REVISION OF THE DEEP-WATER MOLLUSCA OF THE ATLANTIC COAST OF NORTH AMERICA, WITH DESCRIPTIONS OF NEW GENERA AND SPECIES.

PART I.—BIVALVIA.

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THIS article is not intended as a review of all the known species found off our coasts. It is preliminary to a much more extensive report, in which full details of the distribution of all the species collected will be given, and for which the detailed tables have been prepared, giving every station for each species, with its position, depth, temperature, character of the bottom, etc.

Many of the larger and more prominent species were described and figured by the senior author several years ago in various papers published in the Transactions of the Connecticut Academy and elsewhere. The smaller and more difficult species were put aside at that time, for more careful study, and are now presented.

The families that are most fully treated in this article are the Ledidæ, Cuspidaridæ, Diplodontidæ, and Pectinidæ. These include a very large number of deep-sea species in every region, and their species are often very difficult to distinguish without long and patient microscopic study and direct comparison of large series of specimens from various localities.

The present article is intended to give some of the results of studies of this kind, made during several years, of the large series of specimens dredged by the United States Fish Commission off our coasts from 1871 to 1887, together with those previously dredged by the senior author in the same region.

In order to avoid, so far as possible, the uncertainty necessarily connected with mere descriptions of these forms, we have had large camera-lucida figures made, as carefully as possible, not only of the new species, but also of some of those previously described from our coast, for comparison. It is, therefore, to be hoped that future investigators may at least be able to understand the characters of the species now recognized by us, whether they agree with our determinations or not.

Although the collections studied are unusually extensive, and the number of stations represented is very large, it is noteworthy that a considerable number of species were met with but once, and sometimes only a single specimen was obtained. This indicates that many additional species of such small deep-sea shells would be discovered in the same region if additional dredgings should be made.

Our investigations have enabled us to add to the fauna nine genera, four subgenera, and about eighty species and varieties, of which about seventy are described as new species and seven as new varieties; of these, twelve species and one variety belong to the southern fauna.

The following list shows the genera in which the new species and varieties are included.[1] The new genera are printed in italic:

Martesiella, 1.
Abra, var. 1.
Macoma, 1
Montacuta, 4, var. 2.
Kelliopsis.
Cryptodon, 4, var. 1.
Axinulus, 6.
Axinopsis, 1, var. 1.
Axinodon, 1.
Leptaxinus, 1.
Cuspidaria, 8.
Cardiomya, 2.
Halonympha, 1.
Myonera, 3.
Poromya, var. 1.
Cetoconcha, 2.
Cetomya, 1.
Lyonsiella, 2.
Lyonsia, 1.
Clidiophora, 1.
Kennerlia, 1.
Periploma, 1.
Limatula, 3.
Chlamys, 2.
Hyalopecten, 1.
Camptonectes, 1.
Cyclopecten, 2.
Bathyarca, 2.
Bentharca.
Limopsis, 2.
Solemya, 1.
Nucula, 1, var. 1.
Leda, 1.
Ledella, 1, var. 1.
Adranella, 1.
Microyoldia.
Yoldiella, 11, var. 1.
Malletia, 2.
Neilonella, 1.
Tindaria, 3.

No attempt has been made to give the complete synonymy and details of the distribution. Such matters have been reserved for the final report on the collections.

Unless otherwise stated, the station numbers are those of the United States Fish Commission and the serial numbers are those of the United States National Museum.

The drawings, with few exceptions, were made by Mr. Alpheus H. Verrill, under the immediate supervision of the authors.

Peabody Museum of Yale University, New Haven, Connecticut, January 25, 1897.

[1]Owing to the long delay in the publication of this article, some of the new species and genera have been published elsewhere, so that these numbers are not now strictly correct.

Family PHOLADIDÆ.

MARTESIELLA, new subgenus.

This subgeneric name is proposed for the following species, which differs from *Martesia* in having a well-defined, elongated, median, dorsal plate, posterior to the umbos, in addition to the shield-shaped one over them.

MARTESIA (MARTESIELLA) FRAGILIS, new species.

(Plate LXXIX, fig. 10.)

Shell small, white, thin, fragile, wedge-shaped. The anterior end is very short and broadly rounded, the aperture nearly closed in our largest specimen by a pair of callous plates. The antero-dorsal margin is recurved toward the umbos, but not appressed, and forms a deep, spiral, open cavity. The valves have a very obtuse anterior emargination. A broad and moderately deep sulcus runs from the beak to the ventral margin; in front of this the surface is covered by thin concentric ribs, which curve downward at the sulcus and form a distinct angle in line with the anterior emargination and corresponding with a slight ridge on the surface; these concentric ribs are crossed by fine radiating lines, which produce fine serrations on their edges. Posterior to the sulcus the surface is marked only by irregular lines of growth, which, near it, take the form of more distinct grooves or ridges. The posterior end is prolonged, compressed, and bluntly rounded. The umbonal plate is thick, relatively large, and usually heart-shaped, with the posterior end broader and distinctly emarginate in the middle; the anterior end tapers somewhat and is blunt and angulated, or sometimes subacute. The posterior dorsal plate is long, narrow, and somewhat spatulate or clavate, and stands well in relief above the dorsal margin, with the edges free and the narrow anterior end running under the posterior end of the umbonal plate.

Length of one of the largest specimens, 7 mm.; height, 4.5 mm.; thickness, 4 mm.

Young specimens 3 or 4 mm. in length are relatively shorter and thicker than the larger ones, but even these have the anterior callous pretty well developed; the umbonal plate is usually shield-shaped, the lateral borders emarginate, in contact with the most prominent part of the umbos; the posterior border is distinctly emarginate, and the anterior end has a central point or mucro, sometimes defined by slightly concave posterior edges.

Many live specimens were found in a piece of wood floating near station 2566, N. lat. 37° 23′, W. long. 68° 8′, 1885.

Family SEMELIDÆ.

ABRA LONGICALLIS (Scacchi), variety AMERICANA, new.

(Plate LXXXIII, figs. 6, 7.)

Abra longicallis VERRILL, Trans. Conn. Acad., VI, pp. 224, 278, 1884.

Our specimens differ from the European form described and figured by G. O. Sars[1] in having the posterior lateral tooth less remote and the cartilage-pit or chondrophore longer, the antero-dorsal margin more convex, and the whole shell relatively broader.

A very few specimens were obtained at six stations between N. lat. 39° 49′, W. long. 68° 28′ 30″, and N. lat. 36° 16′ 30″, W. long. 68° 21′, in 924 to 2,620 fathoms, 1883–1886.

Family TELLINIDÆ.

MACOMA INFLATA Dawson.

(Plates LXXVII, fig. 1; LXXXVIII, fig. 6.)

Macoma inflata (STIMPSON MSS.) DAWSON, Canadian Naturalist, VI, p. 377, 1872.—VERRILL, Trans. Conn. Acad., V, p. 568, 1882.

A number of live specimens and separate valves were obtained at six stations between N. lat. 47° 40′, W. long. 47° 35′ 30″, and N. lat. 40° 3′, W. long. 70° 31′, in 57 to 206 fathoms, 1877–1886. Murray Bay.—Dawson. Gulf of St. Lawrence.—Coll. Whiteaves.

Family PETRICOLIDÆ.

CHORISTODON ? CANCELLATUS Verrill.

(Plate XCVI, figs. 2, 3.)

Choristodon ? cancellatus VERRILL, Trans. Conn. Acad., VI, p. 435, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 58, 1889.

One valve, station 2265, off Chesapeake Bay, in 70 fathoms, 1884.

Family KELLIELLIDÆ.

KELLIELLA NITIDA Verrill.

(Plates XCI, fig. 8; XCIII, fig. 10.)

Kelliella sp. VERRILL, Trans. Conn. Acad., VI, p. 279, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.
Kelliella nitida VERRILL, Trans. Conn. Acad., VI, p. 438, 1885.

Comparatively few specimens, at seven stations between N. lat. 39° 5′ 30″, W. long. 70° 44′ 30″, and N. lat. 38° 20′, W. long. 70° 8′ 30″, in 1,525 to 2,033 fathoms, 1883–1886.

[1] Mollusca Reg. Arcticæ Norvegiæ, p. 74, pl. 6, figs. 3 *a–c;* pl. 20, fig. 4, 1878.

Family LEPTONIDÆ or ERYCINIDÆ.

KELLIA SUBORBICULARIS (Montagu).

(Plate XCIV, figs. 3, 4.)

Kellia suborbicularis H. and A. ADAMS, Genera Recent Moll., II, p. 475; III, pl. CXIV, figs. 8 *a–c*, 1858.—JEFFREYS, British Conchology, II, p. 225, pl. V, fig. 3, 1863; V, p. 179, pl. XXXII, fig. 2, 1869.—GOULD, Rep. on Invert. of Mass., Binney's ed., p. 83, fig. 394, 1870.—TRYON, Amer. Mar. Conch., p. 171, pl. 32, figs. 433, 435, 1873.—G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 67, pl. 19, figs. 14 *a-b*, 1878.—JEFFREYS, Proc. Zoöl. Soc., London, p. 700, June, 1881.—SMITH, E. A., Report Voy. Challenger, Zoöl. Lamellibranchiata, XIII, p. 201, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 200, pl. LXVIII, fig. 5, 1889.

One fresh specimen, Massachusetts Bay, off Salem, 1877. This species appears to be very rare on the American coast. In its hinge-characters it seems to agree closely with *Bornia* Philippi, 1836.

MONTACUTA BIDENTATA (Montagu).

(Plates XCIII, figs. 7, 8; XCIV, fig. 6.)

Mya bidentata MONTAGU, Test. Brit., p. 44, pl. XXVI, fig. 5, 1803.

Montacuta bidentata FORBES and HANLEY, Hist. Brit. Moll., II, p. 75, pl. XVIII, figs. 6, 6*a*.

Tellimya bidentata H. and A. ADAMS, Genera Recent Moll., II, p. 478; III, pl. CXV, figs. 2, 2*a*, 1858.

Montacuta bidentata JEFFREYS, British Conchology, II, p. 208, pl. V, fig. 1, 1863; V, p. 177, pl. XXXI, fig. 8, 1869.—G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 69, pl. 19, figs. 17*a-b*, 1878.—JEFFREYS, Proc. Zoöl. Soc., London, p. 698, June, 1881.—VERRILL, Trans. Conn. Acad., V, p. 571, 1882.—BUSH, Trans. Conn. Acad., VI, p. 479, 1885; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 590, 1885 Not *Montacuta bidentata* Gould.

Comparatively few specimens have been found in Long Island Sound and at Thimble Island (A. E. Verrill); Provincetown, Massachusetts (S. I. Smith and O. Harger); Vineyard Sound, 1875; Cape Cod Bay, 1879; off Block Island, 1880; Woods Hole, Massachusetts (Gut of Canso, and Naushon Gutters), 1882–83. From low-water to 15½ fathoms. Off Cape Hatteras, North Carolina, in 14 to 48 fathoms, 1883 and 1884.

MONTACUTA BIDENTATA (Montagu), variety TENUIS, new.

(Plate XCII, fig. 7.)

Shell similar to the typical *M. bidentata* in form and size, but relatively more elongated and more nearly elliptical, with the umbos and beaks somewhat less prominent. The surface is covered with fine and pretty regular lines of growth. The teeth in the right valve are strong, nearly equal in length and in the amount of divergence from the dorsal margin. They diverge more strongly and are thicker and more prominent, especially at the inner end, than is usual in the true *bidentata*.

Length of a medium size specimen 4.7 mm.; height, 2.6 mm.

A few separate valves, off Cape Hatteras, North Carolina, in 16 to 17 fathoms, 1884.

MONTACUTA BIDENTATA (Montagu), variety FRAGILIS, new.

(Plate XCII, fig. 8.)

Shell subelliptical, inequilateral, both ends broadly rounded, thin, fragile, covered with delicate lines of growth. The umbos are flattened; beaks but slightly prominent. The teeth in the right valve are smaller and more delicate than in the typical *bidentata*, and diverge but slightly from the dorsal margin, as in that species.

Length, 4 mm.; height, 3 mm.

One specimen (No. 46134), station 816–17, in Narragansett Bay, in 8½ to 10 fathoms, 1880.

MONTACUTA STRIATULA, new species.

(Plate XCIII, fig. 9.)

Shell rather large, thin and somewhat hyaline, compressed, broad-elliptical with both ends well rounded, the anterior much the longer. Antero-dorsal margin nearly straight with a gradual slope; anterior end broadly and regularly rounded, its outline forming nearly the segment of a circle; ventral margin broadly and evenly convex; posterior end bluntly rounded with its dorsal margin slightly concave and sloping rapidly. Umbos not swollen; beaks acute and only a little prominent. Surface covered with fine, regular, concentric, microscopic striæ and more distant lines of growth. Interior somewhat shining with inconspicuous muscular scars. Hinge-margin thin, delicate, only slightly thickened. In the right valve there is, on each side of the beaks, a short, rather delicate, elevated, triangular tooth, terminating distally with an abrupt slope; these are nearly equal in size and length, the anterior one being slightly the shorter and more angular. They are separated by a V-shaped notch, the sides of which form nearly a right angle. In the left valve there are two thin, slightly prominent elevations, scarcely worthy the name of teeth, separated by a very wide angle under the beak.

Length of one of the largest specimens, 7 mm.; height, 6 mm.

This species is much larger than any of our other species of this genus, and may possibly prove to be identical with *M. bowmani*, described and figured by Holmes.[1] Owing, however, to the shortness of the description and small size of the figures, this question cannot be definitely decided without a careful comparison with authentic specimens.

A few separate valves were found off Cape Hatteras, North Carolina, in 15 to 48 fathoms, 1883–84.

[1] Post-pleiocene fossils of South Carolina, p. 30, pl. VII, fig. 2, 1860.

MONTACUTA OVATA Jeffreys.

(Plate XCII, figs. 9, 10.)

Tellimya ferruginosa VERRILL, Notice of Recent Add. to Mar. Invert., Pt. 3, Proc. U. S. Nat. Mus., III, p. 400, 1880.

Montacuta ovata JEFFREYS, Proc. Zoöl. Soc., London, p. 698, pl. LXI, fig. 4, June, 1881.—VERRILL, Trans. Conn. Acad., V, p. 571, 1882; VI, p. 279, 1884.

A very few specimens, at four stations, off Newport, Rhode Island, and off Marthas Vineyard, in 100 to 157 fathoms, 1880–81.

MONTACUTA TUMIDULA Jeffreys.

(Plates XCIII, fig. 6; XCIV, figs. 1, 2.)

Montacuta tumidula JEFFREYS, British Conchology, V, p. 177, pl. C, fig. 5, 1869.—G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 69, pl. 19, figs. 18 *a–b*, 1878.—VERRILL, Trans. Conn. Acad., VI, pp. 225, 279, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 575, 1885.

One live specimen and three valves, at three stations between N. lat. 40° 7′, W. long. 67° 54′, and N. lat. 35° 49′ 30″, W. long. 74° 34′ 45″, in 843 to 1,091 fathoms, 1883–1886.

MONTACUTA CASTA, new species.

(Plate XCIV, fig. 5.)

Shell small, compressed, oblong-ovate, with the anterior end considerably the longer and both ends about equally rounded. Beaks small, scarcely rising above the margin. Surface covered with fine, regular, microscopic, concentric striæ and distant, raised lines of growth. The antero-dorsal margin is at first a little incurved, then slightly convex; with a gradual slope; the anterior end is obtusely rounded; the ventral margin is broadly and evenly rounded; the posterior end is slightly produced and a little angulated below, in some specimens with the dorsal margin sloping more rapidly than the anterior and slightly incurved near the beaks. The hinge-margin is thin and delicate. In the right valve there are two moderately thick, rather prominent teeth; the one behind the beak is shorter than the other, with a more abrupt posterior slope; they are separated from the slightly thickened margin by a deep groove and from each other by a large notch or angle, the sides of which form an angle of about 90°. On the thickened margin there is a thin, rough, shallow ligamentary furrow both in front of and behind the beaks. In the left valve there is an elongated, thin, and not very prominent, tooth-like elevation on each side of the beak; they are nearly equal in size and separated by a very broad angle.

Length of the largest specimen, about 2.4 mm.; height, about 1.8 mm.

A few separate valves, off Cape Hatteras, North Carolina, in 14 to 17 fathoms, 1884.

MONTACUTA CUNEATA, new species.

(Plates XCI, fig. 4; XCIII, fig. 5.)

Shell small, elongated, wedge-shaped, with a much produced, narrow anterior end, and with the dorsal margins nearly straight, sloping rapidly, and forming an obtuse angle at the beaks, which are decidedly behind the middle, prominent, curved inward. Antero-dorsal margin sloping rapidly, at first nearly straight, becoming a little convex, and curving regularly into the ventral margin, thus forming a somewhat rostrated, narrow, evenly rounded anterior end; ventral margin nearly straight, sometimes with a slight incurvature opposite the beaks; posterior end bluntly rounded, with its dorsal margin nearly straight, sloping about equally with the anterior. The surface is covered with fine, concentric, rather regular lines of growth and microscopic striations. Interior somewhat shining. In the right valve there are two well-defined, prominent, thickened teeth, separated by a large, deep notch under the beak; the anterior one is the larger and is broadly triangular, with a prominent excurved tip, and is separated from the hinge-margin by a deep furrow, which runs obliquely within and below the thickened dorsal margin; the posterior one is set obliquely to the margin, from which it is separated by a well-defined groove. In the left valve there is a wide notch beneath the beak, with a rather inconspicuous, elongated, somewhat thickened anterior tooth-like projection, which continues forward as a thickened inner margin nearly to the end, and a shorter, broad, triangular posterior projection. Color cream-white, sometimes tinged with pink.

Length of the largest specimen, about 3 mm.; height, 1.5 mm.

A few specimens were found off Cape Hatteras, North Carolina, in 15 and 16 fathoms, 1883–84.

MONTACUTA TRIQUETRA, new species.

(Plate XCI, fig. 3.)

Shell small, covered with regular concentric grooves, scarcely compressed, somewhat triangular, with a slightly rostrated, angular posterior end, and a regularly rounded anterior one. Umbos a little swollen, beaks nearly central, pointed and a little prominent. The anterior and posterior dorsal margins form nearly a right angle; the anterior margin is slightly convex and passes gradually into the somewhat bluntly rounded anterior end; ventral margin broadly convex, becoming slightly incurved toward the posterior rostration, which is wedge-shaped, rapidly tapered, with a narrow truncate tip, defined below by a faint, radiating ridge; postero-dorsal margin is nearly straight, and slopes rapidly from the beaks. The surface is sculptured with strongly marked, smooth, rounded, concentric ridges having the upper edge smooth and recurved; these are separated by deep, regular grooves

which appear in some places to extend beneath the upper edge of the ridges; on the umbos and posterior rostrum these ridges and grooves become feeble and irregular, like lines of growth. Internally the surface is white and smooth, with the muscular scars rather strongly marked.

The hinge-margin is rather thick; in the right valve there are two strong, prominent, curved, cardinal teeth, separated by a large, somewhat oblique notch which extends upward into the beak; the posterior tooth is the narrower and more prominent, with the tip curved forward and upward; the anterior tooth is connected, just in front of the beak, by a bridge-like extension to the external margin, leaving between the tooth and the margin a deep submarginal groove; the inner edge of the hinge-margin is a little thickened to form a ridge continuous with the anterior tooth. In the left valve there is a distinct notch under the beak for the cartilage or resilium; in front of this is a prominent, tooth-like thickening of the margin of the shell, the proximal end of which becomes tooth-like, but is continuous with the rest of the hinge-margin; behind the notch there is no tooth and the margin is only a little thickened, without any special prominence.

Length, about 2 mm.; height, 1.4 mm.

Two valves, station 2307, off Cape Hatteras, North Carolina, in 43 fathoms, 1884.

TELLIMYA FERRUGINOSA (Montagu).

(Plate XC, figs. 7, 8.)

Tellimya ferruginosa H. and A. ADAMS, Genera Recent Moll., II, p. 479, 1858.
Montacuta ferruginosa JEFFREYS, British Conchology, II, p. 210, 1863; V, p. 178, pl. XXXI, fig. 9, 1869.
Tellimya ferruginosa G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 70, pl. 20, figs. 1, *a–c*, 1878.—VERRILL, Trans. Conn. Acad., VI, 225, pl. XXX, fig. 13, 1884.
Montacuta ferruginosa FISCHER, Manuel de Conchyliologie, p. 1027, fig. 775, 1887.
Tellimya ferruginosa DALL, Bull. U. S. Nat. Mus., No. 37, p. 50, pl. XLV, fig. 13, 1889.

A few specimens were found at low-water at Woods Hole, Massachusetts (Gut of Canso), and Gutters of Naushon Island, 1882–83. The figure of the living animal published by Verrill in 1884 has been copied by Dall, Fischer, and others. We now give additional ones.

KELLIOPSIS, new genus.

Type.—Montacuta elevata Stimpson.

The shell, in size and form, resembles *Kellia* and *Montacuta*. In both valves there is a small, prominent, anterior tooth and a low, elongated, thickened posterior ridge, scarcely amounting to a tooth. The resilium is large and is attached to an elongated, oblique excavation on the proximal edge of the posterior tooth-like ridge, and also to a triangular pit beneath the beak; it bears a large, elongated, curved ossicle. Soft parts not observed.

This genus appears to be closely allied to *Montacuta*, but differs in not having a definite, raised, posterior tooth; in having a large, elongated posterior cartilage, bearing a large ossicle attached to a special groove along a tooth-like ridge; and in having the structure of the hinge in both valves nearly the same. In the position of the resilium it resembles *Erycina*, but the latter has two large teeth in both valves.

KELLIOPSIS ELEVATA (Stimpson).

(Plates XCIII, figs. 2-4; XCIV, figs. 7, 8.)

Montacuta bidentata GOULD, Rep. on Invert. of Mass., 1st ed., p. 59, 1841. (Not of Montagu.)

Montacuta elevata STIMPSON, Shells of New Eng., p. 16, 1851.

Cyamium elevatum H. and A. ADAMS, Genera Recent Moll., II, p. 477, 1858.

Montacuta elevata GOULD, Rep. on Invert. of Mass., Binney's ed., p. 86, fig. 396, 1870.—TRYON, Amer. Mar. Conch., p. 172, pl. XXXIII, fig. 440, 1873.—VERRILL, Report Invert. Anim. of Vineyard Sd., in 1st Rep. U. S. Fish Com., pp. 394, 688, 1874 (auth. cop., p. 418).

Tellimya elevata DALL, Bull. U. S. Nat. Mus., No. 37, p. 50, pl. LXVIII, fig. 6 (as *Montacuta elevata* Stimpson), 1889.

This rare species has been obtained at low-water mark, at Savin Rock, near New Haven, Connecticut (J. E. Todd), 1871; Wellfleet, Massachusetts (Webster), 1879; Woods Hole, Massachusetts (Gut of Canso), 1882; Naushon Island (Gutters and Sheep Pen Cove), 1882; and Narragansett Bay, in 8½ to 10 fathoms, 1880.

Family DIPLODONTIDÆ.

Ungulinidæ FISCHER; *Diplodontidæ* + *Cryptodontidæ* Dall.

CRYPTODON Turton, 1822.

Type.—Cryptodon flexuosus (Montagu).

The typical species of this genus have no distinct teeth in either valve, but the inner margin of the hinge-plate is more or less thickened or swollen in front of and behind the beaks. The ligament is posterior and lies in a long, curved furrow in the midst of the marginal thickening; where it commences at the beak it is marginal and external, but as it runs backward it recedes from the edge and becomes more or less internal and invisible from the exterior. Moreover, the posterior end of the shell has one or more distinct radial corrugations or plications to give the thin shell strength enough to resist the action of the large posterior adductor muscle which is attached directly upon the principal plication. The pedal muscle is attached to the upper plication when the latter is present. Many writers have adopted the name of *Axinus* Sowerby, 1823, for this genus; the latter name was given to a tertiary species, the structure of which is not fully determined. It may belong to a very distinct genus. Moreover, Turton's name seems to have actual priority of publication.

CRYPTODON GRANDIS Verrill.

Cryptodon grandis VERRILL, Trans. Conn. Acad., VI, p. 436, pl. XLIV, fig. 22, 1885; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 575, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 50, pl. XLVI, fig. 22, 1889.

Schizothærus grandis (*pars*) LOCARD, Campagne du "*Caudan*," Annales de l'Université de Lyon, p. 180, 1896.

This large and interesting species, described in detail and well figured in the first article quoted above, is a true *Cryptodon*, although very distinct from any of our other species. Therefore it seems strange that M. Locard has referred it to the very different genus, *Schizothærus* of Conrad, which belongs to the Mactridæ. He identifies without question a single valve, dredged by the *Caudan* off the coast of France, in 1,710 meters, as our species. It is, therefore, doubtful whether his specimen is congeneric with ours, for the latter certainly has no affinity with *Schizothærus*.

One live specimen and a few separate valves were dredged at three stations between N. lat. 38° 29′, W. long. 73° 9′, and N. lat. 35° 9′ 50″, W. long. 74° 57′ 40″, in 938 to 1,582 fathoms, 1883–84.

CRYPTODON INSIGNIS, new species.

(Plate XCI, figs. 1, 2.)

Cryptodon sarsii VERRILL, Proc. U. S. Nat. Mus., III, p. 399, 1880; Trans. Conn. Acad., V, p. 570, 1882.

Shell unusually large and thick for the genus, opaque white or tinged faintly with reddish internally. Outline somewhat variable, usually broad-ovate or subquadrate, usually moderately swollen, sometimes rather compressed. Umbos moderately large, not very prominent; beaks small and turned forward. Lunule cordate, rather large, pretty well defined. The radial folds and lobes are less marked than is usual in this genus. A well-marked fold or shallow undulation extends from the beak to the posterior margin, opposite the scar of the adductor muscle; anterior to this there is a broad, slightly raised ridge, extending from the umbo to the siphonal lobe of the margin; in front of this there is usually a broad faint depression of the surface which is scarcely apparent in many specimens; a posterior groove runs close to and nearly parallel with the postero-dorsal margin. The antero-dorsal margin, in the lunular region, is straight or slightly incurved; the anterior end is short, a little prominent below the lunule, and obtusely rounded; the ventral margin, is very broadly rounded, usually with a slightly more prominent lobe at or just behind the middle, with a more decided but obtuse projection (siphonal lobe) farther back where it joins the posterior margin, which is usually somewhat incurved, corresponding to the external wave-like depression, becoming convex opposite the posterior external fold; the postero-dorsal margin slopes rapidly from the beak and is sometimes broadly rounded, and at others slightly convex. The surface is covered with conspicuous, more or less irregular,

rounded, obtuse, often prominent lines of growth with a thin yellowish brown epidermis which, under the lens, is closely covered with minute granules often arranged in more or less distinct concentric lines. The posterior hinge-margin is somewhat thickened, the ligamental groove is long and curved, diverging considerably from the margin of the shell at its posterior end and extending forward under the beak. Muscular scars and pallial line in the largest specimens strongly marked; the anterior scar is considerably elongated and has a number of lobes or scallops on its inner margin.

Length of a medium-sized specimen, 27 mm.; height from siphonal lobe to beak, 27 mm.; breadth, 14 mm. Length of a larger, more ovate specimen, 32 mm.; height from siphonal lobe to beak, 35 mm.; breadth, 21 mm.

This species presents considerable variation in outline and in the degree of convexity of the valves; some are subquadrate in form, others subcordate, and others pretty well rounded, but the majority are oblong-obvate with a posterior truncation, corresponding to the broad radial groove; some of the valves are considerably inflated, but most of them are more compressed than is usual in this genus. There is also considerable variation in the prominence of the siphonal lobe and broad radial ridge, and in the size of the lines of growth, which in some specimens are quite fine and regular, and in others unevenly developed, those on the anterior part appearing almost like concentric ribs.

Many separate valves, at four stations between N. lat. 44° 54′, W. long. 59° 46′ 45″, and N. lat. 42° 19′, W. long. 69° 47½′, in 65 to 471 fathoms, 1879 and 1885.

The single valve found off Cape Cod, 1879, and identified as *Cryptodon sarsii*, proves to be the young of this species.

CRYPTODON PLICATUS Verrill.

(Plate LXXXIX, fig. 6.)

Cryptodon plicatus VERRILL, Trans. Conn. Acad., VI, pp. 437, 450, 1885.

One young live specimen and one imperfect valve of this characteristic and fragile species were found at two stations, off Marthas Vineyard, in 1,073 to 1,122 fathoms, 1884.

CRYPTODON CROULINENSIS (Jeffreys) Smith.

(Plate XC, figs. 3, 4.)

Clausina croulinensis JEFFREYS, Ann. Mag. Nat. Hist., XX, p. 19, 1847.

Axinus croulinensis JEFFREYS, Brit. Con., II, p. 250, 1864.—G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 62, pl. 19, figs. 8, *a–b*, 1878.—JEFFREYS, Proc. Zoöl. Soc., London, p. 703, June, 1881.

Cryptodon croulinensis SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 193, 1885.

Shell small, obliquely subovate, with the beaks prominent, and the anterior end considerably the longer. The antero-dorsal margin is

nearly straight, sloping rapidly from the beak; the anterior end is distinctly produced, evenly rounded; the ventral margin is slightly but regularly convex to the lower posterior fold; the posterior end is marked by two distinct plications separated by a rather prominent ridge which, at the margin, appears as a rounded projection separating two reentrant curves; the postero-dorsal margin is convex, sloping rapidly to the upper plication. The ligamental area is relatively large, long, elliptical, defined by a distinct groove. Internally the hinge-margin is considerably thickened, especially directly under the beak, where there is a slight swelling; the posterior ligament occupies a very distinct groove, and extends forward under the tip of the beak.

Length, 3.5 mm.; height, 3.75 mm.

The shell here referred to this species appears to agree well with the figures and descriptions given by G. O. Sars. It pretty closely resembles some varieties of *C. gouldii*. The principal differences externally are in the somewhat more produced anterior end and the longer and straighter antero-dorsal margin; the posterior plications are also less strongly developed.

Found in small numbers at about thirty stations north of Cape Cod, between N. lat. 43° 44½′, W. long. 69° 22′, and N. lat. 42° 30′, W. long. 70° 38′, in 13 to 73 fathoms, 1873–1879.

CRYPTODON CROULINENSIS (Jeffreys) Smith, variety ALTUS, new.

(Plate LXXXVIII, figs. 1, 2.)

