White, Kara and all other Siberian seas.

Musculus discrepans (Gray) (=Modiolaria nigra Gray) (plate CVIII, 9 ar) (430)

Shell quite large, elongated, slightly flattened, frequently almost compressed, particularly on posterior, broadly spherical margin. Upper margin regularly arcuate, lower margin straight. Umbo low, does not overlap anterior margin of shell. Length 38-50 (up to 65) mm. Dark-brown, almost black, shiny.

Arctic-boreal (primarily Arctic), circumpolar species, widely distributed in northern seas. In Barents Sea primarily along southeastern coasts on muddy-sandy bottoms.

Genus C r e n e l l a Brown

Crenella decussata (Montagu) (plate CVIII, 11 a1, b1)

The only species encountered in northern seas of the USSR. Shell small, inflated, oval-spherical. High, somewhat anteriorly curved umbones located in middle of shell. Hinge line short, behind umbo; one small tooth in the form of an oblong tubercle in each valve. Ligament internal, quite long, behind umbo. Above ligament hinge line thickened and bears 12-15 denticles transverse to shell margin. Shell exterior bears 35-40 rounded, finely cross-striated costae. Brown, yellowish-grey. Length 3-3.5 mm.

Boreal-arctic (North Atlantic) species, widely distributed in Barents Sea; encountered at various depths from littoral zone to 300-400 m. Abundant in southern, southeastern and central parts of Barents Sea on muddy-sandy bottoms where it is frequently in great numbers encountered in the stomachs of haddock; Kara and White seas.

Genus D a c r i d i u m TorellDacridium vitreum (Holboll) Moller (plate CVIII, 10 ar)

The only species encountered in northern seas of USSR. Hinge line thin, hinge consists of two parts: a short, completely flat tooth with transverse indentations in front; tooth behind umbo longer, also flat, crenulate; ligament internal, resembling narrow cord, in special slit under umbo. Valves thin, fragile, shiny, light-grey, yellowish, iridescent. Length 3.5-6 mm.

Boreal-arctic, deep-sea, North Atlantic species, widely distributed in northern seas; in Barents Sea not encountered in southeastern shallows and Novaya Zemlya bays; White and Kara seas. Found on soft, muddy bottoms of middle and lower layers of sublittoral. Consumed in masses by haddock off the Coast of Murman.

Order EULAMELLIBRANCHIA

Suborder HETERODONTA

Family C a r d i i d a e

Shells of various size, spherical or cordate, usually highly convex, sometimes even inflated. Exterior usually ornamented with radial costae, smooth or with spines, scales or hairs; less commonly shell is smooth with radial costae barely perceptible on anterior and posterior ends of shell. Epidermis poorly developed. Ligament external. Lunula lacking. Hinge plate narrow, often weak. Hinge in most developed species with small anterior cardinal tooth and a large posterior cardinal tooth behind and under it, projecting (as the lateral ones) from under the hinge line, in the right valve; and an anterior cardinal tooth with usually a smaller posterior one behind and above it in the left valve; certain teeth may be reduced. Lateral teeth always present, strong, triangular-lamellose, clearly separated from cardinal ones, one in front and one in back in each valve, or two of each in right valve. Siphons usually short, pubescent; mantle edges below unfused; sinus lacking or very small. Gills plicate, re- (431)
ticulate; anal chamber sometimes separated by siphon septum. Foot elongated, quite powerful, geniculate, smooth at the bottom, or compressed, serrated at the bottom (Serripes).

Key to genera of the family Cardiidae
of northern seas of the USSR

1. (2) Shell exterior smooth; radial costae visible only on anterior and posterior margins of shell. Only one central tooth in each valve, the second tooth is reduced; lateral teeth present. Foot serrated at the bottom. Large forms Serripes.
2. (1) Shell exterior with well-defined radial costae, often with scales, hairs or spines. Two well-developed central teeth in each valve, or one reduced tooth. Lateral teeth present. Foot smooth at the bottom. Medium sized and small forms Cardium (subgenus Cerastoderma)

Genus S e r r i p e s (Beck) Gould

Serripes grönlandicus (Chemnitz) (=Aphrodite groenlandica) Stimpson,
Cardium groenlandicum (Gmelin) (plate CVIII, 12a 1, c1, cr)

The only species encountered in northern seas of the USSR. Shell large, moderately convex, almost equilateral, length somewhat greater than height. Valves and hinge line rather thin. One central tooth and two lateral ones in each valve: anterior lateral more developed in left valve, and posterior lateral in right valve. Teeth poorly defined in mature specimens. Hinge line curved. Shell exterior greyish with darker, fairly wide concentric stripes, and frequently (in young individuals) with zigzag, reddish pattern. Length up to 70-75 mm.

Arctic (high-arctic), circumpolar species, typical for shallow and coastal areas of northern seas, usually does not descend beyond 75-100 m. The highest concentrations are encountered in the Barents Sea on muddy bottoms of southeastern part (Pechora-Kanin area) and Spitsbergen shallows; rare or absent in other areas. Young individuals serve as food for benthophagous fishes.

Genus C a r d i u m Linné

Northern seas of USSR serve as a habitat for members of subgenus Cerastoderma (Poli) Mörch (in the broad sense); the length of the species of

this subgenus is usually somewhat greater than the height, the costae are well developed and covered with scales, hairs or spines; the hinge line is almost straight or arcuate.

Key to species of subgenus *Cerastoderma* of

the genus *Cardium* encountered in northern seas of USSR

- | | | | | |
|---|-----|--|---|---|
| 1 | (4) | Costae flat, interspaces narrow | 2 | |
| 2 | (3) | Shell moderately convex; costae on anterior and posterior ends of shell rather thickly covered with tiny triangular scales (spines); costae in middle of shell almost smooth. Small forms, length 3.5-5.5 mm (rarely up to 10 mm). | | <u><i>C. (C.) fasciatum</i></u> . |
| 3 | (2) | Shell inflated. Costae on almost entire shell exterior covered with thin, low, transverse scales. Length up to 50 mm. . . | | <u><i>C. (C.) edule</i></u> . |
| 4 | (1) | Costae acute-angled, interspaces wide, equal in width to costae or only slightly narrower | | 5 |
| 5 | (6) | Costae completely covered with hairs at the top (hairs may rub off in middle of shell in old individuals). | | <u><i>C. (C.) ciliatum</i></u> . |
| 6 | (5) | Costae completely covered with spines at the top | | 7 |
| 7 | (8) | Spines low, spherically imbricated, convex, thickly cover each costa from umbo to edge, imparting spherical form . . | | <u><i>C. (C.) elegantulum</i></u> . (432) |
| 8 | (7) | Spines on costae thin, quite long, spoon-shaped, relatively sparse. Costae narrow, acutely triangular | | <u><i>C. (C.) echinatum</i></u> . |

Cardium (Cerastoderma) fasciatum Montagu (plate CIX, 2 ar, cr, cl, e)

Shell small, obliquely spherical, posterior margin spherical-angular. Umbones located almost in middle of shell or slightly displaced anteriorly. 24-26 wide, flat costae, interspaces almost thread-like. In right valve central teeth well developed, posterior one triangular, anterior one almost lamellose; lateral teeth weak. Left valve bears only posterior central tooth and anterior lateral tooth. Greyish in colour, sometimes with brown stripes. Length 3.5-5.5 (up to 10) mm.

Boreal species, encountered in the Barents Sea along Norwegian coast and off the coast of western and to some extent eastern Murman. Found on

clean, fine sand in upper and middle sublittoral at temperatures not lower than 1°C.

Cardium (Cerastoderma) edule Linné (plate CVIII, 13 ar, cr, cl)

Shell compact, sturdy, oval-cordate, equilateral. Umbones inflated. Length of shell considerably exceeds height. Two central teeth, two anterior lateral teeth, and one posterior lateral tooth in right valve; two central teeth, one anterior lateral tooth and one posterior lateral tooth in left valve. Hinge line almost straight. Up to 30 costae. Length 20-30 (up to 50-57) mm.

Boreal-Lusitanian species, encountered in littoral zone in innermost bays and inlets off western Murman. Found on muddy-sandy and sandy beaches as one of the predominant forms; biomass often reaches and exceeds 100 g/m².

Cardium (Cerastoderma) ciliatum Fabricus (= C. islandicum Chemnitz)
(plate CIX, 1 ar, cr, 1c)

Shell moderately convex, with fairly thin walls, oval-spherical, expanded at the bottom, slightly inequilateral: narrowed, low umbo lies between the first third and half way point of the shell. 33-35 sharply defined, hairy costae. Valves and hinge line rather thin. One central tooth, 2 anterior lateral teeth and one posterior lateral tooth in right valve; a large anterior central tooth and reduced posterior central tooth, and one anterior lateral and two posterior lateral teeth in left valve. Grey in colour, valves usually covered with mud. Hinge line arcuate. Length approximately 40 (up to 60) mm.

Arctic, circumpolar species, widely distributed in all northern seas; on muddy and muddy-sandy bottoms of middle and lower sublittoral; in Barents Sea highest density of populations in Kanin-Pechora area and bays of Novaya Zemlya. Young often fed upon by haddock and flounder.

Cardium (Cerastoderma) elegantulum (Beck) Möller (plate CIX, 3 ar, cr, cl, e)

Shell small, slightly convex, oval-inequilateral: indistinct umbo located between first quarter and third of the length of the shell, curved toward the anterior. 22-24 costae; posterior field noticeably separated from central field by 1-2 larger costae. Two small central teeth, one anterior lateral tooth and one posterior lateral tooth in right valve; one large central tooth and one anterior lateral tooth in left valve. Pure white or greyish-white in colour; in older specimens scales often rub off and costae become flattened. Length up to 14 mm.

Boreal species, typical for northern abyssal part of boreal region. Encountered throughout southwestern part of Barents Sea and off the coast of western and eastern Murman, on fine muddy sands and sandy muds in middle and lower sublittoral at temperatures not lower than 0.5°C.

Cardium (Cerastoderma) echinatum Linné (plate CIX, 4 ar, cl, cr, e) (433)

Shell moderately convex, spherical-oval, equilateral: broad, convex umbones lie at midlength of almost straight hinge line. 19-21 acute-angled costae on surface of fairly thin valves. Interspaces wide. Two pointed central teeth, 2 anterior lateral teeth and one posterior lateral tooth in right valve; two central teeth, one anterior lateral and two posterior lateral teeth in left valve. White, slightly yellowish in colour. Length 20 (up to 40) mm.

Boreal (boreal-Lusitanian) species, encountered in Barents Sea off the coast of Norway and western Murman, on clean sandy soils of upper and middle sublittoral at average temperatures not lower than 2°C.

Family A s t a r t i d a e

Shell compact, sturdy, spherical-triangular, with concentric, usually sharply-defined costae of various width (from broad to thread-like), or only

with fine concentric striation, smooth or with costae, perceptible only near umbo. Epidermis thin, very consistent, or thick and coarse. From pale yellow to dark-brown and greyish brown in colour. Hinge plate strong. Hinge in its most developed form consists of three cardinal teeth and one lateral tooth in each valve; cardinal teeth obtuse-triangular, separated by triangular sockets. As a rule, the most developed teeth are: one central cardinal in right valve (anterior and posterior weak or lacking), and anterior and central in left valve; posterior tooth may be reduced. Lateral teeth indistinct, poorly developed, imperceptibly separated from cardinal ones and often lacking altogether. Lunula well developed.

Ligament external. Mantle without sinus; one short anal siphon; branchial aperture formed by unfused ciliated edges of mantle. Branchial plates smooth, reticulate, external lamella somewhat shorter than internal one.

Family Astartidae typical for cold waters; largest number of species inhabit Arctic seas; in tropical zone inhabit cold abyssal waters, or become stunted at higher temperatures in upper layers of the sea.

Genus A s t a r t e Sowerby

The only genus encountered in northern seas of USSR (see characteristic features of family).

Key to Astarte species of

northern seas of USSR

1. (6) Shell exterior with very prominent concentric, obtusely or acutely triangular or widely spherical costae of various width (Astarte s. str.) 2
2. (3) Costae quite numerous (up to 45), obtuse- or acute-angled, interspaces narrow. Shell spherical-triangular or spherical-trapeziform, inequilateral; obtuse umbo on anterior half of middle third portion of shell or displaced medially. Anterior part of dorsal margin not concave. Yellow in colour A. crenata.