Shell higher than long, larger than the common form. Umbos prominent, elevated and turned forward, so as to leave a rather large, conspicuous, flattened, lunular area, which is bordered externally by a slight ridge, followed by a concave depression in the surface, which forms a slight indentation in the anterior margin, and resembles the posterior plication, but is more shallow. The antero-dorsal margin in the lunular region is slightly concave, but slopes very rapidly; the anterior end is a little more produced than the posterior, but both are decidedly short; the ventral margin is pretty evenly rounded; posteriorly there are two distinct plications; the lower or larger one is moderately sunken and extends from the beak to the posterior margin, the upper one is much shorter and narrower and defines the narrow, lanceolate, ligamental area; each produces a decided indentation in the margin, that caused by the lower one being more sharply defined and shorter than the other, these are separated by a well-defined, curved, radiating ridge which extends a little below the margin; the postero-dorsal margin is strongly convex, evenly rounded, with a rapid slope; the hinge-margin is considerably thickened, especially beneath the beak, and in the right valve forms a distinctly raised tubercle.

Length, 5 mm.; height, 6 mm. Eastport, Maine, 1870.

Another specimen, from station 292, is slightly smaller. Length,

4.5 mm.; height, 5.25 mm. In this the anterior or upper plication is much less distinct than in the type, and it is therefore possible that this feature is abnormal.

CRYPTODON EQUALIS, new species.

(Plate XCI, figs. 5, 6.)

Shell of moderate size, grayish white, rather swollen, pyriform, usually a little higher than long, but sometimes the height and length are about equal. Umbos rather prominent; beaks median, conspicuously raised above the margin and curved strongly forward so as to produce a rather deep, broad, cordate, but ill-defined lunular area. Anterior and posterior ends nearly equal. The dorsal margin slopes rapidly on both sides of the beak; anteriorly, in the lunular region, it is nearly straight; the anterior end is pretty evenly rounded, forming a continuous curve with the ventral margin, which forms nearly a semicircular curve; the posterior end has one broad, shallow undulation which causes a slight incurvature in the postero-ventral margin; above this the dorsal margin is very slightly convex and forms an angle at the commencement of the fold. The ligamental area is marked by a smooth, long, lanceolate, slightly sunken portion, clearly separated by an incised line. The general surface is covered with slightly marked, more or less irregular lines of growth. The hinge-margin is moderately thickened and is essentially the same in both valves. There is a well marked swelling both before and behind the beak and a more conspicuous one immediately under it; a less conspicuous thickening, with its external edge excurved, extends along the postero-dorsal margin, in the ligamental region. Muscular and pallial scars indistinct.

Length, 5 mm.; height, 5½ mm.; thickness, 4 mm. Some specimens are somewhat larger than this.

In the large series which we have of this species there is some variation. In some cases the form is less swollen, the length is slightly in excess of the height, so that the general outline is more evenly rounded. The species is, however, notable for the equality of the anterior and posterior ends and the presence of the single slight undulation. *Cryptodon gouldii* somewhat resembles this species, but differs in being longer in proportion to its height, in its more compressed form, and in having two distinct folds or undulations. It is also closely allied to *C. flexuosus* of Europe, but is more pyriform in shape and lacks the anterior angulation noticeable in that species.

Taken at thirty-two stations, between N. lat. 47° 40′, W. long. 47° 35′ 30″, and N. lat. 37° 08′, W. long. 74° 33′, in 94 to 1,537 fathoms, 1873–1886.

CRYPTODON PLANUS, new species.

(Plate LXXXVIII, figs. 3, 4.)

Shell small, well-rounded, the length and height about equal, with the beak small, prominent, nearly central, curved strongly forward,

forming a small, sunken, heart-shaped, lunular area. Posteriorly there is only a faint, depressed undulation, which causes but a slight indentation or angulation in the margin; behind this the surface rises slightly and forms an inconspicuous ridge surrounding the ligamental area, which is long, rather narrow, and sunken, so that its margin is scarcely visible in a side view. The dorsal margin is a little convex and slopes but little, and about equally on both sides of the beak; the anterior end is well-rounded and slightly produced; the ventral margin is broadly rounded, a little produced in the middle, and nearly straight or very slightly incurved posteriorly, opposite the undulation; behind this there is a slight obtuse angulation corresponding to the ridge below the ligamental area. Surface dull grayish white. The hinge-margin is considerably thickened, especially below the beaks and lunular area, and a thickened ridge also extends backward beyond the ligamental area. There is no distinct tubercle nor tooth-like projection. The posterior ligament is unusually strong, and occupies a rather conspicuous submarginal groove which runs forward under the beak as a thin incised line.

Length, 4 mm.; height, the same.

Found in 8 to 100 fathoms, north of Cape Cod, in the Gulf of Maine, Casco Bay, Bay of Fundy, and Halifax Harbor, 1872–1885.

CRYPTODON OBSOLETUS, new species.

(Plate LXXXIX, figs. 1, 2.)

Shell small, higher than long, with the ends and ventral margin rounded. Umbos somewhat prominent and swollen; beaks curved strongly forward. Posterior plication obsolete, or nearly so, only visible in certain positions, and imperfectly defined by a faint undulation of the surface and margin. The antero-dorsal margin is slightly convex in the lunular area, and slopes rapidly to the broadly rounded anterior margin with which it forms a very slight and very obtuse angle; the whole ventral margin is well-rounded, a little produced in the middle; the postero-dorsal margin is broadly convex and ends distally in a very obtuse, rounded angle, above which there is a slight inbending of the edge. The hinge-plate is rather thick, especially posteriorly. The ligament is rather strong and considerably curved and occupies a narrow, but very distinct groove, mostly within the margin posteriorly, and extends forward under and in front of the beaks. The anterior hinge-margin is thickened and a little flexuous toward the anterior angle of the shell; the proximal end, just under the beak, is slightly thickened without forming any apparent tooth. Under the microscope, the surface is covered with rather coarse, irregular, concentric undulations, and fine, raised lines of growth, becoming smoother at each end, where there are patches of a closely adherent coating of red mud and iron oxide.

Length, 2.4 mm.; height, 2.6 mm.

Four specimens, at three stations, off Marthas Vineyard, in 100 to 390 fathoms, 1880–1885.

AXINULUS, new subgenus or genus

Type.—*Axinulus brevis*, new species.

We propose this division to include those species which agree with *Cryptodon* in the character of the hinge and ligament, but lack the plications of the shell, and have, therefore, a smaller posterior adductor muscle.

CRYPTODON (AXINULUS) BREVIS, new species

(Plate LXXXIX, figs. 7, 8.)

Shell small, short, the height exceeding the length, somewhat pyriform, with slightly prominent umbos and small subcentral beaks, which are but little prominent and turn forward. The antero- and postero-dorsal margins are about equal in length, the latter slightly more broadly rounded than the former, which is a little incurved near the beak so as to form a very slight lunular area; both ends are broadly rounded and nearly equal; the ventral margin is slightly convex and a little produced just in front of the middle; an exceedingly faint, scarcely discernible undulation runs from the beak to the posterior ventral margin. The surface is covered with very fine, close, parallel lines of growth visible only when much magnified. Grains of fine ferruginous sand or mud usually adhere closely to the surface, both anteriorly and posteriorly. The posterior ligament is well-developed and occupies a well-marked marginal groove; a small, thickened, more internal portion, situated just behind the beak, within the margin, appears to be continuous with the external ligament. The inner edge of the dorsal margin is slightly thickened, for a short distance, just in front of the beak.

Length, 2⅓ mm.; height, 2.5 mm.

Several live specimens and separate valves were found at six stations, between N. lat. 40° 16′ 50″, W. long. 67° 5′ 15″, and N. lat. 38° 22′, W. long. 70° 17′ 30″, in 984 to 1,825 fathoms, 1883–1886.

At station 2208 was found a single imperfect valve closely resembling this species but of much larger size.

Length, 5.5 mm.; height, 6.5 mm.

It is, however, much less regular in outline, having a nearly straight, rapidly sloping antero-dorsal margin, merging very abruptly into the broadly and very slightly curved and sloping anterior margin, forming a somewhat angular and little produced anterior end; ventral margin strongly convex, curving gradually into the posterior margin which slopes rapidly from the beak; postero-dorsal margin is convex but rises only a little above the outline of the distinct ridge which borders the ligamental area.

CRYPTODON (AXINULUS) INEQUALIS, new species.

(Plate XC, figs. 1, 2.)

Shell small, somewhat oblong, with the anterior end much the longer. Umbos rather prominent, beaks elevated, curved strongly forward, so as to leave a small, deep lunular area. The antero-dorsal margin is at first nearly straight, sloping but little, and is nearly parallel with the ventral margin; the anterior end is produced, broadly and evenly rounded; the ventral margin is much less rounded, with the middle portion almost straight for a short distance, toward the posterior end it is subtruncate and slightly angulated; the postero-dorsal margin is convex and slopes rapidly; a very slight depression runs from the beak to the postero-ventral margin, but is so slight as to be scarcely worthy the name of plication or fold; posterior to this there is a distinct submarginal ridge separated by a rather deep groove, from the ligamental area, which is long and narrow. The surface appears to the naked eye nearly smooth, bluish white; under the microscope it is marked by slight, raised, concentric ridges and faint undulations, which are the most regular and distinct on the umbos. In addition to these the whole surface, when highly magnified, has a fine fibrous appearance; on some parts there are remnants of a thin, pale yellowish epidermis. The hinge-margin is distinctly thickened, with a slight protuberance directly under the beak, where it is thicker than elsewhere. The posterior ligament is rather large and strong, and occupies a conspicuous groove extending from under the beak about one-third the length of the postero-dorsal margin.

Length, 4.5 mm.; height, 4.25 mm.; thickness, about 4 mm.

A few specimens have been found in 14 to 49 fathoms, at about eleven stations north of Cape Cod, in Casco Bay, and in Halifax Harbor, 1873–1879.

CRYPTODON (AXINULUS) SIMPLEX, new species.

(Plate XCII, figs. 3, 4.)

Shell small, thin, fragile, translucent bluish white, somewhat inflated, nearly circular in outline and without any posterior undulations. Beaks small, acute, slightly prominent, turned forward. Antero-dorsal margin excavated in front of the beaks and convex farther forward; anterior margin broadly and evenly rounded and, with the ventral margin, forms nearly a circular curve; the posterior margin similarly rounded, but slightly flattened in the middle; postero-dorsal margin broadly convex without any distinct angulation posteriorly. The surface is nearly smooth and somewhat glossy on the umbos; it is marked by rather indistinct, small, concentric waves or undulations and microscopic lines of growth. Interior somewhat shining. The hinge-margin is thin, delicate, and very simple, with but a very slight thickening in the region of the beak; a narrow groove for the ligament is visible just

before and behind the beaks, but there is no tooth-like prominence at any point.

Length, about 3.1 mm.; height, about 3 mm.

One imperfect specimen, station 1093, N. lat. 39° 56′, W. long. 69° 45′, in 349 fathoms, 1882.

This species is remarkable for the plainness of its surface, and the simplicity of its hinge, as it has neither radial undulations nor tooth-like projections on the hinge-margin. In form it greatly resembles *Axinopsis orbiculata*, but lacks the conspicuous concavity in the antero-dorsal margin. It has, however, a very obvious posterior ligamental furrow in the same relative position as that of other species of *Cryptodon*.

A single valve taken at Eastport, Maine, 1872, agrees closely with the type in form, but is somewhat less thin and hyaline and the beaks are a trifle more prominent. The surface has faint and rather distant concentric undulations, visible only under the microscope, being most distinct on the umbo. The microscopic striations are a little more distinct and in some lights give to the surface a fibrous or finely vermiculate appearance when highly magnified. This character, however, has been noticed in other species. The hinge-margin is a little more thickened and has a minute swelling on the inner margin just beneath the beak, scarcely worthy the name of tooth; the ligamental groove is also somewhat more strongly marked. This may prove to be a distinct species more nearly related to *Axinopsis orbiculata* from which it differs in having the antero-dorsal margin convex instead of strongly concave, and the general outline more evenly rounded, and a less evident tooth-like thickening of the hinge-margin.

Length, about 2.8 mm.; height, about 2.6 mm.

CRYPTODON (AXINULUS) PYGMÆUS, new species.

(Plate LXXXVI, figs. 3, 4.)

Shell minute, somewhat compressed, transversely ovate, inequilateral, with the anterior end the longer, and with a slightly produced posterior angulation. Surface scarcely lustrous, covered with fine lines of growth and microscopic striations, and more or less incrusted with ferruginous mud, especially posteriorly; there is barely a trace of a posterior fold. Umbos a little prominent, beaks small, slightly raised above the margin, and turned a little forward. The antero-dorsal margin is nearly straight, or sometimes slightly convex, with a slightly excavated, small, lunular area; the anterior end is broad, considerably produced, and evenly rounded; the ventral margin is broadly rounded, not at all produced, and joins the posterior margin in a small obtuse angulation, above which the dorsal margin is slightly convex and slopes rapidly from the beaks.

The inner surface is smooth with inconspicuous muscular scars.

The hinge-margin in the right valve is slightly thickened with a distinct, tooth-like prominence below and slightly in front of the center of the beak, and an inner fold-like thickening of the posterior margin to support the ligament; in front of the lunular area the margin is convex and slightly everted.

Length, about 1.6 mm.; height, about 1.4 mm.

A few live specimens were found at three stations between N. lat. 47° 40′, W. long. 47° 35′ 30″, and N. lat. 39° 54′ 30″, W. long. 70° 20′, in 206 to 499 fathoms, 1883–1886.

This species is allied to *C. ferruginosus* (Forbes), from which it differs in its distinctly produced and angulated posterior end, and longer or more produced, evenly rounded anterior end. It also has considerable resemblance in form to *C. tortuosus* Jeffreys, but that has a very lustrous surface and more vitreous texture, and moreover entirely lacks the posterior angulation.

C. subovatus of Jeffreys, seems to resemble rather closely the small specimens of this species, but that has more prominent beaks, is wedge-shaped, the antero-dorsal margin sloping pretty rapidly from the beak, instead of being nearly straight and horizontal as in our species.

CRYPTODON (AXINULUS) FERRUGINOSUS (Forbes).

(Plate LXXXVII, figs. 7, 8.)

Cryptodon ferruginosus VERRILL, Trans. Conn. Acad., V, p. 570, 1882; VI, p. 279, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 575, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 50, 1889.

Axinus ferruginosus LOCARD, Campagne du *Caudan*, Annales de l'Université de Lyon, p. 191, 1896.

This very common species was found at numerous stations from N. lat. 42° 47′, W. long. 61° 04′, to N. lat. 35° 12′ 10″, W. long. 74° 57′ 15″, in 125½ to 1,525 fathoms, 1880–1886.

CRYPTODON (AXINULUS) OVATUS, new species.

(Plates XCI, fig. 7; XCIII, fig. 1.)

Shell small, ovate, not swollen, with the posterior end produced and somewhat pointed, rusty brown in color and heavily incrusted with iron oxide. Umbos rather flattened; beaks small and concealed by the coating of ferruginous matter. The anterior end is well-rounded with a nearly semicircular curve; the ventral margin is broadly convex; the posterior margin is tapered and produced at the end, with the dorsal margin a little convex and sloping rapidly. The hinge-margin is a little thickened and much obscured by the incrustation. In the left valve there is a rather prominent, blunt, tooth-like swelling below the lunular area; in the right valve there is a corresponding notch and a rather wide ligamental furrow commencing beneath the beak, and running back subparallel with the dorsal margin, becoming more

internal posteriorly. Just beneath the beak is an elongated tooth-like thickening of the inner margin which consequently curves downward at this point. Muscular scars whitish, inconspicuous. The external surface, so far as visible, seems to be smoothish with irregular lines of growth.

Length, 1.6 mm.; height, 1.4 mm.

Two valves, station 949, N. lat. 40° 3′, W. long. 70° 31′, in 100 fathoms, 1881. This species is encrusted very much as *Cryptodon* (*Axinulus*) *ferruginosus*, but is quite different in its much more strongly developed hinge and ovate form.

From station 2113, N. lat. 35° 20′ 30″, W. long. 75° 19′, in 15 fathoms, there are three specimens (No. 35531) of considerably larger size which agree closely with this species and are probably identical. They are more extensively encrusted with ferruginous mud and are somewhat higher in proportion to their length; the ventral margin being slightly produced in the middle, but they have the same posterior angulation and the same evenly produced anterior end. The beaks are larger, rounded, and relatively more prominent above the margin. The hinge-margin is very thin and delicate, but does not differ essentially in other respects from the smaller specimens.

Length, 2.6 mm.; height, 2.2 mm.

AXINOPSIS ORBICULATA G. O. Sars, variety INEQUALIS, new.

(Plate XCII, figs. 5, 6.)

Axinopsis orbiculata G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 63, pl. 19, figs. 11*a–d*, 1878.—VERRILL, Trans. Conn. Acad., V, p. 569, 1882.—BUSH, Proc. U. S. Nat. Mus., VI, p. 243, pl. IX, fig. 4, 1883.

The numerous specimens of this species show considerable variation in form and character of the hinge. Many specimens show the cardinal tooth and pit as described and figured by G. O. Sars; others have the hinge-margin nearly smooth or with mere rudiments of a tooth and pit. Our specimens moreover show a thin, continuous external ligament, which should be lacking according to Sars' description, but he may have overlooked it. In form many of our specimens are evenly rounded, as figured by Sars, but others have the antero-dorsal margin more concave and the anterior end somewhat produced, while the postero-dorsal margin is somewhat straighter than usual.

Specimens from the Bay of Fundy have a somewhat oblong form, with the ventral margin more nearly straight or but slightly convex, and with the anterior end distinctly produced. This form seems sufficiently distinct to receive a varietal name, and we therefore propose to call it variety *inequalis*.

AXINOPSIS CORDATA, new species.

(Plate XCVII, figs. 5, 6.)

Shell small, white, smoothish, rounded or somewhat cordate, longer anteriorly, with small, little prominent beaks curving forward. Antero-dorsal margin a little convex, sloping gradually and passing somewhat abruptly into the anterior margin, which is broadly and obtusely rounded; ventral margin strongly convex, somewhat produced in the middle; posterior margin pretty evenly rounded, except in the middle, where there is a slightly produced portion corresponding to the plication; postero-dorsal margin strongly convex in the middle. The surface is marked by fine, microscopic, concentric striæ and irregular lines of growth which, on the umbo, appear as slight undulations. The ligamental area is relatively large, prominent in the middle, and defined by a distinct groove, beyond which there is a well-marked but low radiating ridge or plication which forms an inconspicuous projection at the margin; anterior to this there is a very slight wave-like depression of the surface, much as in most species of *Cryptodon*. The hinge-margin is decidedly thickened; in both valves there is a rather large, obtuse tooth just below the beak, from which it is separated by a rather large space for the ligament which runs backward for a short distance in a conspicuous submarginal groove, becoming internal distally; anteriorly the groove is narrow and outside the margin.

Length, about 2 mm.; height, the same.

This species is referred to the genus *Axinopsis* with some doubt, although it has the distinct cardinal tooth and ligament-groove. It has, however, a single posterior plication similar to that seen in some species of *Cryptodon;* but the character of the plications vary in that genus, in some cases being very strong and in others obsolete, or nearly so. In fact, the genus *Axinopsis* can hardly be distinguished from it except by the distinctly developed cardinal tooth, which is only partially differentiated from the proximal end of the anterior hinge-plate.

A few separate valves and two live young were found at six stations between N. lat. 40°, W. long. 71° 14′ 30″, and N. lat. 35° 42′, W. long. 74° 54′ 30″, in 43 to 202 fathoms, 1880–1884.

The young specimens from stations 870 and 943 are referred to this species with considerable doubt, as they have a much more rounded outline, although the hinge-margin is similar.

AXINODON, new genus.

Type.—Axinodon ellipticus, new species.

Shell thin, rounded or ovate, without plications. Hinge with one or two small or subrudimentary teeth. Ligament internymphal, posteriorly so far internal that its inner end, distally, is attached below the inner edge of the hinge-plate, and therefore covers its entire breadth.

AXINODON ELLIPTICUS, new species.

(Plates XC, figs. 5, 6; XCII, fig. 1.)

Shell small, nearly smooth, swollen, transversely elliptical and somewhat oblong, with rather prominent umbos and with the beaks considerably behind the middle and curved forward. The antero-dorsal margin is decidedly convex and somewhat excurved, the anterior end is longer and a little broader than the posterior; both are nearly evenly rounded; the ventral margin is broadly rounded and nearly straight for a short distance along the middle; the postero-dorsal margin is convex and merges into the posterior end in a regular curve. The lunular area is rather distinct, but without any very definite boundary. The surface is nearly smooth, covered only with fine, close lines of growth, which, under the microscope, appear as delicate, raised lines, separated by grooves of about the same width; this sculpture is very regular over most of the surface, but on the umbos some of the ridges are so large as to appear like small undulations. The interior surface is smooth and white; the muscular scars are indistinct; the hinge-margin is rather thin; the posterior ligament is prominent, wedge-shaped, widest distally, and occupies a distinct groove covering the whole breadth and extending about one-third the length of the postero-dorsal margin and running forward under the beaks. In the left valve there are two slightly raised, minute, obscure, rounded teeth under the beak, of which the anterior is a little more distinct than the other; farther forward, and separated from the latter by a slight notch, there is an elongated thickening of the margin forming a sort of lateral tooth or lamina and separated from the outer edge by a narrow groove. In the right valve the anterior tooth-like thickening is less distinct and there is only a very slight rounded swelling of the lunular margin under the beak.

Length, 3.5 mm.; height, 3 mm.

Two live specimens (No. 35175), station 2096, N. lat. 39° 22′ 20″, W. long. 70° 52′ 20″, in 1,451 fathoms, 1883.

LEPTAXINUS, new genus.

Type.—Leptaxinus minutus, new species.

Shell small, short-ovate, inequilateral, with the anterior end the longer, and rounded, and the posterior end tapered and angulated, with a slight plication. Hinge-plate well developed, with a delicate, lateral tooth on both sides of the beak in the right valve, and one posterior lateral tooth in the left valve; in both valves with the proximal end of the hinge-plate enlarged and thickened near the beak, that of the left valve most developed and rising into a blunt tooth-like prominence. Ligament commencing under the beak and running back on the ventral side of the posterior hinge-plate, so that for the greater part of its length it is internal.

This genus differs from *Cryptodon* in the more internal position of the ligament and in having distinct lateral teeth. From *Axinodon*, in the stronger hinge-plate, in the presence of the lateral teeth, in having a posterior plication, and in lacking distinct cardinal teeth.

LEPTAXINUS MINUTUS, new species.

(Plate LXXXIX, figs. 3–5.)

Shell minute, broadly ovate, with a slightly produced obtuse point near the middle of the posterior end, and a somewhat produced, broadly rounded anterior end. Beaks behind the middle, rising a little above the dorsal margin and turned forward, leaving a small, rather deep lunular area. Antero-dorsal margin a little convex, sloping but little; anterior margin broadly and evenly rounded, forming nearly a semicircle, and passing continuously into the ventral margin, which is a little more broadly rounded; the posterior margin is somewhat angular, with a distinct prominence a little below the middle, where the radial ridge terminates, below this for a short space the margin is nearly straight or slightly incurved; above, the postero-dorsal margin is straight as far as a slight angle in the ligamental area, above which it is convex to the beak. The hinge-margin is a little thickened, and in the left valve forms a rather prominent and somewhat angular tooth just below and slightly in front of the beak; the ligamental groove is barely visible on the inner face of the posterior hinge-margin, and runs forward as a narrow groove beneath the beak; in the right valve there is a somewhat less prominent tooth just under the beak, behind which the ligamental groove forms a distinct notch in the margin. Under the microscope there is seen in both valves a distinct submarginal ridge with a conspicuous groove behind it, commencing a considerable distance behind the beak and running in and along the inner hinge-margin; there is also in the right valve a short, indistinct groove along the end of the hinge-margin in front of the beak. Externally a rather shallow, depressed undulation runs from the beak to the postero-ventral margin; behind it is a narrow, but slightly prominent, radial ridge running to the posterior angle; back of or above this a rather short ligamental area projects beyond the margin. The surface is covered with a thin, greenish yellow epidermis and is marked by fine, pretty regular, parallel, raised lines of growth, and also faint and rather numerous radiating lines which are not visible except under a high power.

Length, nearly 2 mm.; height, $1\frac{3}{4}$ mm.

One live specimen (No. 45686), station 949, N. lat. 40° 3′, W. long. 70° 31′, in 100 fathoms, 1881.

Family ASTARTIDÆ.

ASTARTE NANA (Jeffreys?) Dall.

Astarte nana DALL, Bull. Mus. Comp. Zoöl., XII, p. 261, pl. VII, figs. 6*a*, 6*b*, 1886; Bull. U. S. Nat. Mus., No. 37, p. 46, pl. VII, figs. 6*a*, 6*b*, 1889.

A single valve, which agrees perfectly with Dall's figures, quoted above, was found at station 2307, off Cape Hatteras, North Carolina, in 43 fathoms, 1884. South to Sombrero, in 22 to 196 fathoms.—Dall.

Family CUSPIDARIDÆ.

In the classification of this family we have adopted the groups proposed by Messrs. W. H. Dall and E. A. Smith as defined by Mr. Dall.[1] We, however, consider his two subgeneric groups, *Cardiomya* and *Halonympha*, as distinct genera.

CUSPIDARIA UNDATA Verrill.

(Plates LXXII, fig. 1; LXXVIII, figs. 3, 4.)

Neæra undata VERRILL, Trans. Conn. Acad., VI, pp. 223, 277, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 574, 1885.

Not *Myonera undata* DALL, Bull. Mus. Comp. Zoöl., XII, pp. 302, 304, 1886; Bull. U. S. Nat. Mus., No. 37, p. 68, 1889 (in part).

Three live specimens and two valves were found at stations 2098 and 2566, off Chesapeake Bay, in 2,221 and 2,680 fathoms, 1883 and 1885.

Fragments obtained by the *Blake* near Havana, Dominica, and St. Vincent, in 450 to 611 fathoms, are erroneously referred by Mr. Dall to this species. Our shell is certainly not a *Myonera*.

We have a fragment of a left valve from station 2655, N. lat. 27° 22′, W. long. 78° 7′ 30″, in 338 fathoms, found among Foraminifera, which belongs to a strongly undulated species, with a short, angular, subacute rostrum defined below by a rather deep groove at which the concentric sculpture changes abruptly. The beak is prominent and turns strongly backward. The cartilage-plate is strong, deeply concave, and directed backward; a moderately elevated internal rib runs backward from the umbonal region to the posterior muscular scar. The shell is thin and has deep internal grooves corresponding to the external ridges. Judging by the lines of growth, the shell was short-ovate, broadly rounded anteriorly, and having posteriorly a short, angular, subacute rostrum; the escutcheon is concave and well-defined by a small, sharp ridge. This fragment seems to belong to an undescribed species of *Myonera*. It can, however, hardly be the same as Mr. Dall's species, as he states that in his "there is no buttress or appearance of an internal rib."

[1] Bull. Mus. Comp. Zoöl., XII, p. 292, 1886; XVIII, p. 441, 1889.

CUSPIDARIA LAMELLOSA (M. Sars) Dall.

(Plate LXXIV, fig. 10.)

Neæra lamellosa VERRILL, Trans. Conn. Acad., V, p. 561, 1882; VI, p. 277, pl. XXX, fig. 3, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 574, 1885.

Cuspidaria lamellosa DALL, Bull. Mus. Comp. Zoöl., XII, p. 294, 1886; Bull. U. S. Nat. Mus., No. 37, p. 66, pl. XLV, fig. 3, 1889.

Comparatively few specimens, at twelve stations, between N. lat. 40° 2′ 49″, W. long. 68° 49′, and N. lat. 37° 59′ 30″, W. long. 73° 48′ 40″, in 319 to 555 fathoms, 1880–1886.

A few specimens occurred which differ from the typical form in having but five or six concentric lamellæ visible on the antero-ventral portion of each valve and only conspicuous unequal lines of growth on the rest of the surface.

CUSPIDARIA TURGIDA, new species.

(Plates LXXII, fig. 7; LXXVII, fig. 4.)

Shell rather large, thin, delicate, translucent, of a pinkish white color within, long-oval, with prominent, posteriorly directed umbos, and narrow, rather long posterior rostrum. The beaks are central, rather acute and turned distinctly forward. The antero-dorsal margin is slightly convex, forming a broad curve; the anterior end is a little prolonged in the middle but otherwise pretty evenly rounded; the ventral margin forms a regular, broad curve becoming strongly incurved at the base of the rostrum; the postero-dorsal margin is straight at first, but slightly concave along the rostrum. The cartilage-plate is small and very oblique, and in the right valve, is separated by a distinct notch from the lateral tooth, which is long and low, with a rounded summit and a long, gradual, posterior slope; there is no trace of buttress or clavicle. In the left valve the hinge-margin is thin, and nearly simple both anteriorly and posteriorly. The exterior surface is covered with a thin, yellowish gray epidermis and is marked with irregular, rather conspicuous lines of growth; on the rostrum there is a distinct diagonal ridge running from the beaks to the lower margin.

Length, 22 mm.; height, 12 mm.; breadth, 11 mm.; distance from center of beak to end of rostrum, 12 mm.; to extreme anterior end, 12 mm.

In form, general appearance, and length of rostrum, this species is intermediate between *C. glacialis* and *C. rostrata*, but the umbos are more oblique and there are obvious differences in the hinge.

One live specimen (No. 78789), station 2714, N. lat. 38° 22′, W. long. 70° 17′ 30″, in 1,825 fathoms, 1886.

CUSPIDARIA ROSTRATA (Spengler) Dall.

(Plate LXXII, fig. 6.)

Neæra rostrata VERRILL, Trans. Conn. Acad., V, p. 562, pl. LVIII, fig. 39, 1882; VI, p. 277, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 574, 1885.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XII, p. 35, 1885.

Cuspidaria rostrata DALL, Bull. Mus. Comp. Zoöl., XII, p. 294, 1886; XVIII, p. 444, 1889; Bull. U. S. Nat. Mus., No. 37, p. 66, 1889.—LOCARD, Campagne du *Caudan*, Annales de l'Université de Lyon, p. 177, 1896.

This species was obtained at about fifteen stations between N. lat. 40° 6′ 50″, W. long. 70° 34′ 15″, and N. lat. 38° 31′, W. long. 73° 21′, in 65 to 156 fathoms. South to Barbados in 65 to 1,639 fathoms.—Dall.

CUSPIDARIA GLACIALIS (G. O. Sars) Dall.

(Plates LXXI, fig. 9; LXXIII, fig. 5; LXXV, fig. 9.)