- 3. (2) Costae number less than 30, broad, rounded; interspaces wide; anterior half of dorsal margin noticeably concave; umbo curved toward the anterior 4
- 4. (5) Shell equivalved, low, oval-elliptical, elongated. Valves thick, flattened. Up to 22-26 costae; dark-brown or dark greyish-brown in colour A. elliptica.
- 5. (4) Shell inequilateral, high, spherical-trapeziform, contracted; posterior end expanded, truncated almost straight. Valves compact, but not thick, noticeably convex. 22-25 (up to 30) costae, frequently disappearing in lower half. Umbo narrow, prominent, noticeably convex anteriorly. Bright reddish, light-brown in colour A. sulcata.
- 6. (1) Shell exterior almost smooth, with only concentric growth lines, costae only under umbo, weakly defined, or costae small, thin, densely covering entire shell 7 (434)
- 7. (8) Shell exterior with only streaming-concentric striation or only growth lines. Costae, if present, visible only under umbo. Large forms (up to 5 cm). A. borealis.
- 8. (7) Shell exterior uniformly covered with very small concentric costellae, often resembling fine striation. Small forms (1-2 cm) A. montagui.

Astarte crenata (Gray) (plate CIX, 5-8)

Interspaces equal to or only slightly narrower than costae. In mature specimens margins of shell often finely serrated on the inside. Lateral teeth usually reduced and edges of valves only thickened, less commonly weak anterior lateral tooth present. Cardinal teeth well developed: one wide median tooth and a weak, almost lamellose posterior tooth in right valve, and an anterior and median one in left valve.

Arctic, circumpolar species, widely distributed in northern seas.

Encountered on soft muddy, muddy-sandy bottoms of sublittoral.

A. crenata highly variable species, forms several subspecies which are considered as independent species by some authors.

Key to subspecies of Astarte crenata ofnorthern seas of the USSR

1. (4) Shell oval-triangular, valves thin, valve edges sharp, locking tightly, or only slightly obtuse 2
2. (3) Shell convex, slightly inequilateral, umbo obtuse, lies on middle third of shell. Costae numerous (35-40), closely spaced. Valve edges usually slightly obtuse. Greyish-yellow or brown in colour f. typica (Gray) Jensen (plate CIX 5 ar, cl, cr) Central regions of Barents Sea, Coast of Murman, on muds and sandy muds, western and south-western areas of Kara Sea; southward to Lofoten Islands.
3. (2) Shell elongated, noticeably flattened, almost equilateral; small umbo located between first third and halfway point of shell. Fewer costae than in f. typica, 28-30. Valves quite thin, compressed and sharpened at edges. Dark yellow in colour. Length 24-30 mm subaequilatera Sowerby (= borealis Messjatzev) (plate CIX, 6 ar, an) Southern part of Barents and Kara seas; primarily on sandy bottoms. Novosibirsk shallows.
4. (1) Shell high, spherical-triangular or spherical-trapeziform 5
5. (6) Shell contracted, spherical-triangular, umbo high, displaced anteriorly. Valves thick, heavy, their edges highly thickened. Costae numerous (up to 45), quite small. Dark- or light-yellow in colour. Length up to 32 mm crebricostata Andr. et Forbes (= borealis Messjatzev) (plate CIX, 7 ar, an) Barents and Kara seas.
6. (5) Shell high, spherical-trapeziform or even obliquely quadrangular. Costae sharp, obliquely lamellose, up to 40 in number. Anterior margin narrowed, posterior margin expanded, truncated straight. Light-yellow in colour. Small forms. Length up to 13-15 mm acuticostata Jeffreys (= Astarte acuticosta Jeffr.) (plate CIX, 8 ar, an) High-arctic form, inhabiting northern part of Barents Sea (not below 76°S lat.) and Kara Sea, Novosibirsk shallows.

Astarte elliptica (Brown) [= Astarte compressa (Linné)] (plate CIX, 9 ar, cr, cl)

(435)

Length 25-30 (up to 35) mm. Arctic-boreal species, encountered on sandy and sandy-stony bottoms in Barents, White and southern Kara seas in middle and lower sublittoral.

Astarte sulcata (Da-Costa) (plate CIX, 10 ar, cr, c1)

Length 20-24 (up to 30) mm. Boreal species, encountered in Barents Sea on clean sandy bottoms off the coast of Norway and western, partly central, Murman, at constant average near-bottom temperatures approximating 2°C.

Astarte (Tridonta) borealis (Chemnitz) [Tridonta borealis Sars, Astarte semisulcata (Leach)] (plate CIX, 11 ar, d; CX, 1 cr, c1)

Shell large, heavy, oval-triangular, almost equilateral, umbo low. Ligament resembling thick ridge. One well-developed median cardinal tooth and reduced anterior and posterior tooth (rarely) in right valve; two cardinal teeth and poorly defined lateral teeth (one on each side) in left valve. Surface dark- or light-brown or greyish-brown, often with rust-coloured incrustation. Length up to 30 (50) mm.

Primarily an Arctic, circumpolar, rather variable species, forming a number of varieties in northern seas.

Key to varieties of Astarte borealis ofnorthern seas of the USSR

1. (2) Shell highly flattened, oval-elongated, with several concentric costae clearly visible in region of umbo. Epidermis rough, thick. Greyish-brown, rust-brown in colour, frequently with reddish and black ferro-manganese incrustations of considerable thickness. Costae may cover almost entire shell exterior in young specimens var. placenta Morch (plate CX, 2 ar, an) Coldwater, circumpolar form, typical for northeastern regions of Barents and southern and central regions of Kara Sea and highly muddy bottoms; common on brown muds in Kara Sea. White Sea.
2. (1) Shell fairly convex, high. Costae under umbo lacking. Epidermis thick 3
3. (4) Shell with dark-brown, thick, rough epidermis, spherical-triangular, high, convex var. withami Wood (plate CX; 3 ar, d) On muddy bottoms of eastern and southeastern part of Barents Sea, Spitsbergen, White and Kara seas and farther eastward.

4. (3) Shell with light-coloured, reddish or brown lustrous epidermis, spherical with arcuate margins var. arctica Gray (plate CX, 4 ar, d)
Southwestern part of Barents Sea, Spitsbergen, along coast of northern Norway and Murman, not observed farther eastward; on sandy bottoms of upper and middle sublittoral. Variety resembles Cyprina shell in shape and colour, but like all Astarte has well-developed, depressed triangular lunula on anterior part under umbo.

Astarte montagui (Dillwyn) [Astarte (Nicania) banksi (Leach)]
(plate CX, 5-8)

Shell small, almost triangular, equilateral, frequently inflated or flattened. Umbo high, noticeably curved toward the anterior; anterior portion of dorsal margin concave. Valves and margins of shell thin. From dark-brown to greenish-yellow in colour; shiny or dimly opaque. In right valve one large central tooth, sometimes rudiments of small posterior cardinal tooth; in left valve a rather large median and anterior cardinal tooth, sometimes rudiment of anterior lateral tooth. Length 15-25 mm.

(436)

Primarily an Arctic, widely distributed species, encountered mainly in coastal and shallow waters, on sandy bottoms of middle sublittoral.

Highly variable form with a number of varieties in northern seas.

Key to subspecies of Astarte montagui of

northern seas of the USSR

1. (4) Shell contracted, highly convex 2
2. (3) Shell high (height almost twice greater than length of shell), spherical-triangular. Striation thin and fine f. typica (Dillwyn) Jensen (plate CX, 5 ar, cr, cl)
3. (2) Shell inflated, almost spheroid globosa G.O. Sars (plate CX, 6 ar, d)
4. (5) Shell oval-elliptical, highly elongated: ventral margin almost straight. Costellae irregular, frequently undulate . . . vernica Dall (var. warhami Leche, Knipovich et al.) (plate CX, 8 ar)
5. (1) Shell elongated in anterior-posterior direction, flattened 5

6. (6) Shell triangular-elliptical; ventral margin slightly arcuate.
 Costellae uniform (the most frequently encountered form)
 striata Leach

Family C y p r i n i d a e

Shell spherical, convex, equilateral, umbo noticeably curved toward the anterior. Epidermis thick, smooth, with fine concentric striation, shiny, light- or dark-brown. Lunula lacking. Ligament external. Hinge plate very strong. Three cardinal teeth in each valve, one posterior lateral tooth in right valve. Siphons very short. Inhalant and exhalant apertures covered with papillae; sinus lacking. Foot short, broad, smooth at bottom. Gills plicate, external plates shorter. One genus with family characteristics.

Genus C y p r i n a Lamarck (=Arctica Schumacher)

Cyprina islandica Linné (plate CX, 9 ar, cl, cr, d)

Hinge plate strong. Right valve with short lamellose anterior cardinal tooth, median tooth thickest and posterior one long, lamellose; one posterior lateral tooth. Left valve with no lateral teeth, 3 cardinal teeth: anterior one short and triangular; median, final one located under umbones, transverse to hinge plate. Posterior tooth elongated-lamellose. Cardinal teeth separated by rather large flattened indentations. Shell thick, sturdy, with even, sharp margins. Exterior with numerous concentric growth lines. Rich brown in colour, surface glossy. Length up to 10 mm.

Boreal, North Atlantic species; in Barents Sea common off coast of Murman and northern Norway, in Bear Island-Spitsbergen shallows, on clean sandy bottoms; a relict of warm waters in White Sea.

Family C y a m i i d a e (=Kellyellidae)

Shell small, thin; hinge line thin, teeth poorly developed. Branchial plates plicate, internal lamella very wide. Foot quite long.

Key to genera of Cyamiidae of northern

(437)

seas of the USSR

1. (2) Shell spherical; ligament internal; lunula cordate Kellyella
2. (1) Shell elongated-oval; ligament external Turtonia

Genus K e l l y e l l a M. Sars

Kellyella miliaris Philippi (plate CX, 17 al, d)

The only species. Shell inflated, umbones slightly curved. Valves thin, white, shiny. Length 2-2.5 mm.

Genus T u r t o n i a Alder

Turtonia minuta Fabricius (= Cyamium minutum Fabr.) (plate CX, 18 al, cl, cr, d)

The only species in northern seas.

Shell oval-elliptical, inequilateral. Valves thin, with irregular concentric striation. Umbones obtuse, quite prominent, located near anterior third of shell. Hinge of each valve composed of two anterior teeth, lateral teeth lacking. Shell reddish-brown in colour. Length 2-2.5 mm.

Primarily a boreal species; in littoral and upper sublittoral of Barents and White seas, frequently in vast numbers.

Family M o n t a c u t i d a e

Genus M o n t a c u t a Turton

The only genus in northern seas with two most common species.

Montacuta maltzani (Verkrutzen) (plate CX, 10 al, cd)

Shell moderately convex, obliquely oval; umbones convex, located on posterior one-quarter length of shell. Hinge plate carries one anterior and one posterior cardinal tooth. Exterior with very fine radial striation. Sinus lacking. Length 2 mm and less.

High-arctic species, encountered in eastern regions of Barents Sea, in Kara Sea and farther eastward.

Montacuta spitzbergensis Knipowitsh (plate CX, 11 a1, cd)

Shell small, regularly oval, compressed; umbones low. Exterior with thin yellowish epidermis, indistinct and nonuniform concentric striation. Hinge with two strong cardinal teeth in each valve. Length up to 5 mm.

High-arctic species, encountered in Barents Sea in Spitsbergen fjords and eastern shallows on muddy-sandy bottoms, Kara and Chukcha Seas.

Family U n g u l i n i d a eKey to genera of Ungulinidae of northernseas of the USSR

1. (2) Hinge without teeth, but internal hinge line more or less thickened. Posterior edge of valves bears visible radial folds Thyasira
2. (1) Hinge with teeth; radial folds lacking on posterior end of shell. 3
3. (4) Shell round, equivalved, cardinal tooth massive, hinge plate not interrupted under umbo Axinopsis
4. (3) Shell slightly elongated (length slightly exceeds height). Posterior right and anterior left teeth lacinate Diplodonta

Genus T h y a s i r a (Leach) Lamarck (438)

(=Axinus Sowerby, Cryptodon Turton)

Shell spherical or slightly angular, smooth, with 1-2 radial folds on posterior part. Interarea usually well defined. Ligament external and frequently internal. Teeth lacking. Siphons and sinus lacking. Umbo prominent, slightly curved toward the anterior. Hinge line under umbo narrowed, interrupted.