Neæra glacialis G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 88, pl. 6, figs. 8, *a–c*, 1878.—VERRILL, Trans. Conn. Acad., V, p. 562, pl. XLIV, figs. 10, *a–b*, 1882; VI, p. 277, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 574, 1885.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 35, 1885.

Cuspidaria glacialis DALL, Bull. Mus. Comp. Zoöl., XII, pp. 294, 303, 1886; Bull. U. S. Nat. Mu , No. 37, p. 66, 1889.

Cuspidaria arctica var. *glacialis* DALL, Bull. Mus. Comp. Zoöl., XVIII, p. 444, 1889; Proc. U. S. Nat. Mus., XII, p. 280, 1889.

Cuspidaria glacialis BUSH, Bull. Mus. Comp. Zoöl., XXIII, p. 226, 1893.

Not *Cuspidaria artica* (M. SARS).

This very common species was dredged at many stations from N. lat. 44° 26′, W. long. 62° 10′, to N. lat. 37° 8′, W. long. 74° 33′, in 62 to 828 fathoms. South to the Gulf of Mexico, in 64 to 1,467 fathoms.—Dall.

CUSPIDARIA MEDIA, new species.

(Plates LXXI, figs. 5, 6; LXXIII, fig. 6.)

Shell of moderate size, resembling a medium-sized *C. glacialis* (Sars), in form, but decidedly more swollen, with the rostrum narrower and more distinctly defined by a stronger ventral emargination. Umbos large, prominent, and swollen, with strongly incurved and very prominent beaks. The antero-dorsal margin is a little convex and slopes rapidly to the evenly rounded anterior end; the ventral margin is regularly curved and is rather more convex than in *C. glacialis*, and shows a very decided emargination at the base of the rostrum; the postero-dorsal margin is nearly straight but slopes from the beak to the end of the rostrum which is of moderate length and tapers from the base to the narrow, subtruncated end; it has no distinct diagonal ridge, but is separated from the body of the shell by a strongly marked depression. The surface is nearly smooth but is covered with fine lines of growth

which are most distinct on the rostrum. The hinge-margin is thin. The right valve has a thin, low, much elongated posterior lateral tooth which runs nearly parallel with the dorsal margin, above which it projects in a broad curve; the cartilage-plate is small, very oblique, and closely united with the tooth from which it is separated by a faint, curved notch; no buttress. In the left valve there is no lateral tooth, and the cartilage-plate is very small, slightly prominent, with a curved inner edge. The inner surface of the shell is smooth and the muscular scars are faint.

Length of an average specimen, 13 mm.; height, 8 mm.; breadth, 6.5 mm.; beak to end of rostrum, 8.5 mm.; beak to anterior end, 6 mm.

This species is allied to *C. glacialis*, from which it differs in its more swollen form, more oblique anterior end, more prominent ventral margin, more clearly defined rostrum, and straighter postero-dorsal margin. The hinge shows still more decided differences; the lateral tooth of the latter is stouter, more prominent, and less prolonged; the cartilage-plate is smaller and less distinctly defined. From *C. fraterna* it differs in being less produced ventrally and in having a longer rostrum with much straighter dorsal margin and a much longer lateral tooth.

This is a common species off Marthas Vineyard and has been taken at about fifteen stations between N. lat. 40° 10′ 15″, W. long. 70° 26′, and N. lat. 39° 56′, W. long. 70° 54′ 18″, in 63 to 155 fathoms, 1880–1884. A broken valve, station 362, N. lat. 42° 1′, W. long. 69° 34′, in 106 fathoms, 1879, is also referred to this species.

CUSPIDARIA PARVA, new species.

(Plates LXXIV, fig. 9; LXXVII, fig. 7.)

Shell small, delicate, elongated, inequivalved, having a general resemblance in form to the very young of *C. obesa* and *C. fraterna*. Umbos small, rather prominent; beaks small and incurved. The antero-dorsal margin is moderately convex and slopes regularly to the evenly rounded anterior end; ventral margin very broadly rounded, with a decided incurvature at the base of the rostrum, corresponding to the marked depression of the surface; postero-dorsal margin slopes rapidly at first and is usually concave along the rostrum, which is moderately long (the length varies in different specimens), narrow, with an obtusely rounded or subtruncated end. It is crossed by a distinct diagonal ridge, above which there are several small, raised, radial lines; the surface is elsewhere nearly smooth or presents a microscopic, faintly granulose appearance. The left valve is the larger and considerably overlaps the right along the ventral margin and siphonal region; the right overlaps the left along the postero-dorsal margin; the rostrum is a little bent toward the left in some specimens. The hinge-margin is delicate, with the anterior margin a little everted; cartilage-plate minute, sunken, in the right valve well separated from the prominent,

rather elongated lateral tooth; the left valve also has a small, elongated, tooth-like expansion posterior to the cartilage-plate.

Length, 4.5 mm.; height, 2.25 mm.; breadth, 1.5 mm.

This species may easily be mistaken for the young of *C. obesa* and *C. fraterna;* the structure of the hinge is, however, characteristic.

A comparatively few specimens, at seven station, between N. lat. 41° 28′ 30″, W. long. 65° 35′ 30″, and 35° 49′ 30″, W. long. 74° 34′ 45″, in 515 to 1,290 fathoms, 1883–1886.

CUSPIDARIA VENTRICOSA, new species.

(Plates LXXII, fig. 5; LXXVI, fig. 6.)

Shell large, rather solid, swollen, with a ventral enlargement and a moderately elongated, tapered rostrum. Umbos swollen and prominent; beaks incurved. Antero-dorsal margin at first nearly straight, then broadly rounded with the extreme anterior end a little prominent; ventral margin decidedly excurved in the middle, corresponding to the exterior swelling; at the base of the rostrum slightly concave; postero-dorsal margin somewhat concave, the most so at the base of the rostrum, which is obtusely rounded at the end. Exterior covered with very distinct lines of growth and irregular, stronger, concentric grooves. On the rostrum there is an obtuse, diagonal ridge running to the ventral angle of the tip; between this and the dorsal margin there are two others less distinct. The anterior hinge-margin is decidedly thickened in both valves and projects inward with a thick, rounded edge, most conspicuous in the right valve, in which it is abruptly much narrowed near the cartilage-plate; in this valve the lateral tooth is short, stout, obtuse, very prominent, and situated close to the beak, its length along the margin not much exceeding its height; cartilage-plate small, relatively wide, oblique, directed backward and downward, and closely united to the lateral tooth, there being only a slight, rounded notch between.

Length of the larger specimen, 30 mm.; height, 29 mm.; breadth, 18 mm.; beak to end of rostrum, 16 mm.; beak to anterior end, 17 mm. Another specimen is 25 mm. long; 17 mm. high; 12 mm. broad.

Four valves, at three station, between N. lat. 40° 29′, W. long. 66° 4′, and N. lat. 38° 27′ 30″, W. long. 70° 54′ 30″, in 349 to 1,769 fathoms, 1882–1886.

This species has some resemblance to *C. glacialis*, but is a stouter and more swollen shell, with a relatively larger rostrum, much more elongated and less prominent lateral tooth, and very different cartilage-plate. The latter does not have the swollen ventral region, characteristic of our species, nor the diagonal ribs on the rostrum.

CUSPIDARIA ARCTICA (M. Sars) Dall.

(Plates LXXI, fig. 2; LXXIV, fig. 7.)

Neæra arctica SARS, G. O., Mollusca Reg. Arcticæ Norvegiæ, p. 85, pl. 6, figs. 5, *a–c*, 1878.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 35, 1885.

Cuspidaria arctica DALL, Bull. Mus. Comp. Zoöl., XII, p. 294, 1886.

Not *Neæra arctica* VERRILL, Amer. Journ. Science, VI, p. 440, 1873.

A single imperfect valve from station 70, south of Halifax, Nova Scotia, in 190 fathoms, is referred to this species. Though worn and slightly broken, it agrees closely with Sars' figure, but it cannot be fully grown, for it measures but 14 mm. in length and 11 mm. in height.

CUSPIDARIA FORMOSA, new species.

(Plates LXXIV, fig. 6; LXXIX, fig. 9.)

Shell short, high, and swollen. Umbos prominent; beaks incurved. Anterior portion broadly rounded, a little produced at the end, with the dorsal margin convex and a little excurved; the ventral margin is broadly and evenly rounded; the rostrum is short, broad at base, much tapered; the postero-dorsal margin is nearly straight at first, then slightly concave and a little upturned. The exterior is covered with uneven lines of growth between which the surface is microscopically striated and more or less iridescent. The color of the single specimen is pale pink, externally and internally. The right valve has a prominent, triangular lateral tooth with its base prolonged parallel to the margin of the shell; it is separated by a decided notch from the cartilage-plate, which is of moderate size, ovate, somewhat oblique, with its inner edge rounded and prominent.

Length, about 16 mm.; height, 13 mm.; breadth, 10 mm.; beak to end of rostrum, about 9 mm.; beak to anterior end, 8 mm.

A single, much broken, specimen (No. 78313), station 2706, N. lat. 41° 28′, W. long. 65° 35′, in 1,188 fathoms, 1886.

CUSPIDARIA FRATERNA, new species.

(Plates LXXI, figs. 7, 8; LXXV, fig. 6.)

Shell similar to *Cuspidaria obesa* (Lovén), moderately large, considerably swollen, rather thick and firm for the genus, with a moderately long, tapered rostrum. The umbos are rather prominent and swollen, with the strongly incurved beaks nearly in contact. The anterior end is broadly rounded with a regularly curved, convex dorsal edge which rises nearly to the height of the umbos; the ventral margin is a little protuberant. The postero-dorsal line slopes with a slightly concave outline to the end of the rostrum; on the ventral margin there is a distinct incurvature corresponding to a wave-like depression on the surface,

defining the base of the rostrum. The surface is nearly smooth and somewhat glossy, covered with fine lines of growth which become more prominent and irregular on the rostrum, which has no distinct diagonal line. The hinge-margin is somewhat thickened; the right valve has a rather short, prominent, obtuse, triangular lateral tooth only slightly separated from the cartilage-plate by a concave margin; the cartilage-plate is small, very oblique, with the inner edge curved and not at all angulated. Muscular scars and pallial line indistinct; no buttress.

Length, 13 mm.; height, 9 mm.; breadth, 6 mm.; from beak to end of rostrum, 8 mm.; from beak to anterior end, 7 mm.

Found at about thirty stations between N. lat. 40° 2′ 49″, W. long. 68° 49′, and N. lat. 37° 23′, W. long. 73° 53′, in 302 to 984 fathoms.

This species resembles *C. obesa* (Lovén) in form; it is, however, a larger species with a firmer and more swollen shell; the ventral margin is more prominent, so that it has a relatively higher form and is broader at the base of the rostrum. The hinge shows more decided differences, for in *C. obesa* the lateral tooth is smaller, shorter, and closely approximated to the cartilage-plate which is distinctly angulated, the inner end being acute and separated from the tooth by a small angular notch.

CUSPIDARIA OBESA (Lovén) Dall.

(Plate LXXV, fig. 7.)

Neæra obesa LOVÉN, Ind. Moll. Scand. Occid., p. 48, 1846.—VERRILL, Trans. Conn. Acad., V, p. 563, pl. XLIV, fig. 10*c*, 1882; VI, p. 277, 1884 (in part); Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 574, 1885 (in part).—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 43, 1885.

Cuspidaria obesa DALL, Bull. Mus. Comp. Zoöl., XII, p. 295 (not pl. III, fig. 1), 1886; Bull. U. S. Nat. Mus., No. 37, p. 66 (not pl. III, fig. 1), 1889.

Not *Neæra pellucida* STIMPSON.

This species has been found at about twenty-four stations between N. lat. 43° 23′, W. long. 68° 30′, and N. lat. 35° 12′ 10″, W. long. 74° 57′ 15″, in 96 to 811 fathoms, 1873–1887.

It is recorded by Mr. Dall from off Barbados in 100 fathoms and off the coast of California in 16 fathoms.

After a careful study and comparison of the numerous species belonging to the family Cuspidaridæ we have been able to satisfactorily prove that the form described by Stimpson as *Neæra pellucida* is quite distinct from that described by Lovén as *N. obesa*, with which it has been so long confounded.

CUSPIDARIA PELLUCIDA (Stimpson).

(Plates LXXV, fig. 8; LXXVI, fig. 8.)

Neæra pellucida STIMPSON, Invert. Grand Manan, p. 21, pl. 1, fig. 13, 1853.—GOULD, Invert. Massachusetts (2d ed.), p. 61, fig. 378, 1870.—VERRILL, Check-list, p. 24, 1879.

Neæra sp. VERRILL, Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 574, 1885.

Not *Neæra obesa* LOVÉN.

Shell small, much swollen, with a strongly tapered, somewhat produced rostrum. Umbos relatively large and prominent, beaks minute, strongly incurved. The anterior portion is broadly and evenly rounded, the margin forming nearly a semicircle, with the dorsal margin strongly convex and excurved, rising nearly as high as the umbos; the ventral margin is broadly rounded but distinctly incurved at the base of the rostrum which is rather narrow distally, obtusely rounded at the tip and slightly upturned; the postero dorsal margin slopes considerably, is nearly straight at first but becomes slightly concave on the rostrum. External surface nearly smooth but usually showing more or less prominent lines of growth, most distinct on the distal part of the rostrum which is destitute of a distinct diagonal line. The right valve has a short, very prominent, strongly curved lateral tooth rising close to the beak, the most prominent part being near the proximal end which rises rather abruptly from the very minute cartilage-plate from which it is not separated by a notch; just in front of the beak, the hinge-margin is distinctly thickened, sinuous, and a little prominent, forming a sort of tooth, separated from the lateral tooth only by the minute sunken cartilage-plate; the left valve also has a slight, sinuous thickening of the margin in front of the cartilage-plate.

Length of one of the largest specimens, 4.5 mm.; height, 3 mm.; breadth, 3 mm.; beak to end of rostrum, 3 mm.; beak to anterior end, 2.5 mm.

This species has been taken at Eastport Harbor; Bay of Fundy, near Grand Manan Island; and at about twenty-one stations between N. lat. 47° 40′, W. long. 47° 35′ 30″, and N. lat. 35° 14′ 20″, W. long. 74° 59′ 10″, in 52 to 516 fathoms, 1868–1886.

The specimens here described are from the Bay of Fundy, near Grand Manan Island and Eastport Harbor, very near the locality where Doctor Stimpson's types were obtained. In former articles we have united this species with *C. obesa* (Lovén). A careful reexamination of a large series of specimens of both forms has convinced us that they are distinct but closely related species. In *C. obesa* the anterior portion is more produced, giving the shell a more ovate outline; the rostrum is broader and rather more upturned; the cartilage-plate is relatively much larger, more prominent, and angular at the edge, and in the right valve is separated from the lateral tooth by an

angular notch; while the tooth itself is relatively smaller, shorter, less prominent, and more distinctly triangular in form.

CUSPIDARIA SUBTORTA (Sars).

(Plates LXXIII, fig. 1; LXXIV, figs. 4, 5.)

Neæra subtorta SARS, G. O., Mollusca Reg. Arcticæ Norvegiæ, p. 87, pl. 6, figs. 6, *a–c*, 1878.—JEFFREYS, Ann. Mag. Nat. Hist., p. 234, September, 1877; Proc. Zoöl. Soc., London, p. 937, November, 1881.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 35, 1885.

Shell inequivalve, rather short, relatively high, much swollen in the middle, with tumid umbos and a short, tapered, somewhat upturned rostrum. The anterior portion is broadly rounded, the margin forming nearly a semicircle; the antero-dorsal margin is strongly convex and slightly excurved; the ventral margin is evenly rounded, except at the base of the rostrum where it is distinctly incurved, especially in the right valve; the postero-dorsal margin is very strongly concave in the left valve and less so in the right. The rostrum is separated from the body of the shell by a sinuous depression and has a poorly defined diagonal ridge; it is a little bent to the left and, when viewed from above, appears slightly twisted. The surface of the shell is nearly smooth, but shows distinct lines of growth anteriorly, and especially on the superior part of the rostrum; the epidermis is very thin, yellowish white, more or less wrinkled on the rostrum; the hinge-margin is rather strong; the lateral tooth in the right valve is large, rather elongated, rather prominent, obtusely triangular, and not separated from the very small, narrow, oblique, sunken cartilage-plate by a notch; in the left valve there is a small, short, prominent tooth arising from the posterior margin of the cartilage-plate and separated from the posterior hinge-margin by a distinct angular notch.

Length, 8 mm.; height, 6 mm.; breadth, about 5 mm.

One live specimen (No. 52545), station 2499, N. lat. 44° 46′ 30″, W. long. 59° 55′ 45″, in 130 fathoms, 1885.

This species appears to be identical with the European *subtorta*. It differs from all of our other species in having a distinct tooth-like tubercle behind the cartilage-plate in the left valve. The inequality of the valves and the twisted rostrum give the shell a peculiar aspect.

CARDIOMYA ABYSSICOLA, new species.

(Plates LXXIII, fig. 4; LXXIV, fig. 1; LXXVII, fig. 9.)

Shell rather large, swollen, with tumid umbos; outline elongate-ovate, with a narrow, rather elongated, tapered, slightly excurved posterior rostrum, the tips divergent and gaping; the anterior end is broadly round, with the dorsal and ventral margins convex, the latter narrowing gradually posteriorly with a slight sinus at the base of the rostrum; the postero-dorsal margin is concave, so that the end of the rostrum is

somewhat upturned. The entire body of the shell is covered with numerous narrow, elevated, radiating ribs, separated by much wider concave interspaces, some of the widest of which have a small secondary rib in the center toward the margin; the ribs increase in elevation and strength posteriorly, toward the base of the rostrum, but never become broad; for a short distance on the base of the rostrum the ribs are nearly obsolete but become prominent again on its dorsal and terminal portions; this part is also crossed by irregular raised lines of growth which cross the ribs obliquely; the inner surface is covered with rounded grooves corresponding to the external ribs, separated by convex ribs of about the same width; these become obsolete anteriorly and posteriorly. The hinge-margin in the left valve is only a little thickened and slightly excurved, the cartilage-plate is central, stout, regularly ovate in form, with a thickened inner margin; in the right valve there is a prominent, rather stout, elongated posterior tooth, the anterior end of which joins closely the cartilage-plate, leaving scarcely any notch between; the highest part of the tooth is near the middle, the slope, however, is a little steeper anteriorly; a deep groove separates the tooth from the thin, slightly excurved dorsal margin; anteriorly the margin is but slightly thickened, and shows a very narrow, beveled edge externally for the attachment of the thin ligament; a similar but more distinct ligamental groove extends from the beak to the base of the rostrum; there is a short, rather stout, rib-like clavicle or buttress running from beneath the middle of the tooth obliquely backward and downward in the direction of the base of the rostrum; a less prominent buttress is also present in the left valve.

Length of one of the largest specimens, 25 mm.; height, 15 mm.; thickness, 14 mm.; from beak to end of rostrum, 13 mm.; to antero-ventral margin, 12 mm. One badly broken valve is considerably larger than this. There are also two young live specimens which measure about 6 mm. in length and 3.5 mm. in height. Their form is somewhat narrower and longer than in the adult, and the rostrum appears rather longer and narrower; the postero-dorsal margin is nearly straight; the ventral margin is decidedly concave at the base of the rostrum; the shells are very thin, somewhat transparent and glossy, and have about twenty-six sharply defined, considerably elevated, nearly equal, narrow ribs on the body of the shell, separated by much wider spaces; the edge of the left valve overlaps that of the right, especially along the base of the rostrum.

In general appearance this species greatly resembles *C. multicostata* Verrill and Smith. It differs, however, in having a regularly more ovate form with the anterior region somewhat narrower and more prolonged and the postero-ventral margin less incurved at the base of the rostrum, so that the latter is broader and less differentiated. The external costæ differ in being narrow and sharp, separated by broad concave interspaces, and of nearly uniform size, there being no marked contrast between those on the anterior and posterior portions of the shell,

although the elevation and distance between them gradually increase posteriorly, while in the former they are broadly rounded and separated for the most part by narrow interstices. The hinge also differs considerably; the cartilage-plate is less prominent and broader than that of *multicostata*, and the tooth in the right valve is longer and not so prominent and scarcely forms a notch at its junction with the cartilage-plate; anteriorly the margin is very thin and simple with a very narrow, linear, ligamental groove along its outer edge, while in the former the groove is broader and its inner edge is raised almost in the form of a lateral tooth.

It also resembles *C. costellata* var. *corpulenta* Dall in the character of the costæ, but the latter is much shorter and higher in form and has a very short, ill-defined rostrum.

Two young live specimens, two separate valves, and some fragments were taken at three stations, between N. lat. 40° 29′, W. long. 66° 14′, and N. lat. 36° 47′, W. long. 73° 9′ 30″, in 1,685 to 1,813 fathoms, 1885–86.

CARDIOMYA MULTICOSTATA Verrill and Smith.

(Plate LXXIII, fig. 3.)

Neæra multicostata VERRILL, Trans. Conn. Acad., V, p. 559, pl. LVIII, fig. 40, 1882; VI, p. 277, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, pl. XXX, fig. 129, 1885.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 36, 1885.

Not *Cardiomya striata* DALL, Bull. Mus. Comp. Zoöl., XII, p. 298, pl. III, fig. 10, 1886; Bull. U. S. Nat. Mus., No. 37, p. 66, pl. III, fig. 10, 1889; Proc. U. S. Nat. Mus., XII, p. 281, 1889.

Cardiomya striata DALL, Bull. U. S. Nat. Mus., No. 37, pl. LXV, fig. 129, 1889.

Not *Cardiomya costellata* (DESHAYES) var. *curta* DALL, Bull. Mus. Comp. Zoöl., XII, p. 297, 1886.

Neæra multicostata var. *curta* VERRILL, Trans. Conn. Acad., V, p. 560, 1882.

This comparatively rare species was found at but eight stations off Marthas Vineyard, in 85 to 158 fathoms, 1880–1882.

Although this species resembles *Cardiomya striata* (Jeffreys) in the character of its sculpture, the marked difference in outline, especially in its clearly defined rostrum, render it advisable to keep the two forms separate until a careful comparison of the hinges can satisfactorily decide the question of their identity.

The two valves designated as variety *curta* have the radiating ribs rounded and not angular, but fewer in number than the typical form, and must be distinct from *curta* of Jeffreys, which Mr. Dall makes a variety of *costellata* of Deshayes.

CARDIOMYA PERROSTRATA Dall.

(Plates LXXIII, fig. 2; LXXIV, fig. 3.)

Neæra perrostrata VERRILL, Trans. Conn. Acad., V, p. 561, 1882; VI, p. 277, 1884.
Cardiomya perrostrata DALL, Bull. Mus. Comp. Zoöl., XII, p. 296, pl. II, figs. 3*a*, 3*b*, 1886; Bull. U. S. Nat. Mus., No. 37, p. 66, pl. II, figs. 3*a*, 3*b*, 1889.

Only a few specimens were obtained from seven stations between N. lat. 40° 15′ 30″, W. long. 70° 27′, and N. lat. 39° 46′ 30″, W. long. 70° 54′, in 58 to 325 fathoms, 1880–1884.

South to Granada, in 339 to 416 fathoms.—Dall.

CARDIOMYA GEMMA, new species.

(Plates LXXI, figs. 3, 4; LXXIV, fig. 11.)

Neæra paucistriata BUSH, Trans. Conn. Acad., VI, p. 473, 1885.
Not *Myonera paucistriata* DALL, Bull. Mus. Comp. Zoöl., XII, p. 302, 1886; Bull. U. S. Nat. Mus., No. 37, p. 68, 1889; Proc. U. S. Nat. Mus., XII, p. 233, pl. XIII, fig. 12, 1889.
Cardiomya sp. BUSH, Bull. Mus. Comp. Zoöl., XXIII, p. 227, 1893.

Shell small, inequivalved, thin, fragile, translucent, bluish white, somewhat ovate, with a well-defined rostrum. Umbos smooth, a little prominent; the beaks small, inconspicuous. The antero-dorsal margin is convex and rises distinctly above the beaks so that the greatest height of the shell is in front of them; thence it slopes rapidly to the somewhat prominent anterior end; the ventral margin is broadly rounded with a slight angle at the termination of each radial rib, decidedly incurved at the base of the rostrum which is a little elongated, nearly straight, somewhat tapered, and rather upturned distally; the postero-dorsal margin is depressed and somewhat concave. Each valve has three conspicuous, prominent, thin, elevated, distant, radial ribs on the posterior half and a fourth less distinct one at about the middle; this is rudimentary in the left valve; none of them reach the umbos. The surface is also covered with very delicate lines of growth; the rostrum does not have a diagonal ridge. The hinge-margin is thin and delicate; the right valve has a small but prominent, moderately long lateral tooth separated from the very minute cartilage-plate by a distinct notch. The lateral tooth is supported by a small buttress.

Length, 5 mm.; height, 3 mm.

A few specimens off Cape Hatteras, North Carolina, in 16 and 17 fathoms, 1884.

CARDIOMYA GLYPTA Bush.

(Plates LXXI, fig. 1; LXXVI, figs. 3, 7.)

Neæra costata BUSH, Trans. Conn. Acad., VI, p. 472, pl. XLV, fig. 21, 1885; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 587, 1885; not Sowerby, 1834.

Cardiomya ornatissima DALL, Bull. Mus. Comp. Zoöl., XII, p. 296, 1886; Bull. U. S. Nat. Mus., No. 37, p. 66, pl. XLI, fig. 21, 1889.

A few specimens were found at two stations off Cape Hatteras, North Carolina, in 48 fathoms. South to Guadaloupe, in 2 to 124 fathoms.—Dall.

In addition to the published description it should be stated that the antero-dorsal margin of the right valve rises into a distinct, prominent, obtuse lobe in front of the tooth; this lobe overlaps the margin of the left valve when the shell is closed. There is a small buttress beneath the posterior lateral tooth. One broken valve, considerably larger than the type, has in the intervals between the three primary ribs two or three small secondary ones; on the anterior end six ribs are visible, of which one or two are larger than the rest, so that altogether about thirteen or fourteen ribs can be counted; some of these are, however, very small and extend only part way to the umbo; even the largest do not extend over the extreme part of the umbo.

Mr. Dall considers this species to be identical with D'Orbigny's *ornatissima*, but we see no sufficient reason for uniting the two forms.

The name *costata* was used by Sowerby in 1834.

HALONYMPHA STRIATELLA, new species.

(Plates LXXII, figs. 2, 3; LXXVII, fig. 10.)

Shell small, thin, broadly and obliquely ovate, with a narrow, short rostrum. Umbo swollen. Beak behind the middle. The antero-dorsal margin is broadly and nearly evenly convex; the anterior end is evenly rounded; the ventral margin is broadly convex with a slight incurvature at the base of the rostrum, which is short, narrow, and obtuse at the end; the postero-dorsal margin is strongly concave and slopes rapidly. In the region of the umbo the surface is lustrous and nearly smooth, but marked with faint, parallel lines; elsewhere it is closely covered with very regular, fine, raised concentric lines separated by incised lines of about the same width or narrower; on the rostrum there is a faint diagonal ridge posterior to which the concentric lines are irregular. The interior surface is smooth and lustrous but the external lines show through by transparency. In the right valve there is a small, sharp, triangular tooth projecting inward with a very small cartilage-pit in front of and confluent with it; slightly farther forward there is another small, slender tooth rising nearly parallel with the

margin; external to this there are remnants of a small anterior ligament occupying a short furrow. Commencing behind the beak and extending to the base of the rostrum, there is a comparatively large and prominent lamelliform process rising from beneath the margin and projecting downward, with the face portion broadly rounded, and its upper surface concave. Above the base of this, and extending from near the beak to about the middle of the rostrum, is a narrow, slightly thickened ridge separated from the dorsal margin by a narrow furrow.

Length, 6 mm.; height, 4.5 mm.; breadth, about 3 mm.

One valve, station 2655, among Foraminifera, N. lat. 27° 22′, W. long. 78° 7′ 30″, in 338 fathoms, 1886.

This species has considerable resemblance to *H. claviculata* Dall, but the latter is more regularly ovate in form, and has a much shorter and broader rostrum, and somewhat coarser sculpture. The posterior shelf-like clavicle also differs in form, being quite narrow for a considerable distance next the cartilage-pit, and more expanded distally. The shell described and figured by Smith[1] under the same name appears to be a distinct species, and may be identical with our shell, for it has nearly the same form and agrees closely in the narrow tapered rostrum. The figure of the interior, however, in that case, is incorrect, owing to the omission of the clavicle, and apparently the substitution of the hinge of the left valve for the right.

MYONERA GIGANTEA Verrill.

(Plate LXXVI, figs. 4, 5.)

Neæra gigantea VERRILL, Trans. Conn. Acad., VI, pp. 223, 277, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 574, 1885.

Three imperfect, dead specimens have been found at three stations between N. lat. 38° 22′, W. long. 70° 17′ 30″, and N. lat. 37° 56′ 20″, W. long. 70° 57′ 30″, in 1,825 to 1,917 fathoms, 1883 and 1886.

MYONERA RUGINOSA (Jeffreys) Verrill and Bush.

(Plates LXXII, fig. 4; LXXIV, fig. 2.)

Neæra ruginosa JEFFREYS, Proc. Zoöl. Soc. London, p. 942, pl. LXXI, fig. 7, November, 1881.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 35, 1885.

Shell small, short, broad-ovate, not much swollen, with a short, wide, gaping, obliquely truncate rostrum. Umbos small, prominent, not much swollen; beaks small, prominent, incurved, smooth and shining. The anterior portion is evenly rounded, nearly semicircular; the antero-dorsal margin is convex and prominent; the ventral margin is broadly and evenly rounded, except at the base of the rostrum where it is sinuous and incurved; the postero-dorsal margin is nearly straight to the

[1] Report Voy. *Challenger* Zoöl. Lamellibranchiata, XIII, p. 52, pl. IX, figs. 8–8*b*, 1885.

end of the short rostrum which has a distinct, median, diagonal ridge or angulation and another less distinct one at its base. The surface of the shell is thickly covered with very numerous, and crowded, concentric, more or less irregular, raised lines of growth which give it a finely lamellose appearance when viewed under a lens. These lines become more crowded, more prominent, and form two sinuous waves in crossing the rostrum. Color, in alcohol, white tinged with reddish brown. The hinge-margin is delicate; the right valve has no lateral tooth but shows a slight thickening of the posterior margin; the cartilage-plate is small, ovate, directed backward.

Length, 6 mm.; height, 4.5 mm.; breadth, 3 mm.

One live specimen (No. 52544), station 2570, N. lat. 39° 54′, W. long. 67° 5′ 30″, in 1,813 fathoms, 1885.

"*Porcupine* Expedition, 1870," off Cape Mondego, in 740 to 1,095 fathoms.—Jeffreys.

MYONERA LIMATULA Dall.

(Plate LXXIV, fig. 8.)

Neæra limatula DALL, Bull. Mus. Comp. Zoöl., IX, p. 112, 1881.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XII, p. 35, 1885.

Myonera limatula DALL, Bull. Mus. Comp. Zoöl., XII, p. 304, pl. III, fig. 5, 1886; Bull. U. S. Nat. Mus., No. 37, p. 68, pl. III, fig. 5, 1889.

A single live specimen (No. 38171) was taken at station 2048, N. lat. 40° 2′, W. long. 68° 50′ 30″, in 547 fathoms, 1883.

MYONERA (?) PRETIOSA, new species.

(Plate LXXVII, fig. 5.)

Shell small, very thin and fragile, nearly transparent, compressed, elongate-oval with a well-defined, somewhat elongated rostrum. Umbo prominent, scarcely oblique and nearly smooth. The antero-dorsal margin is convex, anterior end evenly rounded; ventral margin broadly convex, becoming incurved at the base of the rostrum; postero-dorsal margin nearly straight. The antero dorsal region is distinctly excavated in front of the beaks. The body of the shell is ornamented with ten or more thin, distinct, slightly raised, concentric riblets separated by much wider interspaces. On the rostrum there are two well-marked minutely spinulous keels between which are delicate lines of growth; the first runs from the beak quite close to and parallel with the dorsal margin; while the second extends from the umbo diagonally across the rostum to its lower edge.

Length, 6 mm.; height, 3 mm.; breadth, about 2 mm.

This shell has no very close resemblance to any hitherto described.

One valve, station 2655, N. lat. 27° 22′, W. long. 78° 7′ 30″, in 333 fathoms, among Foraminifera, 1886.

As but a left valve was found, the true position of this species can not be decided.

Family POROMYIDÆ.

POROMYA SUBLEVIS Verrill, variety MICRODONTA Dall.

(Plates LXXVI, figs. 1, 2; LXXXVII, fig. 1.)

Poromya sublevis VERRILL, Trans. Conn. Acad., VI, pp. 221, 277, pl. XXXII, fig. 21, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 574, pl. XXX, fig. 128, 1885.—DALL, Bull. Mus. Comp. Zoöl., XII, pp. 281, 282, 1886; XVIII, p. 448, 1889 (variety?); Bull. U. S. Nat. Mus., No. 37, p. 68, pl. LXV, fig. 128, 1889.

Poromya microdonta DALL, Proc. U. S. Nat. Mus., XII, p. 290, pl. VIII, fig. 6, 1889 (variety?).

Shell rather large, thick, well-rounded, cordate, inequivalved, very tumid, with very large, prominent umbos which are strongly curved forward spirally; beaks large; lunule small, cordate, often not very distinct. The shell varies considerably in outline and size and elevation of the umbos; in most specimens the height equals or slightly exceeds the length; the outline of the cavity of the shell is usually somewhat elliptical, the length decidedly exceeding the height, but sometimes it is nearly circular. The anterior and posterior margins are usually pretty evenly rounded; the ventral margin usually projects a little in the middle; the beak is situated in front of the median line. Externally the shell is nearly smooth and is covered with a thin, closely adherent, brownish-yellow epidermis; under a lens the surface shows minute raised points or granules which are arranged in radial rows that become more distinct and crowded posteriorly but for the most part disappear on the most prominent part of the umbos. These granule-like points are variable in number and distinctness, in some specimens being nearly obsolete and in others distinct and regularly arranged; the epidermis often also shows fine lines of growth; the beaks are smooth and shining. The left valve has a posterior, wave-like, radial depression, and behind this a low, rounded ridge projecting at the margin as a slight siphonal lobe; in the right valve, the corresponding lobe and depression are only faintly marked in most cases. The right valve is larger than the left and overlaps it considerably along the ventral margin and both in front of and behind the beaks. The interior is pearly and often shows radial striations. The hinge-margin is considerably thickened and strongly curved; the right valve has a large, thick, somewhat rounded tooth just beneath the beak and adnate to the inner surface of the shell, for some distance within the cavity of the beak and to the thickened edge behind the beak, but separated from the anterior margin by a deep, curved furrow in the lunular area; the lunular margin is convex and somewhat everted, separated from the rest of the anterior margin by a slight notch. The ligament is rather long and well-rounded and its groove extends forward in a curved furrow under the beak; it extends backward in a curved line parallel with the margin of the shell for some distance

behind the tooth. External to the posterior part of the ligament there is a submarginal thickening or fold, especially in the right valve. In the left valve the central tooth is represented by an irregular, bilobed, or somewhat V-shaped thickening of the margin, of which the anterior part, situated just in front of the beak, is the more prominent; but this varies in form in different specimens. The postero-dorsal margin along the ligamental region is less thickened but has a distinct rounded ridge inside the ligament.

Length of one of the largest specimens, 16 mm.; total height, 16 mm.; height of cavity, 12 mm.; breadth, 16 mm. In a more rounded specimen the length is 15 mm.; total height, 16 mm.; height of cavity, 13.5 mm.; breadth, 14 mm.

A few dead specimens of the typical form (*sublevis*) have been taken at five stations between N. lat. 39° 15′, W. long. 68° 8′, and N. lat. 37° 56′ 20″, W. long. 70° 57′ 30″, in 1,594 to 1,917 fathoms, 1883–1886.

Several live and dead specimens of the varietal form (*microdonta*) have been taken at eight stations between N. lat. 39° 26′, W. long. 68° 3′ 30″, and N. lat. 36° 47′, W. long. 73° 9′ 30″, in 1,631 to 1,859 fathoms, 1885–1886.

Mr. Dall extends the range south to Patagonia, in 122 to 1,635 fathoms.

Our specimens show considerable variation in form as well as in the prominence of the cardinal tooth in the right valve, and thus unite the extreme forms *P. sublevis* Verrill, and *P. microdonta* Dall.

CETOCONCHA ATYPHA, new species.

Shell short-ovate, nearly equilateral, and nearly equally rounded at both ends, judging from the lines of growth. Umbos rather prominent, but less so than in several allied species. Beaks rather prominent and curved strongly forward, but not spiral. Surface somewhat shining and slightly iridescent where rubbed, covered with a very thin, yellowish epidermis with very numerous, minute, granule-like elevations which are arranged in regular radiating lines, and are much the most numerous on the posterior end where the radial rows are closely crowded and the granules in each are also near together; on the center the rows and granules are more distant, so that the number is only about half as great in the same space; on the anterior end they are so scattered that the radial rows are indistinct and the granules are a little larger; on the lunular area they are nearly obsolete. The anterior end and lunular area are marked by rather conspicuous lines of growth which, near the dorsal margin, take the form of distinct, raised, concentric ridges. The antero-dorsal margin is nearly horizontal and rises up, in a side view, in an acute edge, a little higher than the level of the beak, so as to produce a broad, compressed, lunular margin. When viewed from above, this part of the margin forms a very marked obtuse angle with the posterior hinge-margin. The postero dorsal margin is also nearly

horizontal, slightly convex or nearly straight; the ligament is very prominent behind the beak, extending backward in a conspicuous groove nearly to the posterior end, and terminates anteriorly in a deep narrow groove directly under the beak. In the left valve the inner edge of the posterior hinge-margin is somewhat sinuous; just behind the beaks, opposite the most prominent part of the umbos, it is thickened and somewhat revolute, decreasing both in thickness and elevation to a shallow indentation of the margin; back of this, it increases regularly in thickness and prominence and is again revolute along the posterior part of the ligamental furrow. There is no central tooth nor any distinct resilium. In the right valve the posterior hinge-margin is even more thickened and revolute just back of the beaks, and the indented, thinner portion, at the end of the prominent part of the ligament, is more marked. The ligamental groove is consequently less conspicuous, being partially concealed by the revolute margin. The antero-dorsal margin is compressed and projects strongly upward, rising distinctly above the umbos in a side view and is more convex than in the left valve. There is also a slight elevation within the dorsal margin directly below the beaks, which might be considered the rudiments of a tooth.

The largest specimen, when perfect, would be about 15 mm. long.

Two very much broken valves, station 2229, N. lat. 37° 38′ 40″, W. long. 73° 16′ 30″, in 1,423 fathoms, 1884.

This species somewhat resembles *Cetochonca nitida* (Verrill)[1] Dall.[2] It is however more oblong, with the umbos much smaller and less prominent and the beaks less spiral and nearer together. The granulation of the surface is somewhat stronger and more generally distributed. The ligamental groove is longer, deeper, and the ligament itself is more prominent behind the beaks. The angulation of the hinge-margin of the left valve in a horizontal plane is a peculiar feature not found in the other related species and indicates that the valves are decidedly unlike in form, but the right valve is too much broken to show the anterior margin.

CETOMYA species.

A broken left valve (No. 52013) from station 2481, N. lat. 44° 7′ 30″, W. long. 57° 16′ 45″, in 116 fathoms, resembles *Poromya* (*Cetomya*) *elongata* Dall, from the West Indies and Barbados, in 100 to 119 fathoms. It is, however, too incomplete for determination without direct comparison with authentic specimens.

It is larger and more strongly truncate posteriorly than *Poromya granulata* (Nyst) Forbes and Hanley, and the granules are coarser and not so numerous. It differs, moreover, very strongly in the hinge characters, for the hinge-plate is much thinner and the large tooth in the left valve is wanting in our species.

[1] *Thracia nitida* Verrill, Trans. Conn. Acad., VI, p. 221, pl. XXXII, fig. 22, 1884.

[2] *Cetochonca nitida* Dall, Bull. Mus. Comp. Zoöl., XII, p. 281, 1886.

Family VERTICORDIDÆ.

VERTICORDIA GRANULIFERA (Verrill) Dall.

(Plates LXXXVII, fig. 2; XCV, figs. 2, 3, 4.)

Pecchiolia granulifera VERRILL, Trans. Conn. Acad., VI, pp. 434, 448, 450, 1885.
Verticordia granifera DALL, Bull. Mus. Comp. Zoöl., XII, p. 286, 1886.
Verticordia granulifera DALL, Bull. U. S. Nat. Mus., No. 37, p. 66, 1889.

In addition to the published description, it should be stated that in the type-specimen (No. 44838), the lunular area is small, deeply sunken, with the corresponding internal margin very much thickened, forming a strong, curved, tooth-like projection having a rounded summit, reaching strongly above the margin of the shell when seen in a profile view; behind this, directly under the beak and beneath the overhanging margin, there is a triangular space or notch for the reception of the prominent tooth of the opposite valve; this is followed posteriorly by a short, triangular, shelf-like projection, a little beneath the margin, which has a depression on its upper surface for the reception of its ligament but shows, in this specimen, no notch or scar corresponding to the ossicle. Directly under the strongly incurved beak there is a slight, thin groove in which the front part of the ligament was attached. The postero-dorsal edge is a little thickened and projects inward beyond the general line of the margin; its outer surface has a smooth, slightly excavated groove, extending parallel with the edge, for some distance; this portion was overlapped by the projecting edge of the opposite valve.

A very large specimen (No. 78679) from station 2713, which measures 21 mm. in length, 22½ mm. in height, and 10 mm. in thickness, has, in the right valve, directly beneath the beak, a very strong, high, curved, pointed, angular tooth attached by a very broad, thick base, a considerable distance within the margin. Behind the ossicle, well within and nearly parallel with the margin for its entire length, is a conspicuous shelf-like ridge against which the projecting edge of the opposite valve rests. The ossicle is strong, somewhat rectilinear in outline, with the posterior end deeply forked, the inner surface strongly convex, the outer strongly concave, with thick, somewhat beveled edges, to which the ligament is attached. Interior surface somewhat pearly. Scars and pallial line not very clearly defined.

But four specimens, beside the type, have been found at four stations between N. lat. 40° 9′ 30″, W. long. 67° 9′, and N. lat. 36° 47′, W. long. 73° 9′ 30″, in 1,356 to 1,859 fathoms, 1884–1886.

Family LYONSIELLIDÆ.

LYONSIELLA SUBQUADRATA (Jeffreys.)

(Plate LXXXVII, fig. 3.)

Pecchiolia subquadrata JEFFREYS, Proc. Zoöl. Soc. London, p. 932, pl. LXX, fig. 3, November, 1881.—Not DALL, Bull. Mus. Comp. Zoöl., XII, p. 272, 1886.

Our specimen seems to agree in every respect, except size, with the original description and figure as given by Jeffreys, ours being considerably larger.

The umbo is prominent and the beak is curved strongly forward, producing a deep lunular area which is defined neither by a groove nor a ridge. The surface is everywhere covered with small but prominent granules which are numerous, pretty evenly spaced, and arranged somewhat distinctly in radiating rows which, under the microscope, are defined by slight radial ridges uniting those of the same row. The granulations are easily visible with slight enlargement. Under the compound microscope they have the form of elevated, acute cones and blunt tubercles, their height usually greater than their diameter, except on the umbo, where they are low and rounded. Internally the surface is everywhere marked with small, deep pits looking like punctures made by a fine needle, and corresponding to the external granules. The hinge margin is thickened and entirely edentulous, as described by Jeffreys. Posterior to the beak there is a distinct groove in the thickness of the margin for the reception of a ligament. Beneath the beak there is a slight, oblique, marginal notch or slit for the reception of the resilium, running back within and underneath the dorsal margin, so that it is scarcely visible in a direct front view.

This shell appears to be identical with the species originally described and figured by Jeffreys under the name of *Pecchiolia subquadrata.* Mr. Dall has evidently found an entirely different species in the Jeffrey's collection under this name, which he has referred to the genus *Callocardia* and subgenus *Vesicomya*, belonging to an entirely different family from our shell. In order to avoid confusion the shell examined and described by Mr. Dall should receive a distinct specific name; we therefore propose *Callocardia* (*Vesicomya*) *dalli.* Mr. Dall states that "the sparsely set, microscopic tubercles can only be observed with a magnifier; to the eye the surface looks shining and smooth," which shows the surface to be quite different from that of our shell. In his shell there are also two cardinal teeth in each valve.

One valve (No. 78800), station 2714, N. lat. 38° 22′, W. long. 70° 17′ 30″, in 1,825 fathoms, 1886.

North of the Hebrides, in 542 fathoms; and off Cape Mondego in Vigo Bay, in 740 to 1,095 fathoms. "*Porcupine* Expedition, 1869–70."—Jeffreys.

LYONSIELLA CORDATA, new species.

(Plate XCV, figs. 7, 8.)

Shell rather large and firm for the genus, somewhat translucent bluish white, swollen, cordate, with a posterior obtuse prominence. Umbos prominent, turned forward spirally; beaks small, strongly incurved. Lunule small, cordate, defined only by one of the ordinary fine radial ridges; the part that lies immediately under the beak is deeply sunken with the edge pinched up into a prominent keel. The antero-dorsal margin is strongly convex and prominent in the lunular region, but not so high as the umbos; the anterior margin is but slightly convex and nearly perpendicular to the axis of the shell; the ventral margin is strongly convex and somewhat produced in the middle, farther back it is but slightly convex; the posterior end is obtusely rounded, decidedly prominent but not angular; the postero-dorsal margin is a little convex and slopes gradually. The surface is covered with about sixty delicate, radiating, raised lines or riblets which are crossed by fine lines of growth, the thin, brownish or grayish green epidermis often rising into small points at their intersection, especially anteriorly and posteriorly; these riblets become coarser and more distant anteriorly, and are lacking on the lunule. The ligament is thin and strong and extends backward along nearly the whole of the dorsal margin and curves spirally under and around the beak in the region of the resilium, so that the two come almost in contact. The hinge margin, in front of the beak and lunular area, is strongly convex and protuberant, rising nearly to the height of the umbo; posteriorly it is convex and thin in both valves; in the left one it is strengthened by a slight marginal rib within the ligamental furrow; both of these are less evident in the right valve. There are no teeth in either valve. The ossicle is relatively large, oblong, somewhat saddle-shaped, narrowest and truncated anteriorly, broadest and forked posteriorly, the divisions acute. The resilium beneath the ossicle is well developed, dark brown, and extends forward and upward to the margin, beneath the beak.

Length of the largest specimen, 11 mm.; height, 12 mm. Another is 11 mm. long; 11.5 mm. high; 9 mm. broad.

Two living specimens and one valve, at three stations between N. lat. 39° 15′, W. long. 68° 8′, and N. lat. 37° 38′ 40″, W. long. 73° 16′ 30″, in 1,423 to 1,825 fathoms, 1884–1886.

Family LYONSIDÆ.

LYONSIA GRANULIFERA, new species.

(Plate XCV, fig. 1.)

Shell oblong, truncated posteriorly, narrowed and rounded anteriorly. Umbo rather prominent with the beak in front of the middle and curved forward; lunular area considerably sunken. Anterior end evenly

rounded with the dorsal margin rapidly sloped; ventral margin broadly and evenly rounded; posterior end somewhat obliquely truncated without any definite boundary, but with a distinct depression extending from under the beak to about the middle of the posterior margin; postero-dorsal margin nearly straight, longer, and sloping less rapidly than the anterior. The entire surface is covered with minute, irregular, raised, granules and pretty distinct, but irregular, lines of growth and slightly raised, distant, thin, radiating lines running from the umbo to the margin, except on the posterior end where the lines of growth become more prominent; these radial lines are however, in many places, rather faint and seem to consist mainly of the thin, brownish epidermis, which is lacking in certain parts. Minute grains of sand and shells of Foraminifera are firmly adherent to the surface, mainly along the radial lines, and especially posteriorly. The interior is white, lustrous and but slightly nacreous. Muscular and pallial scars indistinct. The hinge-margin is thin; in the left valve the anterior border is somewhat thickened in the lunular area and terminates abruptly in a rounded, tooth-like shoulder just under the beak; the posterior margin shows a slightly raised elongated, roughened area for the attachment of the resilium, commencing under the beak and running back for some distance within the margin, on its nearly vertical inner surface, so that it is scarcely visible in a front view. Ossicle not observed. Ligament very thin, occupying a groove along the posterior margin.

Length, 19 mm.; height, 13 mm.; breadth, 9 mm.; from the beak to the antero-dorsal angle, 7 mm.; to the postero-dorsal angle, 12 mm.

One valve (No. 52561), station 2492, N. lat. 45° 22′, W. long. 58° 43′ 45″, in 75 fathoms, 1885.

This species is allied to *L. arenosa* (Moller) with which it agrees very closely in the character of the external surface and structure of the hinge. It differs in its longer, more ovate form, in its more produced anterior end, and in its less swollen umbo.

Family PANDORIDÆ.

CLIDIOPHORA INORNATA, new species.

(Plate XCV, figs. 5, 6.)

Shell small, much compressed, very inequilateral, posterior end narrowed, somewhat accuminate, the right valve flat or slightly convex and the left valve a little swollen. Umbos not prominent; beaks small and appressed. The antero-dorsal margin is slightly convex and slopes rapidly to the bluntly rounded anterior end; the ventral margin is broadly rounded and slightly prominent, considerably behind the middle, beyond which it is incurved to meet the posterior rostral angulation; the posterior end is produced into a short, narrow, subtruncated, slightly upturned rostrum, its lower angle formed by a somewhat prominent, radial rib or ridge, extending from the beak (on the

left valve); the postero-dorsal margin is usually slightly concave, but is sometimes nearly straight, and in some cases decidedly concave, and slopes gradually to the superior angulation of the rostrum; the ligamental area is narrow, deep, and long, extending for nearly the entire length of the dorsal margin, and is clearly defined by a marginal ridge which is sharper on the left valve. In most specimens this valve is marked by a slight, ill-defined groove running from the beak to the antero-ventral margin, where it often forms a slight emargination, but is often scarcely discernible, except by the change in the direction of the lines of growth and character of the epidermis. The surface of the left valve is covered with irregular concentric ridges and rather uneven lines of growth; the right valve usually shows rather regular, concentric undulations on which are numerous fine, pretty regular, lines of growth; this valve is also usually marked by faint, and rather indistinct, radiating, impressed lines which are more or less broken and often branched or forked; these are scarcely visible without a lens. Epidermis thin, brownish yellow, usually mostly peeled off in dry specimens, but on the anterior end, in front of the radial groove, it is a little more persistent. In the left valve the anterior tooth is strong and prominent, with the proximal end the thicker, more elevated, rounded or clavate; distally it is curved and diverges considerbly from the antero-dorsal margin; between this tooth and the resilial pit, there is a small central tooth only a little elevated. The resilial pit is directed obliquely backward, and its cavity is obliquely upturned, forming a distinct excavation on the inner surface of the posterior tooth with which it is confluent; this posterior tooth is simply a distinctly thickened and slightly elevated portion of the postero-dorsal margin, which forms the boundary of the ligamental area, it is often, but not always, opposite the position of the resilial pit. In the right valve the anterior tooth is a slightly raised, somewhat curved ridge on the inner surface of the shell, running to the middle of the anterior muscular scar; the central tooth is shorter and much more elevated, most prominent at its inner end; between these two teeth there is an additional, slightly raised, tooth-like ridge; the posterior tooth is about as long as the anterior, and much more elevated and stouter, its distal end being the thicker and higher, with a distinct angular summit; the oblique resilial pit is excavated out of its anterior surface. The ossicle is somewhat elongated, curved or crescent shaped. The interior of the shell is only slightly lustrous and shows but little iridescence.

Length of one of the largest specimens, 19 mm.; height, 11 mm.; thickness, about 3 mm.

Found in considerable numbers at twenty-three stations, north of Cape Cod, off Stellwagens Bank, and off Chatham, in 10 to 43 fathoms, 1872–1881.

This species, which is common in the vicinity of Cape Cod, has probably been confounded, hitherto, with *C. trilineata* Say, and *C. gouldiana* Dall. From the latter, which occurs abundantly in the same

region, it differs in its much smaller size, much less iridescent interior, straighter postero-dorsal margin, less upturned rostrum, and narrow, or more accuminate, posterior half of the shell. The hinge also differs in several respects.

KENNERLIA BREVIS, new species.

(Plate LXXXVIII, figs. 7, *a*, *b*.)

Kennerlia glacialis VERRILL, Notice of Recent Add. to Mar. Invert., Pt. 2, Proc. U. S. Nat. Mus., III, p. 397, 1881; Trans. Conn. Acad., V, p. 567, 1882; VI, p. 277, 1884.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 68, 1889 (in part).

Shell short, sublunate, very inequilateral, obtuse at both ends, slightly narrowed anteriorly. The antero-dorsal margin is short and slopes rather rapidly to the anterior end, where it forms an obtuse angle with the ventral margin which is broadly and nearly evenly rounded, and passes into the rounded posterior margin without angulation, but sometimes with a slightly sinuous curve below; there is also, sometimes, a very slight sinuosity anteriorly; the postero-dorsal margin is nearly straight. The left valve is rather convex, moderately thick, nearly smooth, with a distinct, narrow radial ridge running from the beak to the posterior end. The right valve is smaller, concave or nearly flat, lunate, widest behind the middle, regularly curved ventrally or faintly sinuate anteriorly; its surface is marked by lines of growth and crossed by radial grooves, of which about ten are very distinct, while many others, much finer, can be seen with a lens. In the right valve the hinge consists of two small, divergent teeth, both of which are directed posteriorly. The rather thin, elongated posterior one, in a profile view, is obtusely triangular, its highest point distal to the middle; the slender resilium is attached to this, nearly the whole length of its anterior side, and carries a long, narrow ossicle. The cardinal tooth directly under the beak, is much shorter and somewhat thicker, with its highest point near the proximal end which is close to the dorsal margin. There is also a slightly elevated, rather indistinct, anterior submarginal ridge, parallel with the margin, which supports a slender ligamental groove. In the left valve the hinge consists of a submarginal, thickened, blunt anterior tooth, running forward subparallel with the margin, and a posterior submarginal thickening or ridge having the resilium attached to its anterior side; the V-shaped space is relatively very wide and is not divided by any distinct intermediate ridges, such as occur in typical *Pandora*. The resilium appears to be simple, not divided in a V-shaped form as in the latter genus.

Length of one of the largest specimens, 11.5 mm.; height, 7 mm.; thickness, 3 mm.

Found in small numbers at about ten stations between N. lat. 40° 15′ 30″, W. long. 70° 27′, and N. lat. 35° 10′ 40″, W. long. 75° 6′ 10″, in 58 to 100 fathoms, 1880–1886.

This species, which is southern in its range, is closely related to the

northern *K. glacialis* (Leach) with which it was formerly identified. It is a smaller, shorter, and more inflated species, with a shorter and more sloping antero-dorsal margin and a more evenly curved ventral margin, without the distinct antero-ventral indentation seen in that species. The convex valve has a distinct, posterior radial ridge which is faint or lacking in *K. glacialis*. There are also differences in the hinge, in the right valve of the latter the teeth are more divergent, etc.

Doctor Carpenter, who established the group *Kennerlia*, defined it as differing from typical *Pandora* in having an ossicle on the cartilage or resilium, and radial grooves on the right valve. Perhaps the simple linear form of the resilium in *Kennerlia* and its forked or V-shaped form in true *Pandora* (type *P. rostata* Lamarck) may be of more importance. The intermediate ridge in the left valve of *Pandora* fits between the two divisions of the V-shaped resilium. There is also in *Kennerlia* a small, buttress-like projection within the margin, under the beak, which supports an inward projecting portion of the ligament, darker in color than the resilium.

Family PERIPLOMIDÆ.

PERIPLOMA AFFINIS, new species.

(Plate LXXXVII, fig. 4.)

Shell thin, fragile, broad-ovate, with the beaks behind the middle and with a short, narrowed posterior end. The antero-dorsal margin is broadly convex; anterior end nearly evenly rounded, but slightly produced in the middle; ventral margin evenly convex to the base of the rostral region where it becomes slightly incurved; posterior end much narrowed, compressed and produced into a short, blunt rostrum with the edges gaping slightly at the end; postero-dorsal margin nearly straight, sloping rapidly to the angle of the rostrum; a faint diagonal ridge extends to the lower rostral angle, posterior to which the shell is smoother than elsewhere and marked with several faint, radial riblets. The general surface is covered with irregular, uneven and often rather faint, concentric undulations, separated by rather wide concave intervals which, like the elevations, are covered by thin, elevated lines of growth. The undulations are most regular on the umbos and become less distinct and more irregular toward the margin and anteriorly, and show by transparency on the interior of the shell. The chondrophore is small, but very prominent, spoon-shaped, narrow at the base and expanded distally, with a nearly round resilial pit. The ossicle is well developed, bent into a crescent shape, and so formed as to fit into the small rounded notch in the shell margin in front of the chondrophores. A somewhat elevated submarginal ridge extends forward from the notch and serves to support the thin ligament; a similar but less prominent ridge extends backward from the chondrophores and defines a distinct ligamental groove.

Length of the largest specimens, 13 mm.; height, 10 mm.; breadth, 8 mm.

Three specimens were found at three stations, off Marthas Vineyard, in 100 to 115 fathoms, 1880–81.

This species resembles *P. undulata* in sculpture, but the latter is narrower and longer in form, and has a more decidedly longer rostrum; its chrondrophore is shorter and broader, and not so distinctly spoon-shaped distally, while the marginal notch in front of it is relatively much smaller.

PERIPLOMA UNDULATA Verrill.

(Plates LXXIX, fig. 1; LXXXVII, fig. 5.)

Periploma undulata VERRILL, Trans. Conn. Acad., VI, pp. 433, 448, 1885.

A few specimens were found at six stations between N. lat. 39° 9′, W. long. 73° 3′ 15″, and N. lat. 36° 42′, W. long. 74° 30′, in 541 to 816 fathoms, 1884–1887.

Family LIMIDÆ.

LIMATULA REGULARIS, new species.

Shell small, thin, nearly equilateral, much higher than long, with the hinge-line straight and rather long. Umbos and median part of the shell swollen. Beaks rather prominent, directly incurved. Ligamental area relatively large, elongated, diamond-shaped, with the pointed end extending nearly to the angles of the hinge-margin, with a central, more sunken, short, rhomboidal ligament-pit which, on a separate valve, forms nearly an equilateral triangle. The anterior and posterior ends are nearly equally curved, a little convex, but slightly narrowed where they join the hinge-margin and form a distinct obtuse angle; on one side, supposed to be anterior, below the angle the margin is slightly incurved for a short distance, making this angle less obtuse than the other. The ventral margin is nearly evenly rounded, forming nearly the segment of a circle. The surface is covered with small, elevated, radial ridges separated by concave grooves of greater breadth; in the middle of the shell between ten and twelve of the ridges are distinctly higher and thicker; on each side their size diminishes outwardly, so that near the angles of the hinge they become nearly or quite obsolete, the last ones being mere raised, microscopic threads; in some cases smaller ones alternate with the larger ones, so that the total number can not be definitely determined, but fifty or more can often be counted. There is often no very evident median external sulcus, such as occurs in several related species, but the two or three central radii are often, but not always, distinctly larger than the rest. The radii are crossed by very fine lines of growth not sufficiently strong to render them at all nodulose. The inner margin is

distinctly crenulated along the prominent ventral edge, the crenulations corresponding to the external grooves and ridges, but at the ends it is smooth. There is often a distinct, median internal groove, extending from near the beak to the middle of the ventral margin, bordered on each side by a distinct raised ridge, sometimes having an additional groove on their outer sides. The hinge-margin is rather thin, nearly straight, and a little excavated or incurved along the ligamental pit; on each side and considerably within the margin there is a small triangular buttress or shelf-like process extending to the anterior and posterior margins as in the allied species, but rather larger than usual.

Length of one of the largest species, 6 mm.; height, 9.6 mm.; thickness, about 5 mm.; length of hinge-margin, 3.6 mm.

A number of separate valves, station 2265, N. lat. 37° 7′ 40″, W. long. 74° 35′ 40″, in 70 fathoms, 1884.

This species is allied to *Limatula subovata* (Jeffreys) Smith,[1] which is distinguished by its shorter hinge-margin, more contracted form, with stronger and higher radial ribs and well-marked median sulcus. It also lacks the incurvature of the margins below the angles of the hinge.

LIMATULA NODULOSA, new species.