Key to Thyasira species of northernseas of the USSR

1. (6) Height of shell barely exceeds length, or shell equilateral-spherical 2
2. (5) Shell equilateral-spherical; one shallow fold on posterior end 3

3. (4) Shell small (4-8 mm). Height of shell barely exceeds length; shell very thin, fragile, white, semitransparent. Anterior part of hinge line almost straight and forms obtuse angle with anterior margin of shell Th. flexuosa (Montagu) (plate CX, 12 al, cl, d) Widely distributed, almost cosmopolitan species. Eurythermal and eurybathic form, prefers soft, muddy bottoms where it sometimes is a prolific form. Often encountered in stomachs of benthophagous fishes.
4. (3) Shell large (up to 30 mm), usually smaller, almost completely round, its height usually slightly exceeds length. In mature specimens valves compact, calcareous, in young ones thin, white, with light concentric striation. Anterior part of hinge line concave in front, umbo curved toward the anterior. Anterior margin of shell rounded Th. sarsi Philippi Arctic-boreal species, encountered in Barents Sea primarily off coast of Norway and Murman; very large, but often empty valves found in Kara Sea. Chukchi Sea.
5. (2) Shell high (height always exceeds length), almost oval-spherical; two sharply-defined radial folds on posterior end. Anterior margin of shell forms distinct obtuse-rounded angle with straight anterior part of hinge line. Valves white, very fragile, often semitransparent. Length 10-12 mm Th. gouldi (Philippi) (plate CX, 14 al, d) Primarily an Arctic, coldwater form, encountered in eastern and central parts of Barents and Kara seas; Novosibirsk shallows. Chukchi Sea.
6. (1) Length of shell noticeably exceeds height. Shell oval-spherical, convex; one fold highly undistinguishable posteriorly. Valves white, usually with rust-coloured spots on posterior part. Length 4 mm Th. (Axinulus) ferruginosa (Forbes) (plate CX, 15, ar, d) Arctic-boreal species, widely distributed in Barents Sea, preferring areas affected by North Cape Current; on muddy-sandy bottoms of middle and lower sublittoral.

Genus A x i n o p s i s G.O. Sars

Axinopsis orbiculata G.O. Sars (plate CX, 16 al, cr, cl)

Only species in northern seas. Shell small (2-4 mm), spherical, umbo noticeably curved toward anterior; one rounded central tooth in right valve, one elongated anterior tooth in left valve; valves white, semitransparent.

High-arctic species; in cold shallow areas of Barents and White seas; in Kanin-Pechora area and bays of Novaya Zemlya; Kara Sea and farther eastward; everywhere on soft muddy sea bottoms.

Genus D i p l o d o n t a Bronn

(439)

Shell fairly convex, thick-walled, with concentric striation. Two lacinate cardinal teeth in each valve. Length 15-25 mm. East Arctic (?) species, quite rarely encountered in northern seas of USSR; found near Spitsbergen, northern island of Novaya Zemlya and Kara Sea.

Family T e l l i n i d a e

Shell ovate or spherical-triangular, with two or one cardinal teeth in each valve, lateral teeth may be lacking. Ligament external. Sinus deep, siphons long, thin, unfused. Mantle unfused at bottom. Branchial lamellae smooth or plicate.

Only one genus of Tellinidae known in northern seas of USSR.

Genus M a c o m a Leach

(plate CXI, 2-6)

Spherical-triangular or ovate-elongated, flattened or fairly convex, equilateral shell with more or less well-defined radial fold on posterior margin. Latter often noticeably curved toward right (when viewed from top). Valves thin or compact, grey or white, calcareous or shiny, with thin epidermis bearing numerous concentric growth lines.

Two cardinal teeth in each valve; posterior one in right valve and anterior one in left valve deeply lacinate, the others lamellose. Lateral teeth lacking. Mantle sinus deep, its scars on right and left valves often differ in size, usually extend to middle of shell or even to anterior adductor muscle. Siphons thin, long. External branchial lamella curved upward on each side, in the same plane with internal lamella which hangs downward.

Key to *Macoma* species of northern
seas of the USSR

1. (4) Scar of mantle sinus on interior surface of left valve considerably longer and located closer to anterior adductor muscle than in right valve. Posterior end of shell usually distinctly curved toward right 2
2. (3) Shell high, contracted, spherical-triangular. Length not more than 2 cm. Valves thin, light, moderately convex. Posterior end of shell truncated straight; ill-defined radial fold extends to its lower corner from umbo. Umbo narrow, quite prominent
M. torelli
3. (2) Shell elongated-oval, ovate. Length up to 4 cm. Valves compact, noticeably flattened, particularly posteriorly. Posterior margin rounded, somewhat narrower than anterior margin, distinctly curved to the right. Radial fold almost imperceptible. Umbones small, in form of tubercle M. calcarea
4. (1) Scar of mantle sinus on left valve not longer than that on right. Posterior end of shell not curved to the right 5
5. (6) Valves of shell compact, fairly convex, sometimes inflated. Shell spherical-triangular, contracted. Posterior margin (along which extends an ill-defined radial fold) forms obtuse angle with posterior half of ventral margin. Interior of valves (and frequently exterior under umbo) usually pinkish, violet, less commonly white
. M. baltica
6. (5) Valves of shell thin, light, flattened or slightly convex. Shell oval-elongated, whitish-grey 7
7. (8) Shell of regular oval shape, valves thin, highly flattened, even. Exterior smooth, covered with very thin, shiny, light-grey epidermis. Umbo low, located between posterior third and halfway point of shell M. moesta
8. (7) Shell of irregular oval shape: anterior margin considerably wider and longer than posterior, rounded, contracted one. Valves quite convex. Umbo located between posterior third and quarter of shell M. loveni (440)

Macoma calcarea (Chemnitz) (plate CXI, 2 al, bl, br, cr, cl, d, t)

Sinus deep and broad, of irregular shape; almost reaches anterior adductor muscle on left valve, extends approximately to anterior third or halfway point of shell on right valve.

Shell fairly large, compact, white, calcareous, with growth lines or (in young specimens) with grey, slightly flaking epidermis. Length 30-35

(up to 45) mm.

Arctic-boreal species, widely distributed in all northern seas, particularly abundant in coastal areas and bays, on soft muds of middle sublittoral.

Young consumed in masses by haddock and flounder.

Macoma baltica (Linneé) (plate CXI, 3 a1, b1, br, d)

Sinus scar extends to anterior one-quarter length of shell. Pinkish, pinkish-lilac, less commonly white. Length 14-16 (up to 20) m. Much smaller, not more than 10-12 mm, in highly fresh waters. Quite small in White Sea as well.

Amphiboreal species; in Barents Sea prolific form on muddy-sandy littoral in innermost bays and inlets of Murman Coast. Endures very fresh waters, enters pro-estuarine areas of rivers. Encountered in uppermost layers of sublittoral in southeastern part of Barents Sea and Baidarata Bay of Kara Sea.