Shell small, nearly equilateral, vertically ovate, narrowed above, with a comparatively short, straight, hinge-margin. Umbos prominent, a little compressed. Beaks small, a little prominent, directly incurved. Surface covered with radial ribs which are very fine and even on the anterior and posterior ends, but in the middle region, become much stronger and are rendered nodulose by strongly marked, raised, concentric lines and grooves. The two median ones are much stronger than the others and are separated by a distinct median sulcus. The inner surface is marked by radial ridges and grooves of which the median ones are much the stronger; inner margin crenulated ventrally by the ends of the ribs and grooves. Ligamental area diamond shape with a small, short, rhomboidal ligament-pit in the middle. The hinge-margin forms an obtuse angle at each end, the two nearly or quite equal; internal buttress well developed with the inner margin regularly curved and continuous across the middle, so as to thicken the hinge in this part.

Length, 4.5 mm.; height, 7 mm.; thickness, about 4 mm.; length of the hinge-margin, 2 mm.

A single valve, among Foraminifera, at station 2385, N. lat. 28° 51′, W. long. 88° 18′, in 730 fathoms, 1885.

This species agrees with *L. subovata* (Jeffreys) Smith almost completely in size and form, but differs very decidedly in the strong, nodulose, radial ribs which cover the middle portion of the shell.

[1] *Limæa subovata* Verrill, Notice of Recent Add. to Mar. Invert., Pt. 2, Proc. U. S. Nat. Mus., III, p. 402, 1881.

LIMATULA HYALINA, new species.

Shell small, thin, translucent, vertically ovate, somewhat oblique, and produced postero-ventrally. Hinge-line straight, rather short, forming a well-marked angle at each end owing to the outline of each margin becoming somewhat concave below. Beaks small, acute, incurved. Umbos prominent, smooth, beyond which the shell is covered with numerous, clearly defined, rather sharp radial ridges, separated by wider concave intervals; from twenty to twenty-five of the radii can be easily counted; toward the posterior margin they become faint and indistinct, while the extreme margin, on both sides, is smooth. The anterior margin is broadly rounded and slopes backward below the middle; the posterior margin is nearly straight or even a little incurved in its upper half, but becomes slightly convex below; the ventral margin is evenly rounded and the edge is slightly scalloped by the radial ribs and furrows. There is no distinct median sulcus or larger ribs. The ligamental area is rather short and broad with a relatively large and thick central ligament which occupies a distinctly excavated pit in the hinge-margin.

Length of one of the largest specimens, 4.5 mm.; height, 7.5 mm.; thickness, 3 mm.

A number of live specimens, among Foraminifera, stations 2367 to 2374, N. lat. 29° +, W. long. 85° +, in 25 to 27 fathoms, 1885.

This species somewhat resembles *Limatula confusa* Smith, which was also taken in the north Atlantic and West Indian areas, in 450 to 1,450 fathoms. Our species is, however, more compressed and more oblique, and the radial ribs do not extend to the extreme margins as in the latter. The hinge-margin is also relatively shorter and the ligamental area larger, so that the beaks are more separated.

Family PECTINIDÆ.

In this family the classification adopted is that proposed by the senior author in a recent paper on the group.[1] We give here a brief abstract of the existing genera and subgenera therein described. For fuller discussions of the characters and interrelations of these groups and illustrations of typical species of most of them, reference should be had to that article.

In the following synopsis the generic groups are arranged in chronological order, without regard to their zoölogical affinities.

[1] "A study of the family Pectinidæ, with a revision of the Genera and Subgenera." By A. E. Verrill, Trans. Conn. Acad. of Sciences, X, pp. 43-95 (six plates), July, 1897.

PECTEN Müller, 1776.

Pecten (1st section) KLEIN, 1753 + *Vola*.
Pecten MÜLLER, Prod. Zoöl. Dan., 1776 (*pars*).—DACOSTA, 1778.—BOLTEN, 1798 (restricted).—CUVIER, 1798.—LAMARCK, Syst., 1801.—VERRILL, Trans. Conn. Acad., , pp. 56, 89, 91, 1897.
Janira SCHUMACHER, 1817.—DALL, 1886 (*pars*).—FISCHER, 1887.
Vola H. and A. ADAMS (after KLEIN), 1858.—STOLICZKA, Mem. Geolog. Survey of India, Cretaceous Pelecypod Fauna, III, p. 426, 1871.—ZITTEL, 1881.
Vola + *Janira* CHENU, 1862.

Type.—*Pecten maximus* (Linnæus).

Since Bolten, in 1798, definitely restricted the name *Pecten* to this group, his restriction has precedence over that of Schumacher.

The shells are generally large and heavy, and the valves are very unequal, even when very young. The right valve is strongly convex with a large and much incurved umbo and beak, while the left valve is flat or even concave. It is usually smaller than the right, and shuts closely inside of its scalloped margin, and its umbo is nearly or quite obsolete. The auricles are of moderate size and not oblique, and in the right valve they are strongly convex or excurved in the middle. This valve has a sinuous, excurved byssal notch, with obsolete pectinidial teeth. The surface of both valves has strong radial ribs interlocking at the margin. Internally there are angular, thickened, and fluted radial ribs opposite the external grooves; these ribs become more prominent and bicarinate or fluted near the margins.

AMUSIUM Bolten, 1798.

Amusium BOLTEN, 1798.—MUHLFELDT, 1811.—SCHUMACHER, 1817.—WOODWARD, 1866.—DALL, 1886.—VERRILL, Trans. Conn. Acad., X, pp. 57, 90, 92, 1897.
Amussium H. and A. ADAMS, 1858 (*pars*).—STOLICZKA, Mem. Geolog. Survey of India, Cretaceous Pelecypod Fauna, III, p. 426, 1871.—FISCHER, 1887.—ZITTEL, 1881.
Pleuronectia SWAIN, 1840.—CHENU, 1862.

Type.—*Amusium pleuronectes* (Linnæus).

In this very distinct genus the shell is round, thin, nearly smooth, and strongly compressed. The surface is often polished, sometimes lightly radially striated, never strongly ribbed. The margins are simple and thin. The valves may be a little unequal in convexity and usually differ in color and somewhat in sculpture. The valves come together ventrally, but usually gape at both ends. The auricles are small, symmetrical, nearly equilateral, often with lateral cruræ; the byssal notch is small or absent, pectinidial teeth nearly or quite abortive. The adult probably has no byssus. Hinge-plate simple. Interior of valves strengthened by a number of raised divergent ribs, or liræ, independent of any external sculpture.

CHLAMYS Bolten, 1798.

Chlamys BOLTEN, Mus. Bolt., 1st ed., p. 165, 1798, restricted.—FISCHER, 1887 (*pars*).

Pecten SCHUMACHER, 1817 (restricted).—VERRILL, Trans. Conn. Acad., X, pp. 58, 89, 91, 1897.

Pecten (*pars*) and *Chlamys* (*pars*) H. and A. ADAMS, 1858.—CHENU, 1862.—ZITTEL, 1881.

Pecten STOLICZKA, 1871 (restricted).

Type.—*Chlamys islandica* (Müller).

The original type of this genus is identical with *P. islandicus* (Müller). Therefore this should be adopted, without question, as the true type, as has been done by Fischer and others.

The typical species of *Chlamys* are high, rounded, somewhat oblique, nearly equivalve shells, with large inequilateral and oblique auricles, a large byssal notch, and several pectinidial teeth. The surface is strongly radially sculptured, with both primary and numerous interpolated ribs, increasing in number with age. The ribs are generally crossed by concentric sculpture, often forming rough, scale-like projections. The margins are scalloped and the shell closes rather tightly except at the byssal area. The inner surface has ribs and double flutings, corresponding to the external grooves and radii. The hinge-plate has generally two slightly divergent ribs on each end.

PALLIUM Schumacher, 1817.

Pallium SCHUMACHER, 1817.—H. and A. ADAMS, 1858.—CHENU, 1862.—STOLICZKA, 1871.—ZITTEL, 1881.—FISCHER, 1887.—VERRILL, Trans. Conn. Acad., X, pp. 59, 89, 91, pl. XXI, fig. 4, 1897.

Dentipecten RUPPEL, 1835.

Type.—*Pallium plica* (Linnæus).

The special feature of this very distinct group is the development of several (usually three) well-marked, nearly transverse, blunt teeth, alternating with distinct pits on each end of the hinge-plate. The shell is elevated, rather thick, with external, large, obtuse or rounded radial ribs or corrugations, and with internal, angular, double or bicarinate ribs opposite the external grooves, near the margin. The auricles are small, but high. The hinge-teeth are marked with distinct cross lines.

HINNITES Defrance, 1821.

Hinnites VERRILL, Trans. Conn. Acad., X, pp. 59, 89, 91, 1897.

Type.—*Hinnites cortessi* Defrance.

Shell free and much like *Chlamys*, when young, but later in life it becomes attached by the right valve and irregular.

HEMIPECTEN Adams and Reeve, 1849.

Hemipecten VERRILL, Trans. Conn. Acad., X, pp. 60, 89, 91, 1897.

Type.—Hemipecten forbesianus Adams and Reeve.

This group includes species with thin, irregular shells attached by the right valve, like *Hinnites*, but the attachment is effected mainly by a permanent modified byssus. The posterior auricles are nearly obsolete. The byssal notch becomes irregular and nearly inclosed, as in *Anomia*.

PSEUDAMUSIUM H. and A. Adams, 1858.

Pseudamusium (*pars*) H. and A. ADAMS, 1858 (after KLEIN).—CHENU, 1862.—STOLICZKA, 1871.—ZITTEL, 1881.—FISCHER, 1887.—DALL, 1886 (*pars*).—VERRILL, Trans. Conn. Acad., X, pp. 60, 90, 92, pl. XVII, figs. 8, 8*a*, 1897 (restricted).

Type.—Pseudamusium exoticum (Chemnitz, Lamarck).

The typical species of this group have nearly smooth, round, symmetrical, closed shells with well defined, small, straight, obtuse-angled auricles. The valves are nearly equal and have nearly simple, even margins. The external sculpture consists of small radial striæ or riblets, without strong angular ribs and grooves, and it may differ on the two valves. Some of the species show the fine divergent "camptonectes sculpture" on one or both valves, especially when young. The margin is not scalloped, or but faintly so, and there are no definite internal ribs. The hinge-plate has usually but one longitudinal fold on each end which is feeble and nearly parallel with the marginal ligamental groove and is usually cross-lined. The byssal notch is small and the pectinidial teeth vary from one up to five in number, or sometimes may be lacking.

CAMPTONECTES Meek, 1864.

Camptonectes MEEK, 1864.—STOLICZKA, 1871.—ZITTEL, 1881 (type, *arenatus* Goldfuss).—VERRILL, Trans. Conn. Acad., X, pp. 62, 90, 91, 1897.

Type.—Camptonectes lens (Sowerby).

Shell subovate, plain, not corrugated, and without strong radial ribs; margin nearly plain. Valves subequal. Auricles unequal; byssal notch well developed. Surface of the shell covered with fine, obliquely divergent, curved, crenulated or vermiculated riblets with intervening, narrow, punctate grooves.

The curious vermiculated sculpture is not peculiar to this division, but is more or less obvious on the shells of some species of *Pseudamusium*, and on species of several other groups, both with and without radial ribs. It is a structural feature that runs obliquely across the ribs and grooves. Most of the species are Mesozoic fossils.

The recent *Pecten striatus* and *P. tigrinus* Lamarck, of Europe, apparently belong to this group, and *P. testæ* might also well be referred to it. The latter is one of the types of *Palliolum* which might well be regarded as a section of this genus.

LYROPECTEN Conrad, 1867.

Liropecten of several later authors.

Lyropecten CONRAD, 1867.—VERRILL, Trans. Conn. Acad., X, pp. 63, 89, 91, 1897.

Type.—*Lyropecten nodosus* (Linnæus).

Shell large and strong, corrugated, with large, fluted, and usually nodose, primary radial ribs, which do not increase in number, and with coarsely scalloped margins. Valves somewhat unequal. Auricles of medium size, unequal. Hinge-plate with several, usually three, oblique, divergent ribs on each end. This is one of the best defined groups, and may be regarded as of generic value. It is allied to *Pallium*.

PROPEAMUSIUM Gregorio, 1883.

Propeamusium (subgenus) DALL, Bull. Mus. Comp. Zoöl., XII, p. 210, 1886.—FISCHER, 1887.—(genus) VERRILL, Trans. Conn. Acad., X, pp. 64, 90, 92, pl. XX, figs. 5-9, 1897.

Type.—*Propeamusium inequisculpta* (Tiberi) = *Propeamusium fenestratum* (Forbes).

This group is allied to *Amusium*. It includes small, mostly deep-sea species, with thin, rounded shells, having the valves unequal in size and sculpture; the lower and flatter one is concentrically grooved, and usually turns up at the thin margin to meet the upper valve, as in *Cyclopecten*. The upper valve may be cancellated or radially sculptured. When full grown there are several well-formed, raised, internal ribs; these may be absent in the young.

This division differs from *Amusium* in the sculpture of the valves and in having the auricles and byssal notch well developed.

The species closely resemble those of *Cyclopecten;* the only obvious difference in the shells is in the presence of internal ribs.

PALLIOLUM Monterosato, 1884.

Palliolum (subgenus or section) VERRILL, Trans. Conn. Acad., X, pp. 65, 90, 91, pl. XVIII, figs. 6-14, 1897.

Types cited.—*Palliolum testæ* (Bivona) and *Palliolum vitreum* (Chemnitz).

This group is separated from *Pseudamusium* H. and A. Adams, and can scarcely be distinguished from *Camptonectes* by any known characters.

The two species named by its author as types agree in having thin, rounded, nearly equivalved shells, with the posterior auricle poorly developed, and with fine camptonectes sculpture on both valves, with small radial riblets, and usually with rows of small scales. The margins are plain and come evenly together, without flattening.

ÆQUIPECTEN Fischer, 1887.

Æquipecten (subgenus of *Chlamys*) VERRILL, Trans. Conn. Acad., X, pp. 59, 67, 89, 91, pl. XVI, figs. 6–11; pl. XX, figs. 1–3, 6, 6*a*, 1897.

Type.—*Æquipecten opercularis* (Linnæus).

Shell broadly rounded, with the valves nearly equal and symmetrical. Auricles well-formed, angular; byssal notch well-developed. The sculpture consists of a moderate number of large and nearly equal primary radial ribs, which increase in size, but are not much increased in number with age, by the interpolation of new ones. Internal ribs or flutings correspond to external grooves, but each one is bicarinate or double, especially near the margins. Hinge-plate with one or two slightly divergent ribs at each end, often crossed by strong transverse incisions. Pectinidial teeth abortive in the type, but present in most species. The foot of the type species is subcylindrical, well-developed, with a byssal fissure and a terminal, deeply bilobed "scooped-shaped" disk, which can be expanded. In *Æ. irradians*[1] the foot has a similar structure, but the terminal disk appears to be smaller.

PECTINELLA Verrill, 1897.

Pectinella VERRILL, Trans. Conn. Acad., X, pp. 68, 90, 92, 1897.

Type.—*Pectinella sigsbei* (Dall).

Shell small, thin, swollen, nearly smooth, with convex and slightly unequal valves. Auricles very unequal, oblique, the anterior larger, with a deep byssal notch in the right valve, but without pectinidial teeth; posterior auricle small. The surface is smooth except for fine lines of growth. Camptonectes sculpture is not present. The texture is not hyaline.

The only known species is *Pectinella sigsbei* (Dall)[2] which was taken by the *Blake* Expedition in the West Indies, in 158 fathoms.

LISSOPECTEN Verrill, 1897.

Lissopecten (subgenus of *Chlamys*) VERRILL, Trans. Conn. Acad., X, pp. 68, 90, 91, 1897.

Type.—*Lissopecten hyalinus* (Poli).

Shell slightly inequivalve, broadly rounded, not oblique, thin, translucent, nearly smooth. The external sculpture consists of faint, nearly obsolete radial ridges and obscure riblets, but one or both auricles may have a more or less cancellated sculpture. The interior sculpture consists of very distinct, simple, raised ribs. Auricles angular, well-developed. Byssal notch deep. Pectinidial teeth prominent. Margin not scalloped, nearly plain and simple.

[1] Trans. Conn. Acad., X, pl. XX, fig. 6.

[2] Bull. Mus. Comp. Zoöl., XII, p. 223, pl. IV, fig. 2, 1886.

Although this group agrees with *Amusium* in having internal ribs without corresponding external grooves, it seems to be allied rather to *Chlamys*. It may be regarded as a division of the latter in which the external radial ribs have degenerated.

LEPTOPECTEN Verrill, 1897.

Leptopecten (subgenus of *Chlamys*) VERRILL, Trans. Conn. Acad., X, pp. 69, 89, 91, 1897.

Type.—Leptopecten monotimeris (Conrad).

Shell thin, translucent, oblique, broadly rounded, with strong, rounded radial ridges or folds, like corrugations, which appear in reverse on the interior surface. The internal ribs are not angulated by a deposit of shell, nor distinctly thickened. Margin with broad scallops. The exterior surface is covered with fine divergent camptonectes sculpture, both on the ribs and intervals. The ribs do not increase in number with age but become broader and more flattened. Auricles large and broad, thin, corrugated. Byssal notch large and deep. Pectinidial teeth prominent. Hinge-plate thin and but little differentiated. Cardinal ridge thin and small, close to the ligament, crossed by fine incisions.

PLACOPECTEN Verrill, 1897.

Placopecten (subgenus of *Chlamys*) VERRILL, Trans. Conn. Acad., X, pp. 69, 89, 91, pl. XVIII, figs. 1–7; pl. XX, figs. 7, 8, 8*a*; pl. XXI, figs. 1–2*a*, 1897.

Type.—Placopecten clintonius (Say).

Shell large, compressed, broadly rounded, rather thin, with simple sharp edges, meeting evenly ventrally, but gaping considerably at both ends, especially when adult. Valves only slightly unequal in form, the right one being a little flatter, but they differ in color and somewhat in sculpture, the right one being smoother and paler. Both have fine radial lines or riblets, and they have vermiculated divergent riblets when young. Auricles small, symmetrical, nearly equal. Byssal notch small, simple. Pectinidial teeth generally obsolete, except when young. No internal ribs. Inner surface often with more or less pearly luster and a crystalline structure. Hinge-plate with two feeble, slightly divergent ribs on each end, crossed by fine transverse incisions. The foot[1] is well developed, oblique, slightly narrowed distally and enlarged at the end, where it is divided into two lobes by a rather deep, oblique, longitudinal fissure, so that the lobes can be spread apart or closed at will, thus resembling somewhat the foot of *Ledidæ*. Toward the base, on the anterior side, there is also a short, deep byssal slit, terminating at a prominent tubercle about the middle of the front side.

[1] Trans. Conn. Acad., X, pl. XX, fig. 8.

CYCLOPECTEN Verrill, 1897.

Cyclopecten VERRILL, Trans. Conn. Acad., X, pp. 70, 90, 92, pl. XVI, fig. 1; pl. XIX, figs. 1-4, 1897.

Types.—Cyclopecten pustulosus Verrill and *Cyclopecten imbrifer* (Lovén).

Shells thin, rounded, scarcely oblique, with symmetrical auricles and simple margins. The two valves are unlike in sculpture. The right valve is a little flattened and upturned at the flexible margin, so as to fit tightly against the upper valve. The thin lower valve has, in the typical species, regular, thin, elevated, concentric lamellæ, which aid in the adaptation of the edge to that of the upper valve; the margin is usually flattened or bevelled. The upper (left) valve is radially sculptured, rarely smooth; it usually has radial rows of arched scales, pustules, or points, and also concentric raised lines; it is sometimes cancellated. No radial ribs, nor interlocking points at the margin. Auricles well-developed, subequal, angulated and well-defined at both ends; byssal notch well-defined; few or no pectinidial teeth. Cardinal folds single, rather feebly developed, often cross-lined. Eyes few. Byssus small, and of few threads.

This genus includes a large number of small species, mostly from deep-water.

HYALOPECTEN Verrill, 1897.

Hyalopecten VERRILL, Trans. Conn. Acad., X, pp. 71, 90, 92, pl. XVIII, fig. 5, 1897.

Type.—Hyalopecten undatus Verrill.

Shell compressed, thin, hyaline. Valves nearly equal, with concentric undulations or corrugations, affecting the entire thickness; margins simple; sculpture none, or consisting of fine radial lines on one or both valves, without camptonectes sculpture. Hinge-plate thin and nearly plain; auricles well-developed, unequal; byssal notch distinct.

For the possible relations of this group to the Mesozoic genus, *Syncyclonema*, see the original article.

The species recorded are as follows: *H. dilectus* Verrill and Bush, from 1,813 fathoms, off Marthas Vineyard; *H. fragilis* (Jeffreys), from northern Europe and the Arctic Ocean, and off the United States coast, in 578 to 1,525 fathoms; *H. undatus* Verrill, off the United States coast, in 1,423 fathoms; and *H. pudicus* (Smith), off Marion Island, in 1,375 fathoms.

PARAMUSIUM Verrill, 1897.

Paramusium VERRILL, Trans. Conn. Acad., X, pp. 72, 90, 92, 1897.

Type.—Paramusium dalli (Smith).[1]

Shell thin, rounded, much compressed; valves nearly equal; sculpture nearly obsolete, different on the two valves; the lower valve with concentric undulations. Auricles very small, equal. Byssal notch and

[1] *P. dalli* ranges from the Gulf of Mexico to Barbados, in 218 to 1,591 fathoms.

pectinidial teeth obsolete. The shell has a prismatic structure. Internal liræ and auricular cruræ well-developed.

The structure of the animal was described by Mr. Dall as very different from that of typical *Amusium*. According to his description it has a single pair of gills, with long, simple, separate filaments. The foot is slender, with a byssal groove; the end is much enlarged, with an oblique, expanded, concave terminal disk, striated within. No labial palpi. Ocelli without pigment.

A specimen, well preserved in alcohol, examined by us, had two rows of long, slender, reflected gill-filaments, as usual in this family. They were attached to a broad basal membrane, with a free, lanceolate, posterior portion. Two pairs of broad, foliaceous, incurved palpi, tinged with dark brown. Those of the anterior pair are united into a hood over the mouth; the others are smaller, curved inward, somewhat lanceolate at the tips. No ocelli could be found. The pallial tentacles are all in one row, numerous, of various sizes; from four to six large ones, with as many alternating small ones, correspond to each larger undulation or scallop of the mantle-margin. No guard-tentacles. Muscular pallial border is broad, thickened, radially striated, forming a ridge, as preserved, but not tentaculated. Free portion of rectum long and slender.

A synopsis of the Pectinidæ was recently published by Dr. Frederico Sacco.[1]

He recognized three genera: *Chlamys*, *Amussium*, and *Pecten*, with the same types given by Verrill. Under *Chlamys* he gives nine subgenera. Of these, four—*Chlamys* (restricted), *Hinnites*, *Æquipecten*, and *Palliolum*—correspond with the groups of the same name given by Verrill; *Felipes* Locard (type, *pesfelis* L.), *Peplum* Bucquoy, Dantzenberg, and Dollfus, 1889 (type, *inflexum* Poli), *Macrochalmis* Sacco, 1897 (type, *latissima* Brocchi), *Flexopecten* Sacco, 1897 (type, *flexuosus* Poli), *Lissochlamis* Sacco, 1897 (type, *excisa* Bronn), are additional to those given by Verrill.

Under *Amussium* he has, besides the typical group, four subgenera. Of these, two are new—*Parvamussium* Sacco, 1897 (type, *duodecimlamellatum* Bronn), *Variamussium* Sacco, 1897 (type, *cancellatum* Schmidt). The two others are *Propeamussium* and *Pseudamussium*.

The three new subgenera of *Pecten* are *Amussiopecten* Sacco, 1897 (type, *burdigalensis* Lamarck); *Oöpecten* Sacco, 1897 (type, *rotundatus* Lamarck); and *Flabellipecten* Sacco, 1897 (type, *flabelliformis* Brocchi).

[1] Bolletino dei Mus. Zool. ed Anat. Comp., Univ. di Torino, XII, p. 101. It was apparently issued at about the same time as that by Professor Verrill, here abstracted.

CHLAMYS BENEDICTI Verrill and Bush.

(Plate LXXXIV, figs. 1, 2.)

Chlamys benedicti VERRILL and BUSH, in VERRILL, Trans. Conn. Acad., X, pp. 74, 91, 1897.

Shell small, higher than long; anterior auricle much larger than the posterior, with a deep byssal notch in the lower or right valve. The dorsal margin is straight and but slightly oblique; the posterior auricle in the right valve is decidedly angular, with its outer end slightly incurved and serrated by the termination of the radial ribs; the anterior auricle is considerably prolonged, angulated at the upper corner, obtusely rounded at the end and deeply notched where it joins the main shell; it has four strongly marked radiating ribs, besides the dorso-marginal fold; below these there is a slightly concave space corresponding to the byssal notch; on the body of the shell there are from four to seven sharp serrations along the lower margin of the notch. In the upper valve the anterior auricle is broad and decidedly angular, the dorsal and outer margins forming less than a right angle; its surface is covered with five or six strong radiating ribs decussated by more numerous, finer, concentric raised lines. The anterior and posterior margins of the body of the shell slope about equally and form an acute angle; the ventral margin forms a regular semicircular curve. The entire surface in both valves is crossed by strongly raised, rather close, radiating ribs separated by rather wide, deep grooves and are decussated by regular, raised, concentric lines, which are scarcely apparent on the ribs, except on very young shells, but there are rather strong, elevated, spine-like points arranged along the ribs in pretty regular, concentric lines, especially near the margins; these become higher and more pointed anteriorly and are frequently nearly obsolete in the middle portion of the lower valve; the ribs project at the margin as blunt points or serrations; on the inner surface there are radial grooves corresponding to the external ribs. The hinge-margin is thin, with a slender ligamental, submarginal groove and a small, triangular resilial pit in the center. The color is variable; the single valve from station 2571 is uniform lemon yellow; those from the other locality are chestnut or reddish brown and variegated with paler and sometimes white blotches.

Length of the largest specimen, 5.5 mm.; height, 6 mm.; length of dorsal margin, 4 mm.

A few live young specimens, among Foraminifera, stations 2369 to 2374, in 25 to 27 fathoms, and a single valve, station 2571, in 1,356 fathoms, 1885.

This species is a typical *Chlamys*, allied to *C. varia* of Europe, but when compared with young of that species of the same size the radial ribs are found to be fewer and coarser, and there are other differences which render it probably that they are distinct. It differs from the young of *C. islandica* in the number of ribs and shape of the auricles.

It is probable, however, that it grows to a much larger size than any of the specimens obtained.

It is named in honor of Mr. James E. Benedict, for several years zoölogist in charge on the steamer *Albatross*, through whose care and great interest so many small species were brought to light.

CHLAMYS COSTELLATA Verrill and Bush.

(Plate LXXXVI, fig. 6.)

Chlamys costellata VERRILL and BUSH, in VERRILL, Trans. Conn. Acad., X, pp. 75, 91, 1897.

Shell small, thin, translucent, bluish white, covered on both valves with continuous, elevated and somewhat thickened, well-separated, radiating riblets, of which there are more than thirty in the left valve of the largest example. Length of the shell considerably less than its height. Dorsal hinge-margin elongated, especially on the anterior end. In the right valve the anterior auricle is considerably elongated, obtusely rounded or subtruncated at the end, with a wide, angular byssal notch beneath it, having two or three pectinidial teeth; it has a broad, smooth, angular area next the body of the shell, above which there are three well-marked, angular, radial ridges, separated by wider concave interspaces; the posterior auricle is small, triangular, the outer corner forming a little more than a right angle, and the posterior margin nearly straight, without any distinct notch. The dorsal margins of the body of the shell are nearly straight and diverge at less than a right angle; the ventral margin is pretty evenly rounded, a little produced in the middle. The beak is small, acute, appressed, and does not project beyond the margin. The radial ribs are very distinct, clean cut, thickened, rounded at the summit, separated by nearly smooth intervals, two or three times as broad as the ribs themselves; the ribs increase regularly in width from near the umbo to the margin; a few intermediate ridges commence near the margin. The left valve is badly broken; it is, however, somewhat more convex than the other, and the radial ribs are crossed by numerous concentric striations giving them a finely crenulated or beaded appearance; the anterior auricle is broad, triangular, the outer end slightly rounded, with a slight incurved notch below; it is crossed by about six small, radial ribs, similar to those on the body of the shell; raised lines of growth also occur at irregular intervals. Inner surface smooth and lustrous, showing the grooves corresponding to the external ribs and also a very distinct microscopic structure, but it is destitute of radial liræ. Internally, the hinge-margin is thin and narrow, with a sharply impressed, submarginal groove on each side; the resilial pit is excavated in the margin of the hinge itself; the anterior auricle has internal grooves corresponding to the external ribs.

Length of the largest specimen, 6 mm.; height, 6.5 mm.

Three live specimens, at two stations, off the Grand Banks, in 67 to 72 fathoms, 1885–86.

HYALOPECTEN DILECTUS Verrill and Bush.

(Plate XCVII, fig. 9.)

Hyalopecten dilectus VERRILL and BUSH, in VERRILL, Trans. Conn. Acad., X, pp. 80, 92, 1897.

Shell small, thin, fragile, strongly undulated, slightly oblique, with the ventral margin broadly rounded, dorsal margin straight. In the right valve the anterior auricle is rather narrow, elongated, with a deep angular notch beneath; the posterior auricle is shorter, with a prominent dorsal angle which is less than a right angle, owing to the emargination of the posterior end. In the left valve the anterior auricle is broad, with its posterior end nearly rectilinear, and forms a right angle with the dorsal margin; the posterior auricle has a slightly prominent dorsal angle and posterior emargination as in the right valve. The beaks are a little prominent and project somewhat above the dorsal margin, more in the upper or left valve. The surface in both valves is covered with broad and rather regular undulations, which are most prominent in the left valve, and are crossed by regular, well-spaced, thin, raised, radial lines, which become fine and more crowded at the ends of the valve; they are nearly obsolete in the right valve, being represented by microscopic striæ. In both valves the anterior auricle is marked by several fine, rough, radial ridges which are stronger and more numerous in the left valve. The interior is strongly undulated, and the left valve is marked by distinct, radial grooves. Resilium small, central. Color yellow, or dirty white.

Length, 8 mm.; height, the same.

One live, imperfect specimen (No. 52539), station 2570, off Marthas Vineyard, in 1,813 fathoms, 1885.

This species is closely allied to *Hyalopecten fragilis* (Jeffreys) and resembles very nearly his figure,[1] which probably represents a species distinct from the original type described by him, and may be identical with our shell. The latter differs decidedly from the original description of *H. fragilis*. Moreover, we have obtained from several stations a shell of similar size which appears to be the true *fragilis*,[2] as it agrees closely with the description. *Hyalopecten pudicus* (Smith) from east of Marion Island, in 1,375 fathoms, is a closely related species, as is also *Hyalopecten undatus* Verrill.