Macoma moesta (Deshayes) (plate CXI, 4 a1, br, b1, d)

Shell of regular oval-elongated or ovate form. Sinus on both valves extends to anterior third of shell. Surface of lustrous shell, apart from usual concentric striation, also bears extremely fine, poorly visible radial striation. Length 26-28 mm.

Arctic species, very easily confused with young M. calcarea Ch., from which, on the other hand, it is easily distinguished by sinus depth on both sides and by even posterior margin of flattened valves and small tuberculate umbo.

Kara and Laptev seas; Barents and Chukchi seas.

Macoma torelli (Steenstrup) Jensen (plate CXI, 5 a1, br, b1, d)

Sinus scar on left valve deep, extends to anterior adductor muscle. Easily distinguished from M. baltica by thin valves, straight-truncated posterior

end and deep sinus. Grey in colour, opaque or with dull lustre, frequently with reddish incrustation. Length 15-17 (up to 20) mm.

High-arctic species encountered in northern and eastern regions of Barents Sea and in Kara Sea. On muddy bottoms of middle and lower sublittoral. Novosibirsk shallows, Chukchi Sea.

Macoma loveni (Steenstrup) (plate CXI, 6 al, br, bl, d)

Shell fairly convex, inequilateral, of regular oval shape. Sinus extends to anterior third of shell. Light-grey or white in colour, with dull lustre. Length 16-18 mm. Valves fragile. Posterior end usually obtuse, with fairly distinct radial fold.

High-arctic species, rather rare form. Kara Sea, central and north-eastern regions. Novosibirsk shallows.

Family V e n e r i d a e

Shell equivalved, regular. Ligament external. Cardinal teeth well developed; usually three in each valve, some of them lacinate. Lateral teeth present or lacking. Siphons usually partially fused, sinus more or less deep. (441)

Only one genus consisting of one species from this vast, species-abundant family which primarily inhabits moderate and tropical waters is encountered in northern seas of the USSR.

Genus L i o c y m a Dall

Liocyma fluctuosa (Gould) (= Venus fluctuosa Gould)

Gomphina fluctuosa (Gould) (plate CXII, 1 ar, cr, cl, e)

Small, oval-triangular, inequilateral shell; umbo displaced anteriorly,

located between anterior third and halfway point of shell. Shell exterior light-coloured, shiny, covered with numerous irregular, flattened, concentric costellae. Hinge consists of three cardinal teeth in each valve, of which anterior tooth in right valve and posterior one in left valve are normal, other two in each valve slightly laciniate, median ones more distinct, posterior ones less so. Siphons of different length (anal siphon shorter); sinus shallow, not exceeding one-third length of shell. Length 16-18 (up to 20) mm.

Arctic (high-arctic) species, encountered in shallow waters of eastern Barents Sea and in Kara Sea, Novosibirsk shallows, Chukchi Sea.

Family M a c t r i d a e

Shell equivavled, triangular-spherical or elongated-ovate, sometimes gaping posteriorly. Internal cartilaginous ligament and external ligament. Hinge in left valve with one laciniate or lambdoid (Λ) central tooth, in right valve with two cardinal teeth enclosing it. Lateral teeth well developed. Siphons partially or completely fused, enveloped in a common membrane. Sinus present, varies in depth. Gills smooth, non-plicate. One genus consisting of one species is encountered in northern seas of USSR.

Genus M a c t r a LinneMactra elliptica Brown (plate CXII, 2 al, bl, cr)

Only member of genus encountered in northern seas of USSR. Shell regular, elongated-elliptical, equilateral. Umbo located in centre of uniformly sloped hinge line which in the middle anterior and posterior forms somewhat prominent, loosely built-on corners to which indistinct spherical folds (convexities) extend from the umbo. Shell exterior opaque or slightly glossy, smooth with darker and lighter growth lines. Shell very shiny on interior. Lambdoid, thin, lamellose cardinal tooth in left valve; l i g a - m e n t behind it; one anterior and one posterior lateral tooth. In right valve two thin, lamellose cardinal teeth enclose lambdoid tooth of opposite valve. Two anterior and two posterior lateral teeth.

Sinus narrow, extends almost to halfway point of shell. Length up to 28-30 (up to 38) mm.

Boreal species, encountered in Barents Sea off coast of Norway and Murman, where it is the predominant form of the biocoenosis; prefers clean, sandy bottoms of upper and middle sublittoral. In same areas found in masses in stomachs of haddock.

Suborder ADAPEDONTA

Family M y i d a e

Genus M y a (L.) Lamarck (plate CXII, 3-6)

Shell equivalved, gaping posteriorly (and frequently anteriorly). Ligament internal, cartilaginous, located under umbones and attached by one end to spoon-shaped process (chondrophore) of left valve, and by other end to corresponding semispherical cavity of right valve. Due to this type of attachment of ligament, upper edge of right valve slightly overlaps left valve. Spoon-shaped chondrophore of left valve usually with posterior keel and slightly curved anterior edge.

Hinge teeth lacking. Siphons of different length, usually very long, (442)
 separated or enveloped in common membrane. Sinus deep, broad, with rounded
 end, extends to middle of shell. Umbo low, located in middle of shell.
 Exterior with concentric growth lines and barely visible, irregularly radial
 depressions. Large forms, burrow in mud and sand.

Key to species and varieties of the genus

Mya in northern seas of the USSR

1. (2) Ligamental plate of left valve forms spherical process in front of
 radial fold (keel) which extends over plate; process slightly over-
 laps keel. Shell of regular oval-ovate shape, white or greyish . .
 M. arenaria
2. (1) Ligamental plate of left valve does not form process in front of
 keel, uniform 3
3. (6) Shell contracted posteriorly, truncated 4
4. (5) Shell equilateral, slightly elongated, posterior margin truncated
 vertically; valves comparatively thin. Length approximately 70-75
 mm M. truncata
truncata
5. (4) Shell inequilateral, umbo displaced posteriorly; posterior end
 contracted, somewhat obliquely truncated; valves thick, massive.
 Length up to 60 mm M. truncata var. uddevalensis
6. (3) Shell regular, oval-ovate, length 50-65 mm M. truncata
 var. ovata

Mya arenaria Linne (plate CXII, 3 ar, bl, cl, c)

Shell greyish or white, calcareous, epidermis thin, flaking. Length
 up to 10 cm. Variable species with either more rounded or more acuminate
 posterior margin, larger or smaller gape, and umbo which is slightly displaced
 either toward the anterior or posterior from the centre. For the typical form
 the height: length ratio is about 60%, and the thickness: length ratio approxi-
 mately 30% or slightly higher.