These four species agree in having the valves thin and translucent and sculptured with distinct concentric undulations, while the radial sculpture does not form strong ribs. They seem to be related to the genus or subgenus *Syncyclonema* Meek, which was based on a cretaceous species and has not hitherto been reported as still living. But the exact characters of the typical fossil species are not yet known.

[1] Proc. Zoöl. Soc., London, pl. XLV, fig. 1, June, 1879.

[2] The true *Hyalopecten fragilis* (Jeffreys) was taken at five stations between N. lat. 40° 6′, W. long. 68° 1′ 30″, and N. lat. 35° 49′ 30″, W. long. 74° 34′ 45″, in 578 to 1,525 fathoms, 1883–1886.

CAMPTONECTES GRŒNLANDICA (Sowerby) Verrill.

(Plate LXXXV, fig. 7.)

Pecten grœnlandicus SOWERBY, Thesaurus Conchyliorum, Pt. II, p. 57, pl. XIII, fig. 40, 1842.—HANLEY, Recent Shells, p. 274, 1842 to 1856.—JEFFREYS, Ann. and Mag. Nat. History, p. 231, 1877.

Pecten grønlandicus G. O. SARS, Moll. Reg. Arct. Norveg., p. 23, pl. 2, figs. 4, *a–c*, 1878.

Pecten grœnlandicus JEFFREYS, Proc. Zoöl. Soc. London, p. 560, 1879.—VERRILL, Check-list, p. 26, 1879.

Pecten grönlandicus VERRILL, Trans. Conn. Acad., V, p. 581, 1882.

Pecten grœnlandicus LOCARD, Campagne du *Caudan*, Annales de l'Université de Lyon, p. 217, 1896.

Camptonectes grœnlandica VERRILL, Trans. Conn. Acad., X, pp. 82, 91, 1897.

The shell is rounded, inequivalved, very thin, hyaline, nearly smooth, often with a violet iridescence when fresh. The left valve is covered, even from the nucleus, with fine microscopic camptonectes sculpture, in the form of thin, raised, divergent riblets, more or less irregular and wavy, most visible by translucency. The left valve sometimes has, also, fine radial striæ and delicate lines of growth. The margins are thin and smooth, that of the right valve turns up a little against the other, which is larger, and the valves close very tightly, so that anteriorly there is scarcely any visible gape, even at the byssal notch or at the end of the auricle. The byssal notch is well-marked and the pectinidial teeth are small and few. The byssus is probably very slender. The auricles are not oblique and are nearly equal. The hinge-plate is very thin; the single longitudinal ridge is scarcely visible.

A row of six or seven ocelli can be seen through the shell in alcoholic specimens.

A few live specimens were dredged by the United States Fish Commission at four stations, off Newfoundland Banks, in 130 to 224 fathoms, between N. lat. 47° 40′, W. long. 47° 35′ 30″, and N. lat. 44° 46′ 30″, W. long. 59° 55′ 45″, 1884–1886. It is also known from the Arctic Ocean and off northern Europe.

CYCLOPECTEN NANUS Verrill and Bush.

(Plate LXXXV, figs. 2–4.)

Cyclopecten nanus VERRILL and BUSH, in VERRILL, Trans. Conn. Acad., X, pp. 85, 92, pl. XVI, figs. 12–12*c*, 1897.

Shell small, the breadth and height about equal, the valves nearly equal in size and convexity. Dorsal hinge-margin rather long and straight; auricles relatively large and broad, both ends in the left valve subtruncated or a little convex and forming nearly a right angle with the dorsal margin, and having a small incurved notch, well differentiated from the body of the shell. In the right valve the anterior auricle is narrow, somewhat more elongated, obtusely rounded at the

end, with a sharp, angular, byssal notch beneath it, separated from the body of the shell by a narrow groove. The dorsal margins of the body of the shell are nearly straight and form more than a right angle; the ventral margin is broadly rounded, nearly semicircular, forming a very obtusely rounded angle, where it joins the dorsal margins. Umbos a little prominent, with a small, smooth, rather acute, incurved beak, which projects a little above the hinge-margin. The surface of the left valve is everywhere thickly covered with fine, almost microscopic, radiating striæ, which become a little more distinct on the anterior auricle; slightly raised thin lines of growth are often very distinct on some parts of the shell, especially on the anterior auricle, where they become closer, more regular, and often produce, in crossing the radial striations, a quite regular, microscopic decussation; the sculpture on the posterior auricle is sometimes similar but finer, although in many specimens the surface is nearly smooth or marked only by very fine radial striæ. The right valve is less convex than the left (its ventral edge does not quite reach that of the opposite valve), the umbo is less prominent, the beak less acute, and scarcely projects beyond, and often falls short of, the hinge-margin; the inequality is less marked than in most of the allied species. The body of the shell in this valve is smooth, except for very fine, irregular lines of growth; on the anterior auricle there are from three to six, or more, distinct radial ridges, roughened by conspicuous lines of growth; the margin below the byssal notch is entire, without pectinidial teeth; the posterior auricle is nearly smooth. The internal hinge-plate is thin in the middle, but relatively broad on each auricle, and is crossed by numerous fine, well-marked, transverse striations; these are much more conspicuous than in any of the related species, whether young or old. The resilial pit is small, rounded, situated just under the beak. The inner surface is smooth and glossy, although in fresh specimens the external radiating lines show through by transparency. There are no internal liræ.

The ground color of the right valve is yellowish or grayish white, with more or less numerous light yellowish brown and reddish brown spots or blotches, and sometimes with irregular patches of opaque white; the right valve is white, sometimes with a few yellowish brown spots. Some specimens are nearly destitute of spots.

Length of one of the largest specimens, 7 mm.; height, 6 mm.; dorsal hinge-margin, 4 mm.

It has been taken in considerable numbers, live and dead, at three stations between N. lat. 37° 7′ 40″, W. long. 74° 35′ 40″, and N. lat. 35° 42′, W. long. 74° 54′ 30″, in 43 to 132 fathoms, 1884.

Although very small, this species seems to be adult. It is so distinct from all other species of our coast that a detailed comparison is unnecessary. It resembles the young of *P. clintonius* more than any other native species, but a comparison of specimens of the same size shows marked differences.

CYCLOPECTEN LEPTALEUS Verrill.

(Plate LXXXV, fig. 1.)

Pecten leptaleus VERRILL, Trans. Conn. Acad., V, pp. 232, 281, 1882; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 577, 1885.—DALL, Bull. Mus. Comp. Zoöl., XII, p. 221, 1886.
Pseudamusium leptaleus DALL, Bull. U. S. Nat. Mus., No. 37, p. 34, 1889.
Cyclopecten leptaleus VERRILL, Trans. Conn. Acad., X, pp. 85, 92, 1897.

Mr. Dall has expressed a doubt as to this species being distinct from *Pecten imbrifer* Lovén, therefore a very much enlarged figure of the shell is here introduced for comparison.

In addition to the published description, it should be stated that the concentric lines are somewhat thickened and elevated, even where thinnest, and that the beaded character is quite unlike anything found on *C. imbrifer*, or allied species. The beads are closely arranged, elliptical in form, and most elevated at the center, the elevation being often greater than the diameter; the summit is smooth and glassy, so that when viewed from above, under a lens, they often appear to have a central cavity. The radial lines are comparatively very thin and delicate, and not visible, except when considerably magnified. The beaks are more acute than in *C. imbrifer*, and the nucleus smaller and smoother.

Two live specimens, station 2109, off Cape Hatteras, North Carolina, in 142 fathoms, 1883.

CYCLOPECTEN PUSTULOSUS Verrill.

(Plate LXXXV, figs. 5, 6, 10, 11.)

Pecten pustulosus VERRILL, Amer. Journ. Science, V, p. 14, 1873; Trans. Conn. Acad., III, p. 50, 1874.
Pecten hoskynsi var. *pustulosus* VERRILL, Trans. Conn. Acad., V, p. 581, pl. XLII, figs. 22, 22*a*, 1882 (not pl. XLIV, fig. 11). Not *Pecten hoskynsi* G. O. SARS.
Pecten pustulosus VERRILL, Trans. Conn. Acad., VI, p. 261 (p. 281 in part), 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 557 (in part), pl. XXXI, figs. 142*a*, *b*, 1885.
Pecten imbrifer DALL, Bull. Mus. Comp. Zoöl., XII, p. 220 (in part), (not pl. IV, figs. 4*a*, 4*b*), 1886; Bull. U. S. Nat. Mus., No. 37, p. 34 (in part), pl. LXIV, figs. 142*a*, *b*, 1889 (not pl. IV, figs. 4*a*, 4*b*). Not *Pecten imbrifer* LOVÉN.
Cyclopecten pustulosus VERRILL Trans. Conn. Acad., X, pp. 70, 83, 92, pl. XIX, figs. 3, 4, 1897.

This species has been referred to *Propeamusium hoskynsi* by Jeffreys, and to *Pecten* (*Cyclopecten*) *imbrifer* by Dall. It never has the internal ribs, like the former, which it resembles in sculpture. From the latter, as originally described by Lovén, and redescribed and figured by G. O. Sars, it differs especially in the character of the ornamentation of the left valve. The Scandinavian form, according to these authors, has the vesicles much less crowded in each radial row and subconical and mucronate in form; while in ours they are usually

closely crowded, often even in contact in the radial rows, and in form either rounded or elliptical with the longest diameter in the direction of the concentric lines, with the summit evenly rounded, showing no tendency to the subconical or mucronate form. When perfect they resemble small blisters with the surface roughened or minutely granulose under the microscope; when broken or worn off, as frequently happens, the basal part remains in the form of a semicircular or semielliptical, imbricated, arched scale, usually considerably elevated above the surface and connected by very delicate concentric raised lines. The surface of the anterior auricle of the left valve is roughened by close, elevated, concentric lines, and from four to six well-marked radiating ridges or ribs, upon which the concentric lines form regular elevated arched projections, often so crowded as to be imbricated; in some young examples, like the one figured, the concentric lines on the auricle are less crowded and only two or three of the radial ribs are developed; in such examples the vesicles on the body of the shell are relatively fewer, larger, more rounded, and much less crowded in the radial series. In some specimens the posterior margin, below the auricle, is nearly smooth or marked only by the fine lines of growth, while in others, especially larger specimens, this region is covered by rather sharp granules, some of which, toward the ventral margin, change to pointed scales arranged in crowded radial rows. The raised concentric lines on the right valve are generally more or less appressed and sometimes imbricated; toward the ventral margin some of them show very fine microscopic crenulations, which are much less distinct than on *C. imbrifer*, as figured by Sars.

This species is distinct from that figured by Mr. Dall[1] under the name of *C. imbrifer*. His specimen apparently belongs to the following species.

Several live and dead specimens, at eleven stations between N. lat. 44° 34′, W. long. 56° 41′ 45″, and N. lat. 39° 48′ 30″, W. long. 70° 54′, in 99½ to 547 fathoms, 1872–1885.

CYCLOPECTEN SUBIMBRIFER Verrill and Bush.

(Plate LXXXV, figs. 8, 9.)

Pecten hoskynsi VERRILL, Trans. Conn. Acad., V, p. 581, pl. XLIV, fig. 11, 1882. Not Forbes.

Pecten (Pseudamusium) imbrifer DALL, Bull. Mus. Comp. Zoöl., XII, p. 220 (in part), pl. IV, figs. 4*a*, 4*b*, 1886; Bull. U. S. Nat. Mus., No. 37, p. 34 (in part), pl. IV, figs. 4*a*, 4*b*, 1889.

Cyclopecten subimbrifer VERRILL and BUSH, in VERRILL, Trans. Conn. Acad., X, pp. 84, 92, 1897.

Shell small, inequivalved, white or grayish white, translucent, length and height nearly equal. Dorsal margin straight. Anterior auricle in the left valve rather large and broad, the outer end obtusely rounded,

[1] Blake Mollusca, pl. IV, figs. 4*a*, 4*b*.

covered with small, close, radial ribs and crowded concentric ridges; posterior auricle much smaller, with from one to three faint, radial ridges and many concentric, raised lines, and with its outer end forming less than a right angle, with a slight incurved notch below. In the right valve the anterior auricle has a similar radial sculpture and the byssal notch is rather deep and narrow. The dorsal lines of the body of the shell form rather less than a right angle; the ventral margin forms nearly a semicircle with an obtuse angle where it meets the dorsal outline. Umbos a little prominent; beaks small, acute, smooth, and projecting beyond the margin of the hinge. The surface of the left valve is covered with slightly raised concentric lines, which are interrupted or broken up by small arched scales which are sometimes semicircular, but more frequently somewhat angulated or V-shaped, and usually are separated by intervals about equal to their breadth; these scales vary in number, but are usually arranged in about forty radial rows, and increase regularly in size from the umbos, where they are replaced by thin, slightly raised, radial lines crossing the stronger, more elevated, concentric lines, but not rising into points. In some specimens the radial arrangement is scarcely discernible; the scales appear as irregularities in the concentric lines. The postero-dorsal area below the auricle is nearly smooth, except for the fine lines of growth, but sometimes shows minute granules. The right valve, which is smaller than the left, is covered by fine, thin, close, concentric, raised lines, which sometimes show microscopic striations. The anterior auricle is decussated by from six to eight, or more, small radial ridges, which are crossed by the raised, concentric lines; the latter rise into sharp scales at the dorsal margin; the small posterior auricle has finer concentric lines and only two or three faint, radial ridges.

Comparatively few specimens, at three stations, between N. lat. 42° 45′ 30″, W. long. 62° 43′, and N. lat. 39° 53′ 30″, W. long. 71° 13′ 30″, in 121 to 312 fathoms, 1877–1885.

C. kermadecensis (Smith), from north of Kermadec Islands, in 600 fathoms, is a related species.

PROPEAMUSIUM THALASSINUM (Dall) Verrill.

(Plate LXXXVII, fig. 6.)

Amussium fenestratum VERRILL, Trans. Conn. Acad., V, p. 582, 1882.
Amussium sp. VERRILL, Trans. Com. Acad., VI, pp. 261, 281, 1884.
Pecten (*Pseudamusium*) *thalassinus* DALL, Bull. Mus. Comp. Zoöl., XII, p. 221, 1886; Bull. U. S. Nat. Mus., No. 37, p. 34, 1889.
Propeamusium thalassinum VERRILL, Trans. Conn. Acad., X, pp. 87, 92, pl. XIX, figs. 5–7, 1897.

Found at thirteen stations, between N. lat. 40° 5′ 39″, W. long. 70° 23′ 52″, and N. lat. 35° 42′, W. long. 74° 54′ 30″, in 43 to 317 fathoms, 1880–1885. South to Barbados, in 22 to 317 fathoms.—Dall.

Family ARCIDÆ.

BATHYARCA Kobelt.

Type.—Bathyarca pectunculoides (Scacchi).

Shell oblong, subovate, or rounded, rather thin, usually finely cancellated, with hairy or scaly epidermis, more or less equilateral, frequently slightly inequivalved, with a slight byssal sinus. Byssus very small. Ligamental area lanceolate, longer and narrower behind the beaks, with a sagittate posterior ligament. Hinge-margin nearly straight, usually narrow and edentulous in the middle, with a series of small, oblique, striated and crenulated teeth on each end, the distal ones becoming larger and more oblique; those of the posterior series usually longer and more oblique, or divergent, than those in the anterior.

The animal of *B. pectunculoides* var. *grandis*, preserved in alcohol, has the margin of the mantle plain without ocelli, with a well-developed muscular septum, posteriorly; the foot large and thick, geniculate, pointed posteriorly, with a strong byssal groove and a slender, solid, byssal stem; two pairs of rather small, long, lanceolate palpi; the rectum with a free terminal portion; two pairs of rather large gills, with the posterior end of the stem free for some distance, curved, and tapered to a point, and with the reflected portion of the filament of the same length as the direct; the filaments are very slender, delicate, and soft and but slightly attached to each other.

This division, which is probably of generic value, includes a number of small and mostly deep-water species which have been variously placed by recent authors. Mr. E. A. Smith puts several of them in *Scapharca* with a mark of doubt. Mr. Dall puts two allied species in the Jurassic genus *Macrodon*,[1] with which they do not seem to agree very closely, and mentions the affinity of others to *Barbatia*.

The last group differs in the stout, rough shell, strongly gaping ventrally for the large byssus, and in the character of the teeth and ligament. *Scapharca* has a thick, strongly ribbed, inequivalved shell, a firm byssus, and continuous, strong, lanceolate ligament. *Macrodon* has, on the posterior hinge-plate long, divergent lamellæ, nearly parallel with the dorsal margin.

We would refer the following species to *Bathyarca*.—*B. pectuncu-*

[1] The two West Indian species described by Mr. Dall as *Macrodon asperula* and *M. sagrinata*, should, perhaps, form a separate genus, characterized by the few very oblique, sublamellar, posterior teeth and several smaller, nearly transverse anterior ones. It may be designated as *Bentharca*, with *Bentharca asperula* as the type.

These are closely related to one of the Eocene fossil species (*Arca adversidentata*), which Deshayes placed in his group of "Cucullaires," but later writers (Conrad, 1869, Fischer, and others) have taken his first species (*heterodonta*) of that group as the type of the genus "*Cucullaria*," which differs in having the anterior as well as the posterior teeth long and lamelliform; hence we would associate Tertiary species like *Bentharca adversidentata* with the living deep-water forms.

loides (Scacchi) and its varieties, *grandis* Verrill, *Freilei* Jeffreys, *septentrionalis* Sars, *crenulata* Verrill, *orbiculata* Dall, from off St. Vincent, northward. *B. glacialis* (Gray), Arctic America and Europe. *B. anomala* Verrill and Bush, Gulf of Maine. *B. abyssorum* Verrill and Bush, off Delaware Bay. *B. profundicola* Verrill, from off West Indies, northward. *B. glomerula* (Dall), *B. polycyma* (Dall), *B. culebrensis* (Smith), off West Indies. *B. inæquisculpta* (Smith), *B. pteroessa* (Smith), Atlantic and Pacific. *B. imitata* (Smith), Pacific.

Bentharca asperula (Dall), and *B. sagrinata* (Dall), are from the West Indies, in deep water.

BATHYARCA ABYSSORUM, new species.

(Plate LXXVI, fig. 9.)

Shell small, short, well-rounded at both ends, swollen, inequilateral, slightly oblique, with a rather long, straight hinge-margin. Umbos large, swollen, prominent. Beaks prominent and curved strongly forward, situated considerably in front of the middle. Surface everywhere covered with nearly equal, delicate, raised, radiating lines and small, rather even, raised lines of growth; these together produce a finely cancellated surface which, when fresh, is covered with a thin brownish-yellow epidermis forming small scale-like points at the intersection of the lines; the surface is also marked with slight, irregular, concentric waves or undulations.

The anterior margin is shorter than the posterior and forms an obtuse, rounded angle at its junction with the hinge-margin; the ventral margin is obliquely curved, most prominent behind the middle, where the curve forms nearly the segment of a circle; posterior margin is very broadly rounded and forms a distinct obtuse angle where it joins the dorsal margin. The ligamental area is lanceolate, moderately large, decidedly wider just in front of the beaks, becoming narrow and pointed posteriorly. The dark ligamental patch is arrow-shaped, situated behind the beaks. The hinge-margin is rather wide and strong, with a small, central edentulous space, mostly behind the beaks. The teeth, which are striated on the sides and crenulated on the edge, are equally and decidedly oblique in the two series; the proximal ones are small and the others increase in size and obliquity to near the end of the series, where one or two of the outermost are decidedly smaller and very oblique. In the largest specimen there are about six teeth in the anterior and eight in the posterior series. The inner surface shows faint radial grooves and ridges, much coarser than the external striæ; there is also a fine, impressed line, with a finely crenulated edge close to the margin.

Length of the largest specimen, 6 mm.; height, 6.5 mm.; thickness, 5.5 mm.; length of the hinge margin, 3.5 mm.

Three specimens were found at stations 2713 and 2714, off Delaware Bay, in 1,825 to 1,859 fathoms, 1886.

This species is allied to *B. glomerula* Dall. The latter differs in having a less rounded form with a longer hinge-margin, more definite terminal angles, and much more numerous and smaller teeth which are nearly continuous. In our specimens of *B. glomerula* of corresponding size, there are about ten teeth in each series and they are about one-half as large. According to Mr. Dall's figures, the umbos of his species are larger than in the more northern form, but our specimens of his species have the umbos smaller than is indicated by his figures. The position of the beaks and form of the ligamental area is nearly the same in both species; but the latter appears to be a little wider in ours and the beaks are a trifle more oblique. The external sculpture is similar but the radial lines are decidedly stronger and less numerous in *glomerula*, and the sculpture is quite different in the two valves, while in ours there is no perceptible difference. *B. inæquisculpta* (Smith) is also a closely allied species which Mr. Dall considers identical with *B. glomerula*. Mr. Smith's figures are quite different from those of Mr. Dall, and also from our West Indian specimens of the latter, and still more different from *B. abyssorum*.

BATHYARCA PROFUNDICOLA (Verrill).

(Plate LXXVIII, fig. 2.)

Arca profundicola VERRILL, Trans. Conn. Acad., VI, p. 439, pl. XLIV, figs. 23, 23*a*, 1885.—DALL, Bull. Mus. Comp. Zoöl., XII, p. 245, 1886.

Macrodon profundicola DALL, Bull. U. S. Nat. Mus., No. 37, p. 42, pl. XLVI, figs. 23, 23*a*, 1889.

A very few specimens, at three stations, between N. lat. 40° 29′, W. long. 66° 4′, and N. lat. 37°, W. long. 71° 54′, in 1,769 to 2,620 fathoms, 1884 and 1885. Also among Foraminifera, station 2385, N. lat. 28° 51′, W. long. 88° 18′, in 730 fathoms.

BATHYARCA ANOMALA, new species.

(Plate LXXVII, fig. 8.)

Shell small, oblong, inequilateral, much swollen with large prominent umbos, and pointed beaks, curved strongly forward and considerably separated, owing to the unusually wide, lanceolate, ligamental area, which is covered behind the beaks with the remains of a dark thickened ligament. Dorsal margin straight for nearly its entire length; anterior and posterior ends broadly and about equally rounded, the posterior a little the more swollen below and longer; ventral margin broadly rounded, a little prominent in the middle, with a slight byssal indentation in front. Surface everywhere covered with fine, regular, raised, radiating lines which are decussated by finer lines of growth; the rather thin brown epidermis is scaly or chaffy on the radii, especially toward the margins, where it forms minute points. Hinge-margin considerably thickened, increasing in strength toward the ends; in the

middle, where it is narrowest, it is nearly smooth and rounded, with only slight indications of one or two transverse teeth on each side; next these there are two or three somewhat oblique, slightly divergent, irregular, longitudinal, slightly striated and crenulated folds, separated distally by rather deep grooves nearly parallel with the inner margin. The inner edge of the ventral margin is thin and plain.

Length, 8.5 mm.; height, 7 mm.; thickness, 6 mm.

One living specimen (No. 74081) was dredged by the *Bache* at station 52, off Cashes Ledge, in 27 fathoms, 1874.

As only a single specimen has been found, it is possible that it is but an abnormal variety, although it appears to have been healthy and well-grown in every respect. It is related to *B. pectunculoides* (Plate LXXVII, fig. 6), but differs remarkably in the character of the hinge, which has the transverse teeth scarcely discernible, and oblique, irregular folds on the distal parts of the margin, and also in the greater width of the ligamental area.

Family LIMOPSIDÆ.

LIMOPSIS SULCATA, new species.

(Plates XCII, fig. 2; XCV, fig. 9; XCVI, fig. 1.)

Shell very oblique (young specimens are less oblique and in some cases are more nearly circular), broad-ovate, the posterior ventral margin much produced and obtusely rounded; auricles only slightly developed. The dorsal margin is short and straight, with a narrow, smooth area beneath the beaks; the anterior margin is subtruncate, or very obtusely rounded; the ventral margin is oblique, broadly rounded, forming an obtusely rounded angle with the posterior margin, which is strongly sloping and only a little convex. The umbos are small and somewhat prominent; the beaks small, pointed, and curved inward. The entire surface is covered with strongly marked, concentric grooves and prominent rounded, narrow ribs; the latter are crossed by numerous fine, radiating, incised striations, which divide them into beadlike, or squarish, portions, which are most obvious on the middle and posterior parts and become very faint anteriorly. The hinge-margin is much thickened and bears a curved series of rather large, flattened teeth, of which about eight are situated in front of the beaks and about ten behind them; those nearest the center are small; the resilial pit extends upward to the beak in the form of a small triangular depression. The inner surface of the shell is marked by fine, radiating striæ; the margin is thickened and cut away near the edge; no crenulations have been observed in our specimens.

Greatest length, 12 mm.; greatest height, 13 mm.; breadth, 6 mm.

A number of separate valves, at about ten stations, between N. lat. 40° 8′, W. long. 68° 45′, and N. lat. 37° 7′ 4″, W. long. 74° 35′ 40″, in 64 to 349 fathoms, 1880–1884.

LIMOPSIS MINUTA (Philippi).

(Plates LXXV, fig. 1; LXXVIII, fig. 7.)

Limopsis minuta VERRILL Trans. Conn. Acad., V, p. 576, 1882; VI, p. 280, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 577, 1885.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 258, 1885.—DALL, Bull. Mus. Comp. Zoöl., XII, p. 236, 1886; Bull. U. S. Nat. Mus., No. 37, p. 42, 1889.—BUSH, Bull. Mus. Comp. Zoöl., XXIII, p. 235, pl. I, fig. 8, 1893.—LOCARD, Campagne du *Caudan*, Annales de l'Université de Lyon, p. 198, 1896.

A very common and abundant species, at eighty-two stations, between N. lat. 44° 7′ 30″, W. long. 57° 16′ 45″, and N. lat. 35° 49′ 30″, W. long. 74° 34′ 45″, in 116 to 2,221 fathoms, 1880–1887. South to Barbados, in 30 to 2,221 fathoms.—Dall.

LIMOPSIS AFFINIS Verrill.

(Plate LXXV, fig. 2.)

Limopsis affinis VERRILL, Trans. Conn. Acad., VI, p. 442, 1885.

Two live specimens, at station 2092, N. lat. 39° 58′ 35″, W. long. 71° 30″, in 197 fathoms, 1883.

LIMOPSIS PLANA Verrill.

(Plate LXXV, fig. 5.)

Limopsis sp. (?) VERRILL, Trans. Conn. Acad., V, p. 280, 1884.
Limopsis plana VERRILL, Trans. Conn. Acad., VI, p. 441, 1882; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 577, 1885.
Limopsis aurita, var. *plana* DALL, Bull. U. S. Nat. Mus., No. 37, p. 42, 1889.
Limopsis plana BUSH, Bull. Mus. Comp. Zoöl., XXIII, pp. 240, 244, pl. II, figs. 19, 20, 1893.

Three live specimens and one valve, at two stations, between N. lat. 38° 22′, W. long. 70° 17′ 30″, and N. lat. 37° 40′ 30″, W. long. 70° 37′ 30″, in 1,825 to 2,221 fathoms, 1883–1886. South to Dominica, West Indies, in 1,131 to 2,221 fathoms.—Dall.

The largest specimen, from station 2710, is 18.5 mm. long; 18.5 mm. high; hinge-margin, 11 mm. long; ligamental area, 3 mm. long.

LIMOPSIS AURITA (Brocchi) Jeffreys.

(Plate LXXV, fig. 3.)

? *Arca aurita* BROCCHI, Conch. foss. Subap., II, p. 485, pl. XI, fig. 9 (t. Jeffreys).
Limopsis aurita JEFFREYS, British Conch., II, p. 161, pl. IV, fig. 3, 1864; V, pl. XXX, fig. 1, 1869.—SMITH, E. A., Report Voy. *Challenger*, Zoöl., Lamellibranchiata, XIII, p. 257, 1885.—DALL, Bull. Mus. Comp. Zoöl., XII, p. 237, 1886; Bull. U. S. Nat. Mus., No. 37, p. 42, 1889.—LOCARD, Campagne du *Caudan*, Annales de l'Université de Lyon, p. 197, 1896.
Not *Limopsis aurita*, variety, VERRILL, Trans. Conn. Acad., VI, p. 440, 1885.

One valve, among Foraminifera, station 2385, N. lat. 28° 51′, W. long. 88° 18′, in 730 fathoms. South to Grenada, in 21 to 1,582 fathoms.—Dall.

The northern specimens (*L. profundicola*) formerly referred doubtfully to this species prove to be distinct. The single specimen now included agrees well with a specimen of the fossil form from Europe.

LIMOPSIS PROFUNDICOLA, new species.

(Plates LXXV, fig. 4; LXXXIII, fig. 4.)

Limopsis aurita, variety (?) VERRILL, Trans. Conn. Acad., VI, p. 440, 1885.

Comparatively few specimens, at ten stations, between N. lat. 41° 7′, W. long. 65° 26′ 30″, and N. lat. 36° 47′, W. long. 73° 9′ 30″, in 1,525 to 1,859 fathoms, 1884–1886.

Family MYTILIDÆ.

CRENELLA FRAGILIS Verrill.

(Plate LXXXIII, figs. 1, 2.)

Crenella fragilis VERRILL, Trans. Conn. Acad., VI, p. 444, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 40, 1889.

One valve and a fragment, station 2265, N. lat. 37° 7′ 40″, W. long. 74° 35′ 40″, in 70 fathoms, 1884.

GLOMIDÆ, new family.

Glominæ VERRILL and BUSH, Amer. Journ. Sci., III, pp. 53, 59, January, 1897.

Shell short, roundish at both ends. Hinge-plate with a row of transverse teeth each side of the middle. Ligament thick, elongated, attached for most of its length to the inner surface of the posterior hinge-plate and running forward in a narrow groove beneath the beaks, so that its anterior portion is external and its thickened posterior portion is partly internal. No pallial sinus. Animal not known.

This group includes, so far as known, only the genus *Glomus* Jeffreys, which has been referred by several writers to the Arcidæ, and by others to the Ledidæ, from both of which it differs widely. Its relations to the Nuculidæ are somewhat uncertain, owing to our ignorance of the soft parts. In the form and position of the ligament it differs entirely from all other genera of Nuculidæ and Ledidæ.

A more mature consideration of this group, since the publication of our former article, leads us to consider it as a family distinct from Nuculidæ.

GLOMUS Jeffreys.