Boreal species, encountered in littoral and uppermost sublittoral, on
 muddy-sandy bottoms, bays and inlets of Murman Coast, White Sea. Endures very
 fresh waters.

Mya truncata Linne (plate CXII, 4 b1, c1)

Shell greyish or light-brown in colour. Length up to 75 mm. Height: length ratio 70-80%, thickness: length ratio about 50%. Arctic-boreal species. On soft muddy bottoms of lower littoral and upper sublittoral, primarily up to 50 m, less commonly at greater depths. Barents, White, Kara and Chukchi seas. Siphons of M. truncata consumed in masses by cod and haddock. Apart from main form, the following two varieties are encountered:

M. truncata var. uddevalensis Hancock (plate CXII, 6 ar, b1)

Distinguished from major form by somewhat obliquely truncated posterior margin; at siphon opening posterior margin of shell overgrows with siphon cuticle, forming a whole with siphon surface. Length up to 60 mm. Primarily in upper sublittoral; distribution similar to that of major form.

M. truncata v. ovata Jensen (plate CXII, 5 b1)

Shell sometimes difficult to distinguish from M. arenaria in appearance and shape. Distinguished from M. arenaria by structure of spoon-shaped ligamental process and distribution in sublittoral at great depths.

Arctic-boreal form, similar in bathymetric distribution to major species. Distribution not known, as it is often confused with M. arenaria.

Family T e r e d i n i d a e

Genus T e r e d o Linné

Body vermiform, highly elongated. Shell of complex structure consisting of two valves with widely gaping front and back at its most anterior point. Each valve consists of three parts which serve as boring devices: a front part with finely serrated ridges on the surface; a middle part with coarse serration (the ridges of these two parts are positioned at a right angle to each other), and a third part, the "ear", which is smooth and without teeth. A flat, calcareous process, the a p o p h y s i s, protrudes from under the umbones

into the shell. Some of the foot muscles are attached to the apophysis. Ligament and hinge teeth lacking. Siphons long, for the most part fused, separate only at ends. Posterior end bears two conical calcareous plates, "pallets", which protect the posterior end of the body and which are able to close the entrance to the siphon.

Foot reduced, short, highly contractile, can attach, greatly assists mollusk in its movement along burrows. Gills long, reticulate, partially extend into lower siphon.

Burrows of teredinids in wood are lined with thin calcareous layer secreted by animal and not associated with shell.

Teredo norvegica Linné (plate CXII, 7 a, f, h)

Only species known for certain in northern seas of USSR. Boreal species, reaches Murman Coast from west, going as far as Svyatoi Nos, but apparently does not reproduce in the Barents Sea due to low water temperatures.

Feeds on the sawdust produced by burrowing.

Length of mature T. norvegica up to several centimetres, diameter of burrow in wood 0.5 cm, length of burrows differs, may reach several tens of centimetres.

Family S a x i c a v i d a e

Gills long, narrow, plicate, overlap into lower (branchial) siphon. Ligament external, highly developed, attached to fairly strong ligamental nympha, internal ligament lacking. Shell often gapes at one or both ends.. Siphons enveloped in common membrane, completely or for the most part fused. Cardinal teeth (odontoid thickenings of hinge line) poorly developed or lacking. Epidermis well developed.

Key to genera of Saxicavidae of northern
seas of the USSR

1. (2) Shell thick-walled, coarse, heavy, of irregular quadrangular form. Teeth usually present only in young forms Saxicava
2. (1) Shell thin-walled, lightweight, fairly elongated, uniform. Each valve bears one odontoid process behind which lie ridge-like processes, l i g a m e n t a l n y m p h a e (folds). Shell gapes at front and back; dorsal and ventral margins even, parallel Cyrtodaria

Genus S a x i c a v a Fleuriau
de Bellevue

Saxicava arctica (Linné) (plate CXII, 9 a1, b1)

Umboes located on first quarter of irregularly angular, elongated shell. Two visible radial folds extend posteriorly from umbo to upper and lower corners of posterior margin. Exterior rough, calcareous. Sinus indistinct. Highly variable species (in shape, elongation of shell, obtuseness of it posterior end and rugosity). Length 3.5-4.5 cm. (444)

Cosmopolitan, biopolar species; eurybathic form, encountered primarily on hard, mixed stony bottoms. Capable of boring through rock, lithothamnions.

Genus C y r t o d a r i a Daudin

Cyrtodaria kurriana Dunker (=C. siliqua Spengler)
(plate CXIII, 1 a1, c, d)

Length of shell almost 3 times greater than height; equilateral: flattened umbo lies in centre of long hinge line. Sinus up to one-third of length of shell. Exterior smooth, brown. Length up to 3-4 cm (usually less).

Arctic species, encountered in freshwater shallow areas at depths up to 50-60 m. Barents Sea, along coast of Novaya Zemlya; Kara Sea and farther eastward to Chukchi Sea.

Order ANOMALOBANCHIA (ANOMALODESMATA)

Family L y o n s i i d a e

Shell equivalved or slightly inequivalved, teeth lacking; internal ligament with lithodesma, lies in small depression under umbo; siphons short, separate, without any particular retractor muscles; sinus indistinct. External branchial lamella fairly wide. Foot short, with byssus. The only genus with family characteristics.

Genus L y o n s i a TurtonLyonsia arenosa (Möller) (plate CXIII, 2 a1, c1, c)

Shell thin, fragile, oval-trapeziform; posterior margin noticeably expanded, elongated and flattened, forms significant angle with straight posterior half of hinge line at the top. Length 20-25 mm.

High-arctic species, encountered in shallow waters of all northern seas in USSR. Quite rare in Barents Sea, encountered only in northern and eastern regions. Found on muddy-sandy bottoms of upper and middle layers of sublittoral at temperatures approximating 0°C and lower.

Lyonsia schimkewitschi Derjugin et Gurjanova also encountered in White Sea. Smaller in size than L. arenosa, with higher and more inflated shell, with high umbones and delicate, fragile valves. Length up to 15 mm (plate CXIII, 3 a1, d).