Glomus JEFFREYS, Annals Mag. Nat. Hist., p. 433, November, 1876.—VERRILL and BUSH, Amer. Journ. Sci., III, pp. 53, 59, January, 1897.

Type.—Glomus nitens Jeffreys.

Shell thin, smooth, subequilateral, rounded at both ends, with the beaks turned forward. No lunule or escutcheon. Hinge with two series of obliquely transverse teeth; a small lateral tooth may be present.

The following are described species:

G. nitens Jeffreys, North Atlantic (Europe) and from off Marthas Vineyard south to off Rio de la Plata (America); *G. jeffreysi* Smith; *G. simplex* Smith, and *G. inæquilateralis* Smith, West Indies; *G. japonicus* Smith, off Japan.

GLOMUS NITENS Jeffreys.

(Plate XCVII, figs. 1, 2.)

Glomus nitens JEFFREYS, Annals Mag. Nat. Hist., p. 433, November, 1876; Proc. Zoöl. Soc., London, p. 573, pl. XLV, fig. 5, June, 1879.—VERRILL, Trans. Conn. Acad., VI, p. 231, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.—SMITH, E. A., Report Voy. *Challenger*, Zoöl., Lamellibranchiata, XIII, p. 248, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 46, 1889.—VERRILL and BUSH, Amer. Journ. Sci., III, p. 53, figs. 1, 2, January, 1897.

The specimens which we refer to this species agree closely in size and form with Jeffreys's figures, but there is in both valves a small submarginal lateral tooth just beyond the posterior series of teeth, and in the right valve a similar but less prominent one just beyond the anterior series. These are not mentioned in Jeffreys's description. In the posterior series there are fewer teeth than in his figure and they have an acute, oblique, V-shaped outline and are but little raised; in the anterior series there are four larger, oblique teeth which are not so distinctly V-shaped, owing to their oblique position and because the surface of the hinge-plate is turned downward. The posterior ligament is strong, long, wedge-shaped, widest distally where it occupies most of the width of the hinge-plate; the narrow prolongation runs forward under the beaks in a narrow groove. There is a thickened, edentulous space under the beaks, separating the two series of teeth, which has, when highly magnified, a very small, angular notch in the middle of its lower edge, which in our specimen is filled with what appears like the remains of a resilium; there is also a very minute, V-shaped notch in the external margin. The beaks turn forward. The pallial impression is rather indistinct, but appears entire. Interior somewhat lustrous, but not at all nacreous.

Two imperfect specimens, at two stations, off Marthas Vineyard and off Delaware Bay, in 1,544 and 1,608 fathoms, 1883 and 1886. South to Rio de la Plata, in 294 to 1,900 fathoms.—Dall and Smith.

REVIEW OF THE GENERA OF LEDIDÆ AND NUCULIDÆ OF THE ATLANTIC COAST OF THE UNITED STATES.[1]

These families are often united by modern malacologists under a single family (Nuculidæ), while others regard them as distinct. They are certainly closely related anatomically, as well as by the structure of the shell. Thus all the members of both families have a single pair of

[1] An abstract of the portion of this article relating to these families was published in the American Journal of Science, III, p. 51, January, 1897.

simple "foliobranchiate" (or protobranchiate) gills; two pairs of large labial palpi, the outer ones furnished with long extensile labial tentacles; a large muscular foot with an expanded, concave, terminal disk, adapted for rapid motions in jumping and swimming, as well as for creeping; and all have two series of transverse or oblique teeth on the hinge-margin. The peculiar structures of foot and gills appear together elsewhere only in the family Solemyidæ, which is evidently a related group, though it lacks hinge-teeth and has a very different shell. As these three families have gills of a peculiar and simple structure, each one consisting of two rows of flat lamellæ, attached to a single stem, they have recently been regarded as forming a special order (Protobranchiata).

This group is of special interest because of its great antiquity. Large numbers of fossil forms very closely allied to existing genera and species occur even in Silurian and Devonian formations.

Thus the common living genera *Nucula* and *Leda* are represented by numerous Devonian species, many of which can not be separated from the recent forms, even as subgenera, by any tangible characters. Other species of the same age, referred to *Palæoneilo*, agree in nearly all essential characters with the living genus *Tindaria*. These fossil shells are generally larger and stronger than the corresponding living species. Many Palæozoic genera which are now extinct were as highly organized and as much specialized as their living allies.

The thin-shelled, strongly siphonate genera, such as *Yoldia*, *Yoldiella*, etc., do not appear so early in geological time and may be regarded as more modern specializations of the Leda-like forms. They are also the forms that swim and jump with the greatest activity. Therefore the thin and light character of their shells may be regarded as having been secondarily acquired, partly in consequence of their active movements, in which a heavy shell would be disadvantageous, and partly because the development of long siphons enables them to live concealed much of the time beneath the surface of the soft mud in which they generally live. In *Solemya* the shell is still lighter and thinner, in accordance with more developed swimming habits, combined with burrowing when at rest. Such forms as *Nucula* and *Tindaria*, which have no siphon tubes, must live at or near the surface of the mud, over which they creep with their large expanded pedal disk. These have, for their protection, comparatively solid shells similar to those of Palæozoic species, in form, texture, and sculpture.

The family Nuculidæ differs from Ledidæ mainly in having no siphon tubes, the mantle edges being completely disunited. The Ledidæ are remarkable for the great variations in the structure of the hinge-teeth, ligament, cartilage, and mantle, as well as in the form of the shell. The pallial sinus may be wanting or well-developed. Some genera have long united siphons (*Yoldia*); some have shorter ones, more or less separated (*Leda*); while in *Tindaria* there is no true siphon, but only an

efferent orifice differentiated. The ligament may be wholly external, as in *Malletia*, *Tindaria*, etc., or it may be rudimentary and replaced by an internal cartilage or "resilium," or both may coexist in varying degrees of development and degeneration. The hinge-teeth may be very numerous and regularly V-shaped in each series, or they may be comparatively few and irregular, sometimes becoming oblique and lamelliform (*Silicula*). The beaks generally turn backward (*Yoldia*, *Leda*, *Nucula*), but in *Malletia*, *Tindaria*, and some other genera they turn forward. On this account, when there is neither pallial sinus nor external ligament, it is often difficult, if not impossible, to tell which is the anterior end of the shell without the soft parts. Hence many fossil and some recent species have probably been reversed in the descriptions. Thus many of the Palæozoic species referred to *Nucula* are described as having the beaks turned forward, the longer end of the shell being considered posterior, but in modern *Nuculæ* the beaks turn backward and the shorter end is posterior. Many of the deep-sea species with small, thin shells show no distinct muscular nor pallial scars, which increases this difficulty. When a differentiated external ligament is present, we have assumed that it is posterior to the beaks (opisthodetic), though a narrow extension usually runs under and forward of the beaks in a groove. When the shell of a dimyarian bivalve gapes posteriorly, the existence of a siphon may generally be assumed; for otherwise the internal soft parts would be exposed to enemies. The existence of a posterior rostrum or a protrusion of the posterior margin defined by an inferior emargination indicates the existence of a siphon, or at least an anal tube, but these organs may exist without such modifications of the shell. If these rules be applied to Palæozoic forms we must conclude that the rostrate and subrostrate forms of *Palæoneilo*, etc., had some sort of a siphon, and therefore were not true Nuculidæ.

Numerous Palæozoic species referred to the genus *Palæoneilo* probably belong to or near the Tindarinæ. Some of the species[1] from the American Devonian rocks can hardly be distinguished from *Tindaria* by any important structural characters, unless it be the form of the teeth. It is probable that *Nuculites* and several related genera belong near this division, for they have an external ligament and no resilium. In these genera the plain, transverse teeth are very numerous and more simple than in the modern genera, seldom showing any trace of the acute, V-shaped form characteristic of most modern genera, though in some species the teeth are slightly angulated in the middle.

Mr. Dall has proposed the family Ctenodontidæ[2] to include numerous Palæozoic species belonging to *Ctenodonta*, and allied genera, some of which Zittel and others refer to Arcidæ on account of their thickened pectunculoid shells. They seem to be allied rather to Tindarinæ.

[1] For example see *P. constricta* Hall, *P. plana* Hall in Palæontology of New York, V, Pt. I, pp. 333, 334, pl. XLVIII, figs. 1–28, 1885.

[2] Trans. Wagner Free Inst., III, p. 515, 1895.

The Ledidæ, as here understood, were divided into five subfamilies by Fischer, namely:

(1) Cucullellinæ = Ctenodontidæ Dall + *Palæoneilo* and *Cardiolaria;* (2) Sareptinæ (for *Sarepta* only); (3) Ledinæ; (4) Malletinæ (including *Tindaria*); (5) Lyrodesmatinæ (for ancient fossil forms like *Lyrodesma*, but including the living genus *Phaseolus* or *Silicula*). An additional group was formed for some other doubtful fossil genera. The second of these groups is not well founded, for *Sarepta* agrees closely with *Yoldia*, except in the alleged absence of a pallial sinus, but its gaping shell indicates a siphon tube. The fourth should not include *Tindaria*, which lacks the pallial sinus and siphon tubes characteristic of the rest of the group and should be taken as the type of a new subfamily. The fifth should not include *Phaseolus*, which differs widely from the fossil forms and belongs in the Ledinæ. The other genera of this group are referred to Trigoniadæ by other authors, and that would seem to be a more correct arrangement.

Family NUCULIDÆ.

NUCULINA d'Orbigny, 1845.

Pleurodon S. WOOD, 1840.
Nuculina D'ORBIGNY, 1845.
Nucinella S. WOOD, 1848.
Nuculina VERRILL and BUSH, Amer. Journ. Sci., III, pp. 53, 59, January, 1897.

We have included *Nuculina* in the Nuculidæ with some doubt, because authors differ as to its structure. Some state that its ligament is wholly external and others to the contrary. Fischer places it in the Arcidæ, near *Limopsis*, but it has no ligamental area.

Mr. Dall kindly forwarded to us excellent unpublished figures of two American species of this genus. In these the thickened ligament is external to the hinge-plate, on the end of the shell which is destitute of a lateral tooth, and is the shorter (posterior?). The beaks turn toward this end. Mr. Dall states that the shells are not distinctly nacreous within.

The following are some of the known species:

N. miliaris Deshayes; *N. ovalis* S. Wood; *N. calabra* Seguenza, fossil; *N. munita* Carpenter, from the Catalin Islands; *N. sulcata* A. Adams, from Korean Straits; *N. adamsi* Dall, from Florida and the West Indies.

NUCULA Lamarck, 1799.

Nucula LAMARCK, Prodrome d'une Nouv. cl. des Coquilles, p. 87, No. 104, 1799.
Nuculana LINK, Beschr. Rost. Samml., p. 155, 1807 (not of Adams, 1858, nor of Harris, 1897).
Nucula DALL, Bull. Mus. Comp. Zoöl., XII, p. 245, 1886.

Type.—Nucula nucleus Lamarck.

Nuculana (Link) was an exact synonym or variant of *Nucula*, of earlier date, as the description plainly shows. There was, therefore,

no valid excuse for applying it to a different group (*Leda*), that had already received a valid name, as was done by H. and A. Adams.

That a species belonging to *Leda* was mentioned by Link does not alter the case, for all the species of *Leda* and *Yoldia* then known were referred to *Nucula* by Lamarck and all other conchologists.

NUCULA PROXIMA Say, variety OVATA, new.

(Plates LXXXI, fig. 6; LXXXVIII, fig. 5.)

We designate by this name a single specimen which differs so widely in form from the ordinary type of *Nucula proxima* that it could well be taken for a distinct species if it had occurred in large numbers or in a remote locality. It is broad-ovate or elliptical in form and much less angular and oblique than the typical *proxima*. It is decidedly compressed with the umbos much less prominent than usual. The surface is glossy, grayish white, marked with distinct lines of growth and microscopic radiating striæ. The anterior end is evenly rounded and more produced than in *proxima;* the ventral margin is broadly and evenly rounded; the posterior end is obtuse, slightly produced and scarcely angulated; the postero-dorsal margin is convex and slopes much less rapidly than in *proxima*, so that the posterior end is more evenly rounded and broader. Internally the margin is plain. The hinge-teeth are much as in *proxima*, but the two series are less curved and meet in a broad angle.

Length, 3.5 mm.; height, 3 mm.

One live specimen (No. 73467), station 863, in Vineyard Sound, off Cuttyhunk, in 18 fathoms, 1880.

NUCULA SUBOVATA, new species.

(Plates LXXXI, fig. 8; LXXXIII, fig. 5.)

Shell small, broad-ovate, with somewhat prominent umbos, and rather acute, somewhat prominent beaks behind the middle. Surface smooth and lustrous, covered with rather regular, concentric lines of growth, which are scarcely visible to the naked eye. Epidermis thin, pale yellowish green. The antero-dorsal margin is nearly straight at first; then, forming a convex curve, slopes gradually to the bluntly rounded anterior end which is somewhat produced but not angulated; the postero-dorsal margin is convex, sloping rapidly, and forms a slight rounded angulation in the middle of the posterior end, where it joins the broadly rounded, ventral margin. Hinge-margin rather broad and strong in proportion to the size of the shell, with a moderately large rounded, slightly oblique chondrophore projecting considerably within the margin. The portion of the hinge-plate behind the beaks is considerably shorter than that in front and bears about six, strong, V-shaped teeth of which the two distal ones and the two proximal ones are much smaller than the others; in front of the beaks it is broad and

strongly curved, and bears about nine broad, elevated, strong, transverse teeth of which five or six in the middle are much larger than the others; above these the outer hinge-margin is somewhat expanded and everted. There is a thin, continuous ligament both before and behind the beaks. Epidermis thin, pale greenish yellow. The inner ventral margin is thin and plain.

Length, 4.9 mm.; height, 3.9 mm.

Some of the smaller specimens have a narrower and less thickened hinge-plate with the teeth more delicate than in the type.

Four specimens, at four stations, between N. lat. 40°, W. long. 71° 14′ 30″, and N. lat. 37° 8′, W. long. 74° 33′, in 157 to 444 fathoms, 1881–1885.

This species has some resemblance to *N. tenuis*, but it is much less oblique and more elongated in form, and is less inequilateral, the posterior end not being subtruncated, while the anterior end is narrower, relatively shorter, and much less oblique. The hinge-margin is also different; the teeth are fewer and much stronger, and the hinge-margin much broader, while the chondrophore is smaller, more rounded, much less oblique, and projects freely from the inner hinge-margin instead of being united closely to it.

It also bears some resemblance in form to *Nucula pernambucensis* Smith,[1] but there are marked differences in the hinge and number of teeth.

NUCULA GRANULOSA Verrill.

(Plates LXXXI, fig. 2; LXXXVIII, fig. 8.)

Nucula granulosa VERRILL, Trans. Conn. Acad., VI, p. 280, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 42, 1889.

Taken at about sixteen stations, between N. lat. 41° 53′, W. long. 65° 35′, and N. lat. 38° 36′ 3″, W. long. 73° 6′, in 384 to 1,061 fathoms, 1880–1886.

NUCULA VERRILLII Dall.

(Plate XCV, fig. 10.)

Nucula trigona VERRILL, Trans. Conn. Acad., VI, p. 438, 1885 (not Bronn, 1849, not Seguenza, 1877).

Nucula verrillii DALL, Bull. Mus. Comp. Zoöl., XII, p. 248, 1886; Bull. U. S. Nat. Mus., No. 37, p. 42, 1889; Proc. U. S. Nat. Mus., XII, p. 257, pl. XIV, fig. 4, 1889.—BUSH, Bull. Mus. Comp. Zoöl., XXIII, pp. 240, 243, pl. I, fig. 6, 1893.

Comparatively few specimens, at six stations, between N. lat. 39° 43′ 45″, W. long. 70° 7′, and N. lat. 36° 47′, W. long. 73° 9′ 30″, in 1,140 to 1,825 fathoms, 1884–1886. South to Yucatan, in 430 to 1,685 fathoms.—Dall.

[1] Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 227, pl. XVIII, figs. 10–10*a*, 1885.

NUCULA CANCELLATA Jeffreys.

(Plates LXXXI, fig. 3; LXXXVI, fig. 5.)

Nucula cancellata VERRILL, Trans. Conn. Acad., VI, pp. 231, 280, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 42, 1889; Proc. U. S. Nat. Mus., XII, p. 258, 1889.

A very abundant species, at forty-four stations, between N. lat. 42° 47′, W. long. 61° 4′, and N. lat. 37° 27′, W. long. 73° 33′, in 384 to 2,033 fathoms, 1883–1887. South to off Tobago, West Indies, in 880 fathoms.—Dall.

Family LEDIDÆ.[1]

Subfamily LEDINÆ.

LEDA Schumacher, 1817.

Leda VERRILL and BUSH, Amer. Journ. Sci., III, pp. 54, 62, January, 1897.
Nuculana HARRIS, Cat. British Museum, p. 348, 1897 (not Link, 1807).

Type.—*Leda rostrata* (Montagu, 1808).

This genus has been variously extended and restricted by authors, and several subgeneric and sectional groups have been proposed. In the more extended sense it is scarcely capable of a definition that will distinguish it from *Yoldia*, etc.

We proposed, therefore, to restrict it to the typical species, such as *L. cuspidata* Gould, *L. caudata* (Donovan), *L. pernula* (Müller), *L. tenuisulcata* (Couthouy), and many others closely related. These have a long, tapered, bicarinate rostrum, and well-developed siphon tubes, partially united. The palpal tentacles are long, flat, tapered, and arise external to the bases of the outer palpi, which are broad with slender, acute, posterior tips.

Mr. Harris quotes *rostrata* Linnæus as the type of his *Nuculana*, but no such species occurs until Gmelin's edition, 1790; *rostrata* Chemnitz, 1784, used by Schumacher as the type of *Leda*, is now considered the same as *fluviatilis* Sowerby and also Schrœter, 1779; *rostrata* Lamarck, 1819, is the same as *pernula* Müller, 1774 or 6?, so that in using *rostrata* Montagu, 1808, we avoid confusion of names without leading to any misunderstanding of the form of the shell, for all of the above species have the same rostrated form.

LEDA BUSHIANA Verrill.

(Plates LXXIX, fig. 8; LXXXII, fig. 9.)

Leda bushiana VERRILL, Trans. Conn. Acad., VI, pp. 229, 280, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 44, 1889.

A few specimens, off Cape Hatteras, North Carolina, in 516 fathoms, 1883. South to Florida Straits, in 120 to 516 fathoms.—Dall.

[1] *Nuculanidæ* Harris, Australian Ter. Moll., Cat. British Museum, p. 348, 1897.

LEDA PERNULA (Müller).

(Plate LXXXII, fig. 2.)

Leda pernula G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 35, pl. 5, figs. 1 *a–d*, 1878.—JEFFREYS, Proc. Zoöl. Soc., London, p. 574, June, 1879.—VERRILL, Proc. U. S. Nat. Mus., III, p. 401, 1881; Trans. Conn. Acad., V, p. 572, 1882; not VI, p. 280, pl. XXX, figs. 14, 14*a*, 1884.—Not DALL, Bull. U. S. Nat. Mus., No. 37, pl. XLV, figs. 14, 14*a*, 1889.

Found at a number of stations between N. lat. 46° 23′, W. long. 52° 45′, and N. lat. 37° 8′, W. long. 74° 33′, in 25 to 471 fathoms, 1872–1885.

LEDA CAUDATA (Donovan).

(Plate LXXXII, fig. 1.)

Arca caudata DONOVAN, British Shells, pl. LXXVIII; Chenu ed., p. 50, pl. XVII, figs. 8–12.

Leda caudata LOVÉN, Ind. Moll. Scand., p. 34.—GOULD, Rep. on Invert. of Mass., Binney's ed., p. 165, fig. 471, 1870.—TRYON, Amer. Mar. Conch., p. 182, pl. XXXVIII, figs. 494, 495, 1873.

Leda pernula VERRILL, Trans. Conn. Acad., V, p. 572, 1882, in part; VI, p. 280, pl. XXX, figs. 14, 14*a*, 1884.—DALL, Bull. U. S. Nat. Mus., No. 37, pl. XLV, figs. 14, 14*a*, 1889.—(?) BUSH, Bull. Mus. Comp. Zoöl., XXIII, p. 234, 1893.

Leda caudata VERRILL and BUSH, Amer. Journ. Sci., III, p. 54, fig. 19, January, 1897.

This deeper-water form, previously identified as *Leda pernula*, was found at a very few stations between N. lat. 42° 57′, W. long. 69° 50′, and N. lat. 37° 16′ 30″, W. long. 74° 20′ 36″, in 102 to 641 fathoms, 1874–1885.

LEDELLA Verrill and Bush, 1897.

Junonia SEGUENZA, Nuculidi terziarie merid. d' Ital., R. Acad. Lincei, p. 1175, 1877 (not of HÜBNER).

Ledella VERRILL and BUSH, Amer. Journ. Sci., III, pp. 54, 62, January, 1897.

Type.—*Ledella messanensis* (Seguenza).

This group includes a large number of small species, both living and fossil, in which the shell is rather short, usually ovate or swollen, with a small, acute or subacute unicariate rostrum, situated medially or submedially, and defined below by an emargination or undulation in the postero-ventral margin. The postero-dorsal margin is convex. The escutcheon or ligamental area is very distinctly defined by the carina, but is not sunken. The chondrophore is usually small but distinct. The siphon tubes are separate, at least in some species. It includes numerous minute tertiary species referred by Seguenza to the section of *Leda* named by him *Junonia*, and also a considerable number of recent deep-water species generally described by authors under *Leda*. As the name *Junonia* was preoccupied, the group, which seemed to be of generic value, required a new name.

The following species appear to belong here:

L. seminula (Seguenza), *L. nicotræ* (Seguenza), *L. peraffinis* (Se-

guenza), *L. rectidorsata* (Seguenza), *L. confusa* (Seguenza), fossil; *L. solidula* (Smith) and *L. semen* (Smith), from off Brazil; *L. confinis* (Smith), off the Azores; *L. inopinata* (Smith), *L. prolata* (Smith), and *L. ultima* (Smith), from the Pacific; *L. messanensis* (Seguenza), from off the Barbados, northward; *L. messanensis* (Seguenza) var. *sublevis* Verrill and Bush, off Delaware Bay, northward; and *L. parva* Verrill and Bush, off Marthas Vineyard.

LEDELLA MESSANENSIS (Seguenza).

(Plate LXXXI, fig. 9.)

Leda acuminata JEFFREYS, Ann. Mag. Nat. Hist., p. 69, July, 1870 (not VON BUCH).—SEGUENZA, Nuculidi terziarie merid. d'Ital., R. Acad. Lincei, 1877, p. 1175, pl. III, figs. 15, 15*a*, 15*e*.

Leda messanensis JEEFREYS, Proc. Zoöl. Soc. London, p. 576, June, 1879.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 237, 1885.—DALL, Bull. Mus. Comp. Zoöl., XII, p. 249, 1886; Bull. U. S. Nat. Mus., No. 37, p. 44, 1889.

The shell which is here regarded as the true *messanensis* is small, swollen, ovate, nearly equilateral, with a distinct, short, oblique rostrum bent downward at the tip and separated from the body of the shell by a distinct depression and marginal indentation. The shell is thick and solid for so small a species; its surface is covered with fine, regular, raised, thin, concentric lines separated by wider concave grooves. The hinge-margin is thick, strong, with about seven or eight, mostly strong, nearly erect, and not crowded, teeth in each series. The chondrophore is relatively large, triangular, and projects on the inner margin. The epidermis is pale yellow. According to Jeffreys the siphon tubes are long and separate.

Length, about 2.6 mm.; height, about 2 mm.

A few specimens, at three stations between N. lat. 38° 29′, W. long. 73° 9′, and N. lat. 37°, W. long. 71° 54′, in 965 to 2,620 fathoms, 1884–85. South to the Barbados, in 32 to 2,033 fathoms.—Dall.

LEDELLA MESSANENSIS (Seguenza) variety SUBLEVIS, new.

(Plate LXXXI, fig. 7.)

Yoldia messanensis, variety VERRILL, Trans. Conn. Acad., VI, pp. 227, 280, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.

Ledella messanensis, variety VERRILL and BUSH, Amer. Journ. Sci., III, p. 60, fig. 13, January, 1897.

This variety differs from the form above described, principally in having the concentric sculpture wholly or partially obsolete and in its somewhat more elongated form. It has nine or ten teeth in each series, due perhaps to the larger size of the specimen.

Comparatively few specimens, at thirteen stations, between N. lat. 42° 47′, W. long, 61° 4′, and N. lat. 38° 20′, W. long. 70° 8′ 30″, in 1,188 to 2,033 fathoms, 1883–1886.

LEDELLA PARVA Verrill and Bush.

(Plate LXXXI, fig. 1.)

Ledella parva VERRILL and BUSH, Amer. Journ. Sci., III, p. 54, fig. 18, January, 1897.

Shell minute, narrow-ovate, the anterior end the longer and obtusely rounded, and the posterior end with a short, subtruncate, median rostrum. Umbos somewhat swollen; beaks a little prominent and turned slightly backward. The surface is nearly smooth, showing only microscopic lines of growth. The antero-dorsal margin is elongated, slightly convex, and slopes very gradually to the rounded anterior end; the ventral margin is broadly and evenly convex, but somewhat pinched up posteriorly to form a slight emargination below the rostrum, which is short, narrow, subtruncate at the tip, and is defined by a slight, inconspicuous ridge; the postero-dorsal margin is nearly straight and slopes rapidly to the upper angle of the rostrum. The hinge-plate is strong, considerably thickened, with a very obtuse angle at the beak; the anterior portion is the longer with the inner margin convex, and the posterior portion is the wider, more oblique, with the inner margin strongly concave; the plain outer margin is sharp and projects considerably above the teeth which are strong, stand nearly erect, and are less V-shaped than usual. There are about fifteen in the anterior series, of which three or four proximal ones are quite small, and nine stouter ones in the posterior series, including one very small one next the beak. The chondrophore is rather small and deep with a distinctly projecting inner edge.

Length, 3 mm.; height, 2 mm.

One valve (No. 78365), station 2689, off Marthas Vineyard, in 525 fathoms, 1886.

This species seems to be closely allied to *L. semen* (Smith) from off the coast of Brazil (Voyage of the *Challenger*), but that species, although of the same size, has fewer teeth, nine of which are said be anterior and twelve posterior.

PORTLANDIA Mörch, 1857.

Portlandia VERRILL and BUSH, Amer. Journ. Sci., III, pp. 54, 62, January, 1897.

Type.—Portlandia arctica (Gray) 1819 = *Leda portlandica* (Hitchcock).

We consider this a distinct genus, but would restrict it to the original type, unless a few species, which we have not seen, should prove to belong to it. In any case it does not appear that any of the northern species of Europe and America that have been referred to it are really closely allied to the type. In many respects this genus is intermediate between *Leda* and *Yoldia*. In its closed shell, definite rostrum, etc., it agrees more nearly with the former, but in general outline, with the latter.

YOLDIA Möller, 1842.

Yoldia VERRILL and BUSH, Amer. Journ. Sci., III, pp. 55, 62, figs. 12, 16, January, 1897.

Type.—*Yoldia hyperborea* Torrell = *Yoldia arctica* Möller (not Gray).

We have restricted this genus to the typical forms, such as *Y. limatula* (Say), *Y. sapotilla* (Gould), *Y. myalis* (Couthouy), and many closely allied foreign species.

These have a nearly smooth, compressed, lanceolate, gaping shell, more or less prolonged and tapered posteriorly, with a poorly defined, wide rostrum, generally without carinations. The external ligament is marginal, feebly developed, continuous under the beaks, and not much differentiated from the general epidermis. The chondrophore is large, concave, and projects within the margin. The pallial sinus is large and deep. The siphon tubes and posterior pallial tentacle are long. The palpal tentacles are long and tapered; in life they may extend nearly to the end of the expanded siphon.

ADRANELLA, new subgenus of Yoldia.

Type.—*Adranella casta*, new species.

This subgenus is allied to *Yoldia*, but is distinguished by its oblong-ovate, compressed form, with a broadly rounded, posterior end, having a very small, nearly obsolete, rostrum. Surface sculptured with distinct, raised, concentric lines. Hinge-plate and teeth strong. Resilium occupying a distinct pit in the apex of a large shelf-like, triangular chondrophore.

YOLDIA (ADRANELLA) CASTA, new species.

(Plate LXXX, fig. 4.)

Shell small, oblong-ovate, somewhat compressed, inequilateral, with the posterior end a little the longer and considerably the broader. Umbos small; beaks curved inward and slightly backward. Antero-dorsal margin slightly concave near the beak, a little convex opposite the distal teeth; anterior end a little narrowed, obtusely rounded; ventral margin broadly and evenly rounded with a very faint undulation posteriorly; postero-dorsal margin a little convex, sloping less than the anterior, and turning up at the end so as to form a slight, hardly distinct rostrum. The hinge-plate is rather large and thick, especially distally on each side, becoming narrow and turning upward at the beak, where it is interrupted by a small, rather deep resilial pit, which is bordered interiorly by a thickened extension of the hinge-margin forming a sort of shelf, the whole constituting a broadly triangular chondrophore with the pit near its apex. The anterior series of teeth contains twelve, of which three or four proximal ones are very small, and form a series which curves upward, exterior to the chondrophore, and terminates at the superior margin of the shell; the teeth

become large, strong, and thick distally, with broad V-shaped bases separated by deep pits. In the posterior series, which is a little the longer, there are eleven teeth corresponding in form and arrangement with those of the anterior series. The exterior surface is regularly sculptured with prominent, sharp, concentric, raised lines separated by wider intervals. Interior very glossy. Muscular scars and pallial line not visible. Exterior sculpture clearly seen through the shell.

Length, 4.2 mm.; height, 2.8 mm.

One valve, among Foraminifera, station 2150, N. lat. 13° 34′ 45″, W. long. 81° 20′ 10″, in 382 fathoms, 1884.

ORTHOYOLDIA Verrill and Bush, 1897.

Orthoyoldia VERRILL and BUSH, Amer. Journ. Sci., III, pp. 55, 62, January, 1897.

Type.—Orthoyoldia scapina (Dall).

Shell oblong, gaping, blunt or rounded at both ends, without a distinct rostrum; no carina. Pallial sinus large and broad. Teeth numerous in both series. *O. scapina* (Dall), from off Brazil and *O. solenoides* (Dall) from the West Indies.

MEGAYOLDIA Verrill and Bush, 1897.

Megayoldia VERRILL and BUSH, Amer. Journ. Sci., III, pp. 55, 62, fig. 17, January, 1897.

Type.—Megayoldia thraciæformis (Storer).