Family P a n d o r i d a eGenus P a n d o r a Brugiere

Shell inequivalved: right valve flat, left valve convex, covers right one. Umbo low, displaced anteriorly. Ligament complex: weak external ligament and strong internal one usually consisting of three parts, with lithodesma. Siphons short, sinus lacking. Foot fairly large, with byssus. External branchial lamellae consists of one row of filaments, curved upward where it

adheres to walls of mantle. Internal lamella of usual type, double, fused with opposite internal lamella along edges, forming a sort of septum which separates the anal siphon from the branchial one. Valves on the inside under umbo with small diverging odontoid folds at the point where ligament attaches.

Pandora (Kennerlia) glacialis Leach

(plate CXIII, 4 al, bl, br, k)

Only species in northern seas belonging to subgenus Kennerlia Carpenter in which lithodesma is observed and right, flat valve bears irregular, fine, divergent striation.

Shell spherical-trapeziform, with elongated posterior end, with (445) noticeably prominent ventral margin and straight posterior half of dorsal margin.

Shell exterior silvery-white, without costae, nacreous inside. Length 18-20 mm.

High-arctic species, encountered in upper and middle layers of sublittoral of Arctic seas, on sand bottoms; rare in Barents Sea, primarily inhabiting cold eastern regions. White Sea and all Siberian seas.

Family P e r i p l o m a t i d a e

Genus P e r i p l o m a Schmacher

Shell slightly inequivalved, ovably spherical. Teeth lacking, ligament attached to special spoon-shaped processes in each valve, which are supported by transverse nymphae. Siphons long, sinus deep. Ligament with lithodesma. Umbo with small vertical slit, particularly visible from within.

Periploma fragilis (Totten) (= P. abyssorum Verrill) (plate CXIII, 5 ar, bl, br, d)

The only species encountered in northern seas of USSR. Valves thin, white, opaque, fragile; two ill-defined radial folds on posterior end of shell

and one on anterior end. Sinus narrow, deep, extends to halfway point of shell. Length 35-40 mm. Shell in young specimens angularly spherical, in mature specimens somewhat elongated, with well-defined growth lines. Anterior and posterior radial folds in young specimens usually present only on right valve, hinge also differs somewhat, slit under umbones may be lacking.

High-arctic, eastern, deep-sea species. Kara Sea on soft brown muds of middle and lower sublittoral, Chukchi Sea.

Family *T h r a c i i d a e*

Shell slightly inequivalved, thin-walled, with calcareous exterior, hinge teeth lacking; ligament internal or external, siphons long, separate, sinus deep. Foot small, without byssus. External branchial lamella consists of one row of filaments, fused with mantle at top; internal ones fused with each other.

One genus in northern seas.

Genus *T h r a c i a* (Leach) Blainville

Thracia myopsis (Beck) Moller (plate CXIII, 6 ar, br)

Shell calcareous, greyish, small, with characteristic vertically striated posterior end, to lower corner of which extends an indistinct radial convexity from umbo. Length 20-36 mm.

Arctic-boreal species, encountered in lower, less commonly in middle sublittoral, on muddy-sandy bottoms in all northern seas of USSR.

Family *V e r t i c o r d i i d a e*

One genus in northern seas.

Genus *L y o n s i e l l a* M. Sars

(= *P e c c i c o l a* M. Sars)

Shell small, highly convex, spherical-trapeziform; umbo displaced anteriorly. Gills "reticular", highly reduced: one lamella on each side of body, intergrown with thin septum, separating mantle cavity into upper and lower chambers.

Teeth lacking. Ligament internal with lithodesma. One upper siphon, lower one undeveloped. Foot with thin byssus. One species most frequently encountered in northern seas.

Lyonsiella abyssicola (M. Sars) (plate CXIII, 7 al, cl, c, e) (446)

Shell trapeziform, almost rhomboid; posterior half of dorsal margin almost parallel to ventral margin. Valves very thin, semitransparent, with radial striation (16-20 lines). Interspaces finely dotted. Length 4.5-6 mm.

Primarily boreal, deep-sea species; in western and northern parts of Barents Sea, in northwestern part of Kara Sea (rare); in lower sublittoral on soft mud.

Family P o r o m y i d a e

Genus P o r o m y a Forbes

Shell oval, inflated, nacreous inside, internal ligament weak, with lithodesma, closely underlying external one. Small hinge plate with one cardinal tooth in each valve under umbones. Gills converted to horizontal septum with several openings on each side. Siphons short. One species in northern seas of USSR.

Poromya granulata (Nyst et Westendorp) (plate CXIII, 8 al, cr, cl, e)

Shell oval-triangular, convex, equivalved, equilateral. Anterior margin rounded, posterior one somewhat obliquely truncated at very end, noticeably angular, gapes slightly; low spherical fold extends from umbo to posterior lower corner. Valves thin, semitransparent, smoky grey, covered with microscopic spines and granules. Length 18-20 mm.

Boreal, deep-sea species, quite rare in northern seas, encountered in southwestern part of Barents Sea at depths of 200-400 m on soft muds.

Family C u s p i d a r i i d a e

Genus C u s p i d a r i a Nardo (=Neaera Gray)

Shell asymmetrical, with more or less beak-shaped posterior end.

Teeth lacking or one weak lamellar posterior lateral tooth in right valve. Chondrophore small, narrowly cochleariform, lies under umbones, slightly displaced posteriorly; ligament internal; if external ligament present, located in front of umbones. Shell exterior with concentric striation. Siphons fused, almost non-contractile, lie inside of beak, enveloped in common membrane on outside. Foot small, geniculate, byssus lacking. Branchial lamellae lacking, septum sturdy, muscular, with two rows of slit-like openings on each side of body.

Cuspidaria arctica M. Sars (plate CXIII, 9 ar, cl, d)

Beak short, does not exceed $\frac{1}{4}$ total length of inflated shell.

Shell inflated, valves thin, but strong, compact, frequently calcareous. Umbones high, convex, curved toward the posterior. Greyish-white in colour. Length up to 30 mm.

Arctic-boreal species; widely distributed in lower sublittoral of open parts of Barents, White and Kara seas, on soft muddy bottoms.

Cuspidaria rostrata Spengler (plate CXIII, 10 al)

Beak long, equal to $\frac{1}{2}$ total length of shell.

Shell small, moderately convex; valves thin, white, semitransparent, with very fine concentric striation. Length up to 22 mm.

Boreal species, encountered in deep, muddy depressions along coast of Norway and western Murman in Barents Sea, on muds, at temperatures not lower than 2°C.