We have established a new generic group for this large and well-known species, which has sometimes been referred to *Yoldia* and sometimes to *Portlandia*. No closely allied species is known. It is probably the largest known species of this family and is remarkable for its broad, short, compressed form, with a very short, blunt, indefinite, postero-dorsal rostrum, and with a low radial ridge, ending in a postero-ventral marginal lobe. The chondrophore is remarkably large and strong, concave, striated within, and projects much within the margin of the hinge-plate. The pallial sinus is large and deep. In outline it somewhat resembles typical *Portlandia*, but differs in being broader, flatter, and gaping at both ends, and in having a strongly developed external ligament. From *Yoldia* it also differs in the last character, as well as in outline, but agrees with it in its compressed gaping shell.

The postero-ventral margin of the mantle forms a pouch-like protrusion, corresponding to the radial ridge. The siphon tubes are long and united; the posterior pallial tentacle is long and slender. The palpi are very large. The palpal tentacles originate from the body-wall at the base of the outer palpi; they are long and thick, with a large furrow on one side.

MICROYOLDIA Verrill and Bush, 1897.

Microyoldia VERRILL and BUSH, Amer. Journ. Sci., III, pp. 56, 62, January, 1897.

Type.—Microyoldia regularis (Verrill).

Shell small, tightly closed, veneriform, with the anterior end shortest and with the beaks turned forward. A posterior marginal ligament in a distinct groove, continued under the beaks. Hinge-plate and teeth rather strong; the anterior series of teeth the shorter, forming a marked angle with the posterior series. Resilium supported by a relatively large and strong chondrophore, placed on the surface of the hinge-plate, distinctly behind the beaks and at the proximal end of the posterior series of teeth. Pallial line indistinct.

The curious little shell for which this genus is proposed is remarkable for its form and the size and position of the cartilage and chondrophore, as well as for its few blunt teeth. If we are correct in our conclusions as to the anterior and posterior ends, the beaks turn forward as in *Tindaria.* The principal reason for considering the longer end posterior is the existence of a well-formed ligament and groove along that end and not on the shorter one.

MICROYOLDIA REGULARIS (Verrill).

(Plate LXXVIII, figs. 5, 6.)

Yoldia regularis VERRILL, Trans. Conn. Acad., VI, pp. 228, 279, 1884.
Microyoldia regularis VERRILL and BUSH, Amer. Journ. Sci., III, p. 56, figs. 5, 6, January, 1897.

This species closely resembles the very young of *Megayoldia thraciæformis* (Storer) Verrill and Bush, in the character of the hinge. Specimens of the latter measuring 3.5 mm. in length have the relatively large, concave, cartilage-plate just before the beaks, which curve strongly backward and are nearer the center of the shell, and the teeth are more numerous and more slender.

In *M. regularis* the shell is cordate-ovate or veneriform. The beaks curve strongly toward the short (anterior ?) end. There is on this end a sunken lunular area defined by a slight groove which indents the hinge-margin. The anterior (?) part of the hinge-margin is thickened and incurved along the lunule and bears an inner ridge and four or five, small, blunt teeth of which the proximal two project above the margin in a dorsal view, the others are low and rather obscure. Under the beak the hinge-plate is thickened, sinuous, edentulous for a short distance; back (?) of this there is a large, thick, oblique, concave chondrophore which occupies the whole breadth of the hinge-margin and projects inward beyond it as a shelf-like border; beyond this there is a series of six or seven prominent, blunt teeth. The external ligament lies in a distinct grove along a large part of the edge of the longer (posterior?) dorsal margin and runs under the beak, but fades out in front of it. The pallial sinus is not visible, consequently it is not possible to decide which is the anterior end.

But one specimen from station 199, off Thatchers Island, in 98 fathoms, 1878, has been referred to this species, besides the type specimens (No. 38420) station 1093, off Marthas Vineyard, in 349 fathoms, 1882.

YOLDIELLA Verrill and Bush, 1897.

Yoldiella VERRILL and BUSH, Amer. Journ. Sci., III, pp. 55, 63, January, 1897.

Type.—*Yoldiella lucida* (Lovén).

This group includes a large number of small, mostly deep-sea species with glossy, iridescent, ovate, and usually wedge-shaped shells, nearly always having a slight antero-ventral sinuosity, which feebly defines an obscure, blunt, rostal region, without any definite carination. The shells do not gape, but close tightly except that at the rostral angle of some species there may be a slight divergence. The internal cartilage, which is often relatively large, occupies a simple notch which interrupts the hinge-margin more or less completely and generally shows externally in a dorsal view; the notch usually terminates within, on the inner or inferior surface of the hinge-plate and is often bounded within by a slight ridge. A weak external ligament is present on the postero-dorsal margin. A relatively small pallial sinus has been observed in several of the species, but is usually indistinct. The siphon tubes, as observed in a few of the species, are slender and united for more than half their length.

The following are some of the species: *Y. lucida* (Lovén) Verrill and Bush, *Y. iris* Verrill and Bush, and var. *stricta* Verrill and Bush, *Y. inflata* Verrill and Bush, *Y. inconspicua* Verrill and Bush, and *Y. jeffreysi* (Hidalgo) Verrill and Bush, off Cape Hatteras, North Carolina, northward; *Y. dissimilis* Verrill and Bush, north of Cape Hatteras, North Carolina, northward; *Y. fraterna* Verrill and Bush, off Chesapeake Bay, northward; *Y. minuscula* Verrill and Bush, and *Y. subequilatera* Verrill and Bush, off Delaware Bay, northward; *Y. frigida* (Torell) Verrill and Bush, and *Y. curta* Verrill and Bush, off Marthas Vineyard, northward; *Y. subangulata* Verrill and Bush, and *Y. lenticula* (Möller) Verrill and Bush, var. *amblia* Verrill and Bush, Gulf of Maine; *Y. expansa* (Jeffreys) Verrill and Bush, off Grand Banks; *Y. pachia* Verrill and Bush, southern; *Y. hoylei* (Smith) Verrill and Bush, North Pacific.

YOLDIELLA LUCIDA (Lovén) Verrill and Bush.

(Plates LXXVII, fig. 2; LXXX, fig. 3.)

Yoldia lucida LOVÉN, Index Molluscorum, p. 34, 1846.

?*Leda obesa* STIMPSON, Proc. Boston Soc. Nat. Hist., IV, p. 113, 1851; Shells New Eng., p. 10, pl. II, fig. 1, 1851.

Leda lucida JEFFREYS, British Conchology, V, p. 173, pl. C, fig. 1, 1869.

Yoldia obesa GOULD, Rep. on Invert. of Mass., Binney's ed., p. 155, fig. 463, 1870.

Leda obesa TRYON, Amer. Mar. Conch., p. 184, pl. XXXVIII, figs. 500, 501, 1873.

Yoldia obesa VERRILL, Amer. Journ. Sci., VII, pp. 46, 412, 503, 1874.—SMITH and HARGER, Trans. Conn. Acad., III, pp. 18, 23, 1874.—VERRILL, Explorations Casco Bay, pp. 352, 368, 1874; Invert. Anim. Vineyard Sd., p. 396, 1874.

Portlandia lucida G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 37, pl. 4, figs. 8*a*, 8*b*, 1878.

Leda lucida JEFFREYS, Proc. Zoöl. Soc., London, p. 578, 1879.

Yoldia lucida VERRILL, Trans. Conn. Acad., V, pl. XLIV, fig. 1, 1882; VI, p. 279, 1884 (in part); Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885 (in part).—BUSH, Bull. Mus. Comp. Zoö. l, XXIII, p. 233, 1893.

Yoldiella lucida VERRILL and BUSH, Amer. Journ. Sci., III, p. 55, fig. 14, January, 1897.

Shell small, swollen, subovate, with a posterior angle, smooth, or more or less striolate, iridescent. The umbos are but little prominent, in front of the middle; the beaks interrupted or obliterated by the dark central cartilage which occupies a relatively large notch intersecting the entire thickness of the hinge-margin. The antero-dorsal margin is convex with the edge a little expanded; it slopes rapidly from the beak to the anterior end which is obtusely rounded; the ventral margin is broadly and regularly curved nearly to the posterior end where there is a slight protrusion corresponding to a faint undulation of the surface; the posterior end is somewhat wedge-shaped, a little compressed and tapered, and makes a distinct but obtuse angle where it joins the dorsal margin in line with a rounded posterior ridge running from the convex part of the umbos; just below the angle the margin is usually convex or subtruncate and without any definite lower angle; the posterior dorsal margin slopes less rapidly than the anterior, is nearly straight with the edge compressed and a little expanded into a thin keel which is usually slightly convex in the middle. The hinge-margin is strong, somewhat prolonged, scarcely angulated in the middle; the part in front of the chondrophore is well-arched and bears, in the largest specimens, nine or ten, sharp, prominent, angular teeth, of which two or three nearest the beak are quite small; the posterior portion is nearly straight, a little longer and narrower than the anterior and bears about eleven thin, sharp, erect teeth, counting one or two minute proximal ones; a thin smooth margin extends outside both series of teeth. The cartilage-pit is relatively large, in the form of a notch, and cuts through the hinge-margin into the substance of the beak itself; it is occupied by a dark brown resilium which usually shows plainly externally. Just in front of the cartilage-pit on its border within the series of teeth, there is a small conical, tooth-like process in both valves. The ligament is thin and delicate. Externally the shell is covered with a glossy, yellowish, or pale olive epidermis which reflects brilliant prismatic colors; the surface is marked by faint lines of growth and frequently also with fine concentric grooves or sulci, especially toward the ventral and anterior margins; in many specimens these are absent.

Length of one of the largest specimens, 7 mm.; height, 4.25 mm.; breadth, 3.2 mm.

Found in small numbers, at many stations, between N. lat. 43° 39′,

W. long. 69° 22′; and N. lat. 35° 12′ 10″, W. long. 74° 57′ 15″, in 22 to 516 fathoms, 1872–1885.

The most prominent character of this species is the relatively large size of the cartilage-pit which intersects both the hinge-margins and the beaks and is therefore plainly visible from the exterior. In outline it is similar to *Y. iris* and *Y. inflata* but is more pointed and narrower posteriorly than either of them. They differ also in having much smaller cartilage-pits and in the number of the teeth.

Specimens formerly identified as *Yoldia obesa* Stimpson, agree perfectly with authentic specimens of *lucida* sent by Doctor Friele from Spitzbergen. As none of the species known to us agree sufficiently well with the description and figure of *Leda obesa* Stimpson, for us to decide definitely as to its correct position, unless we are to consider the figure a very incorrect representation, we prefer to let it remain doubtfully, as a synonym of *Y. lucida*, where Jeffreys and others have placed it.

YOLDIELLA IRIS, new species.

(Plates LXXX, figs. 1, 2; LXXXII, fig. 11.)

Shell small, thin, rather delicate, long-ovate or ovate-elliptical, with the beaks in front of the middle, not much swollen; surface smooth, or nearly so, with brilliant iridescence. The antero-dorsal margin is convex and slightly arched, sloping gradually to the obtusely rounded and slightly produced anterior end; ventral margin very broadly and evenly curved; posterior end obliquely ascending, obtusely pointed or rounded at the tip with a slight dorsal angulation; postero-dorsal margin slightly convex, sloping but little, pinched up into a thin, rather prominent keel. The umbos are small and prominent with the beaks small, curved inward and backward, closely appressed to the margin. The epidermis is grayish or greenish yellow, smooth and shining; the surface is brilliantly iridescent, covered with faintly marked, fine, concentric lines, most distinct near the ventral margin and anteriorly; under the lens these appear like faint, close undulations over most of the surface. Escutcheon defined by a well-marked depression.

The hinge-margin is thickened and forms a very obtuse angle at the beaks; the posterior portion which is only slightly curved distally is longer than the anterior which is nearly straight. In the largest specimens there are twelve or thirteen acute erect V-shaped teeth in each series, including one or two minute, proximal ones. The resilial pit is minute, situated on the inner face of the thin edentulous hinge-plate, beneath the beaks, and faces ventrally so that it is scarcely visible in a front view and but partially interrupts the hinge-plate. Outside the series of teeth, on both sides of the beak there is a smooth, raised margin.

Length of one of the larger specimens, 7.5 mm.; height, 5 mm.; from beak to posterior end, 4.5 mm.

Found in considerable numbers, at about forty-five stations, between N. lat. 47° 40′, W. long. 47° 35′ 30″, and N. lat. 35° 12′ 10″, W. long. 74° 57′ 15″, in 20½ to 781 fathoms, 1872–1886.

This species is more elongated and more regularly elliptical than any of the allied species; the hinge-margin is also less angulated.

A single specimen (No. 74325), station 43, off Cape Sable, in 90 fathoms, 1877, at first thought to be a distinct species, differs from the typical form in being more oblong with the ventral margin less curved, the posterior end more evenly rounded with only a slight indication of a superior angulation, so that the shell has a pretty regular, narrow elliptical form. In all other respects, however, it agrees well with the ordinary form. This specimen, which receives the varietal name *stricta*, is figured on Plate LXXX, fig. 1.

Length, 5 mm.; height, 3 mm.; breadth, 1.3 mm.; length from beak to posterior end, 3 mm.

YOLDIELLA INFLATA Verrill and Bush.

(Plates LXXX, fig. 8; LXXXII, figs. 5, 6.)

Yoldia lucida VERRILL, Trans. Conn. Acad., VI, p. 279, 1884 (in part).
Yoldiella inflata VERRILL and BUSH, Amer. Journ. Sci., III, p. 56, figs. 3, 4, 11, January, 1897.

Shell small, swollen, rather short, subovate, with the posterior end broad, angulated postero-dorsally; beaks at about the anterior third; surface smooth. Antero-dorsal margin regularly convex and sloping rapidly to the anterior end which is evenly rounded, very obtuse, and passes insensibly into the evenly curved ventral margin which is decidedly convex, although the degree of convexity varies considerably in different specimens; the posterior end is obliquely subtruncated, with an obtuse curve below and an obtusely rounded angle at its upper extremity where it joins the nearly straight postero-dorsal margin. The umbos are full and well-rounded but not very prominent; the beaks are small, directly incurved, appressed to the margin. There is no distinct lunule but the margin is slightly pinched up in a small crest both before and behind the beaks. The ligament is delicate and shows slightly on both sides of the beak. Epidermis pale olive yellow or straw color; surface smooth, shining, reflecting prismatic colors, showing more or less distinct lines of growth which sometimes become regular, concentric, very fine striations, especially anteriorly. Hinge-margin well developed, moderately broad and considerably thickened, forming an obtuse angle at the beak where it is thin, encroached upon by the beak and interrupted by the cartilage-pit; the two portions are nearly equal in length, the anterior somewhat arched, the posterior nearly straight, each having a thin, smooth border above the teeth, about equal in breadth to the hinge-plate. In the largest specimens there are nine to eleven (most frequently ten) rather stout, angular teeth and about ten very similar posterior ones; the cartilage-pit is small and

just beneath the beak, forms a notch which completely interrupts the hinge-margin.

Length of one of the largest specimens, 6 mm.; height, 4.5 mm., thickness, 3 mm.; from beak to posterior angle, 4 mm.

Found in considerable numbers, at about twenty stations, between N. lat. 41° 53′, W. long. 65° 35′, and N. lat. 35° 9′ 50″, W. long. 74° 57′ 40″, in 516 to 1,608 fathoms, 1883–1886. Several live specimens, at station 2079, in 75 fathoms.

This species is closely related to *Y. lucida* (Lovén), from which it is easily separated by its shorter, broader, more swollen form, its strongly curved ventral margin, and very distinct postero-dorsal angle. It is shorter and has a broader posterior end than most of the related species. The resilium is not visible externally.

YOLDIELLA SUBANGULATA, new species.

(Plates LXXVII, fig. 3; LXXIX, fig. 6.)

Very similar to the preceding species in form but less pointed posteriorly and larger. The umbos are small, not prominent; beaks are small, directly incurved, appressed to the hinge-margin but not distinctly notched by the resilial pit. The antero-dorsal margin is convex, arched; the anterior end is a little produced, obtusely rounded; ventral margin evenly and broadly rounded, slightly produced posteriorly, forming an obscure obtuse angle as it merges into the posterior end which is obliquely subtruncated or a little inflexed in the middle, with a prominent dorsal angle; the postero-dorsal margin slopes but little, and is nearly straight, with the compressed edges forming a slight keel, which is a little convex in the middle. A well-marked ridge runs to the postero-dorsal angle, and a less distinct one to the postero-ventral angle; between these there is a slight depression of the surface. Surface nearly smooth, lustrous, reflecting prismatic colors, and covered with faint lines of growth and a few inconspicuous irregular sulci; epidermis pale olive yellow. The hinge-margin is narrow, very obtusely angled, and is interrupted under the beaks by the small notch-like resilial pit. The anterior series of teeth is slightly arched and contains about seventeen teeth, including three or four minute proximal ones; the larger ones are high and sharp. The posterior series is a little longer and contains about eighteen, similar, but somewhat more slender teeth. A thin, smooth margin extends along outside both series. There is a small internal denticle at the front edge of the resilial pit. Pallial sinus narrow, considerably inflexed.

Length, 8 mm.; height, 5 mm.; thickness, about 4 mm.; from beak to anterior end, 3 mm.; posterior end, 5 mm.

One live specimen was dredged by the *Bache* at station 46, N. lat. 43° 3′; W. long. 70° 4′, in 51 fathoms, 1874.

YOLDIELLA JEFFREYSI (Hidalgo).

(Plates LXXXI, fig. 5; LXXXIII, fig. 3.)

Leda lata JEFFREYS, Ann. Mag. Nat. Hist., p. 431, November, 1876.

Leda jeffreysi JEFFREYS, Proc. Zoöl. Soc. London, p. 579, pl. XLVI, fig. 2, June, 1879.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 234, 1885.

Not *Yoldia jeffreysi* VERRILL, Trans. Conn. Acad., VI, p. 229, 1884.

Shell small, ovate-elliptical, somewhat thick for its size, rather swollen, covered with a glossy, iridescent, brownish yellow epidermis. The posterior end is considerably the longer, somewhat narrowed, bluntly rounded without any distinct rostrum. Umbos rather prominent, somewhat swollen; beaks prominent, curved inward and backward. The antero-dorsal margin is broadly convex, slopes a little and becomes continuous with the rather regularly curved outline of the rounded anterior end; ventral margin is broadly and regularly curved without any distinct flexure; the posterior end is obtusely rounded and not defined by any radial lines or ridges, with the dorsal margin nearly straight at first, usually slightly convex in the middle, and sloping gradually. The surface beneath the epidermis is nearly smooth but shows more or less distinct lines of growth, which sometimes have the form of fine parallel striations. The hinge-plate is thickened and rather strong; the two series of teeth are long and form a very obtuse angle at the beak; the anterior is somewhat the shorter and more oblique and a little curved. In our type specimen there are thirteen anterior teeth of which three or four proximal ones are very small; and fifteen posterior ones, including four or five small proximal ones; a somewhat larger specimen has fifteen in the anterior series and eighteen in the posterior. The two series are interrupted beneath the beak by a small, well-defined, concave, triangular resilial pit supported on the inner side by a distinct shelf-like projection.

Length of the type-specimen, 5 mm.; height, 3.1 mm. Length of the largest specimen, 5.6 mm.; height, 4.2 mm.

Six separate valves, at three stations, between N. lat. 37° 38′ 40″, W. long. 73° 16′ 30″, and N. lat. 36° 42′, W. long. 74° 30′, in 727 to 1,423 fathoms, 1884–1886.

As all of our specimens are much larger than the measurements given by Jeffreys, they are referred to *Y. jeffreysi* (Hidalgo) with some doubt, although they appear to agree well with Jeffreys's figure of that species in form and in the character of the hinge.

YOLDIELLA LENTICULA (Möller) variety AMBLIA, new.

(Plates LXXX, fig. 9; LXXXI, fig. 4.)

Nucula lenticula MÖLLER, Ind. Moll. Grœnl., p. 17, 1842.

Yoldia abyssicola TORELL, Spitzbergens Molluskfauna, p. 149, pl. I, figs. 4, *a–b*, 1859.

Portlandia lenticula G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 39, pl. 4, figs. 10, *a–b*, 1878.

Leda lenticula JEFFREYS, Proc. Zoöl. Soc., London, p. 577, June, 1879.

Our specimens, which are worn and imperfect, referred to this northern species, differ somewhat from the typical specimens from Spitzbergen, received from Doctor Friele. They are relatively shorter, higher, and somewhat less swollen, with a thicker and heavier shell. The posterior end is less produced and less tapered, so that it has a more ovate form. The hinge-teeth are stouter; the posterior series is shorter but contains the same number of teeth in specimens of similar size. With the amount of material that we have for examination, the differences, however, seem hardly sufficient to warrant the separation of our shells as a distinct species. We therefore propose the varietal name *amblia* for our specimens.

A few separate valves, at two stations, north of Cape Cod, in 110 to 122 fathoms, 1878–79.

YOLDIELLA FRATERNA, new species.

(Plates LXXX, fig. 5; LXXXII, fig. 8.)

Yoldia frigida VERRILL, Trans. Conn. Acad., VI, p. 279, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885 (in part).

Shell small, thin, delicate, irregularly elliptical in form, the posterior end being a little the longer, unusually broad, and slightly produced above, but not distinctly angulated, with a glossy, iridescent, yellowish green epidermis. Umbos a little swollen; the beaks small, scarcely prominent, and subcentral. The anterior end is broad, a little produced in the middle, and obtusely rounded; the dorsal margin is nearly horizontal in the region of the teeth; distally, sharp, and convex, then sloping rapidly to the middle of the anterior end. The ventral margin is broadly rounded, expanding a little posteriorly and then ascending pretty rapidly to the posterior tip which is obtusely rounded superiorly; postero-dorsal margin slightly convex and nearly horizontal for the greater part of its length. The surface beneath the epidermis is marked only by faint lines of growth. The hinge-margin is thin, rather delicate, with the two series of teeth of nearly equal length and diverging from the beaks at a broad angle; each series contains about ten rather thin and delicate teeth, of which the one or two proximal ones are very small and rather indistinct. Beneath the beak the margin is attenuated and interrupted by a small, oblong resilium which occupies the entire thickness of the margin and a slight notch in the beak. The pallial sinus is relatively rather large and deep, but in most specimens is invisible.

Length of the figured specimen, 4 mm.; height, about 2½ mm.

A comparatively small number of specimens, at about twenty stations, between N. lat. 47° 40′, W. long. 47° 35′ 30″, and N. lat. 37° 8′, W. long. 74° 33′, in 90 to 1,608 fathoms, 1873–1886.

This is a deep-water form formerly identified by us as *Yoldia frigida* Torell.

YOLDIELLA CURTA, new species.

(Plate XCVII, fig. 8.)

Phaseolus ovatus (?) VERRILL, Trans. Conn. Acad., VI, p. 230, 1884; Expl. *Albatross*. Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885 (not Seguenza).

Shell small, short-ovate, rather swollen in the middle, with rather prominent umbos, somewhat inequilateral, the posterior end the longer and slightly produced. Beaks small, incurved, with a slight posterior twist and a little separated from the margin. The dorsal margin is nearly straight medially, both before and behind the beaks, anteriorly it merges gradually into the broadly rounded anterior end, which usually has an obscure, blunt angulation in the middle; ventral margin broadly and evenly rounded, merging gradually into the more abrupt curve of the posterior end which is a little tapered, but obtusely rounded without any distinct rostrum or angulation; the postero-dorsal margin is a little prominent, pinched up and convex, with a considerable slope, so that the tip of the shell is but little above the middle. The surface is polished and somewhat iridescent, marked only by fine, irregular lines of growth. Epidermis pale greenish or brownish yellow. There is a relatively very large resilium, appearing yoke-shaped or wide W-shaped in the separated valves, and covering a relatively long, edentulous space beneath the beaks. The teeth are compressed, oblique, imperfectly V-shaped, especially posteriorly, and but slightly elevated. There are six or seven in the posterior series, of which the proximal ones are rather indistinct; and four distinct and two or three indistinct ones in the anterior series. In a dorsal view five are visible above the margin behind the beak and four before. They are not very long and rather blunt, with the distal side sloping and the side next the beak a little incurved and concave.

Length, 2.6 mm.; height, 1.8 mm.; thickness, about 1 mm.

A few live specimens, at three stations, between N. lat. 41° 11′ 30″, W. long. 66° 12′ 20″, and N. lat. 39° 38′, W. long. 70° 22′, in 499 to 1,290 fathoms, 1883–1886.

This species somewhat resembles *Y. frigida* in form, but it is relatively shorter, higher and less distinctly rostrated. Its hinge is also quite different. The present species is peculiar in having fewer and blunter teeth and a much larger resilium than most of the related species.

YOLDIELLA PACHIA, new species.

Shell very broad, oval, considerably swollen in the middle, with the length and height nearly equal; umbos rather prominent. The posterior end is narrowed and slightly produced, but not defined by any groove or carination. The dorsal margin is very obtusely angulated, anteriorly it is convex and slopes pretty rapidly to the broadly and evenly rounded anterior end; posteriorly it is nearly straight at first, then slopes gradually to the posterior end. The ventral margin is very

broadly rounded and slightly produced in the middle; it joins the curve of the posterior end with a scarcely perceptible incurvature in some specimens; the posterior end is obtusely rounded and situated about midheight of the shell. The dorsal edges of the valve are thin and a little pinched up, but there is no distinct lunule and only a very narrow ligamental furrow. The epidermis is polished and somewhat iridescent, and marked with fine, somewhat irregular lines of growth, in some places showing faint, microscopic, radial striations. Color of the dead valves, brownish yellow. Hinge-plate strong, narrow near the beak, wide distally, strongly angled, with the outer edge naked and rather broad, especially anteriorly. Teeth large and prominent distally, with about three small proximal ones; about eight in the anterior and ten in the posterior series. The resilial pit is a distinct, triangular fossette, or chondrophore, on the face of the margin, covering its whole breadth, and bordered internally by a thickened edge which causes an excurvature of the margin. There is a distinct marginal external ligament and furrow, or escutcheon.

Length, 4.6 mm.; height, 4.8 mm.

Three separate valves, among Foraminifera, at station 2385, N. lat. 28° 51′, W. long. 88° 18′, in 730 fathoms, 1885.

In outline this species resembles *Y. curta*, but differs in its wider and stouter hinge-plate, more numerous and more highly developed teeth, and especially in the form and structure of the resilial pit.

YOLDIELLA INCONSPICUA, new species.

(Plate LXXIX, figs. 3, 5.)

Shell small, thin, delicate, compressed, subovate; posterior end a little produced and narrowed medially. Surface lustrous and iridescent. Umbos scarcely prominent; beaks small, projecting but little above the dorsal margin. The antero-dorsal margin is slightly convex and nearly horizontal at first, then slopes gradually to the evenly rounded anterior end; ventral margin broadly rounded, slightly swollen posteriorly, ascending more rapidly to the narrow and bluntly rounded posterior end; postero-dorsal margin nearly straight toward the beak, then slightly convex and sloping very gradually. The surface is covered with fine, pretty regular, concentric grooves and raised lines, visible only under the microscope. Epidermis thin, shining, iridescent, greenish yellow. The hinge-margin is thin and delicate, nearly straight; the two series of teeth form a very obtuse angle at the beaks and are interrupted, for a considerable space, by the resilium which does not lie in a distinct pit. The ligament shows as a delicate, continuous marginal line, both in front of and behind the beaks. The teeth are small, oblique, V-shaped. In the anterior series there are about six distinct ones with one or two minute proximal ones; in the posterior, about seven distinct ones with one or two rudimentary ones near the beak.

The pallial sinus is rather wide and moderately deep, but is invisible in most specimens.

Length of the largest specimen, 3.6 mm.; height, 2.3 mm.

A number of specimens, at about fifteen stations, between N. lat. 42° 33′, W. long. 69° 58.5′, and N. lat. 35° 12′ 10″, W. long. 74° 57′ 15″, in 100 to 705 fathoms, 1878–1886.

This species is distinguished from *Yoldiella frigida*, and most of the other small species which it resembles, by its narrower, or lower, and more compressed form, more delicate shell, straighter dorsal margin, and the more central prolongation of the posterior end. It is apparently more nearly related to the smaller species, *Y. minuscula*, than to any other. The latter has a smaller, shorter, and more swollen shell, more convex ventrally, with the hinge-margin somewhat more angulated.

YOLDIELLA MINUSCULA, new species.

(Plate LXXIX, figs. 2, 7.)

Yoldia jeffreysi VERRILL, Trans. Conn. Acad., VI, pp. 229, 279, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.

Shell minute, broad-ovate, covered with microscopic, pretty regular concentric striations, with a very lustrous, somewhat iridescent, yellowish epidermis. The two ends are nearly equal in length; the posterior somewhat narrowed and obtuse at the end, the anterior well-rounded. The umbos are not prominent and the beaks are very small and project but slightly above the margin. The antero-dorsal margin is slightly convex at first, and nearly horizontal, and passes gradually into the curve of the anterior end; ventral margin is broad and nearly uniformly convex; the posterior end is a little produced in the middle and forms there a slight obtuse angle; the postero-dorsal margin is a little convex and nearly horizontal at first and then slopes rather rapidly to the tip. The hinge-margin is thin and delicate; the two series of teeth lie nearly in a straight line but the anterior one is a little oblique, so that they form a very wide angle at the beaks where the resilium entirely interrupts the hinge-margin forming a wide notch without any definite pit or shelf; the teeth are small, very oblique, and only slightly prominent; there are only about five in the anterior and six in the posterior series.

Length, about 2.3 mm.; height, about 1.5 mm.

Only a few specimens, at four stations, between N. lat 41° 53′, W. long. 65° 35′, and N. lat. 38° 27′, W. long. 73° 2′, in 705 to 1,290 fathoms, 1883–1885.

This very minute species may, with a larger series, prove to be the young of some of the preceding species.

YOLDIELLA SUBEQUILATERA (Jeffreys).

Leda subequilatera JEFFREYS, Proc. Zoöl. Soc., London, p. 579, pl. XLVI, fig. 3, 1879.

Yoldia subequilatera VERRILL, Trans. Conn. Acad., VI, pp. 229, 279, 1884 (in part); Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885 (in part).

Leda subequilatera DALL, Bull. Mus. Comp. Zoöl., XII, p. 252, 1886.

Yoldia subequilatera DALL, Bull. U. S. Nat. Mus., No. 37, p. 44, 1889.

Several live specimens (No. 35204), from station 2037, N. lat. 38° 53′, W. long. 69° 23′ 30″, in 1,731 fathoms, 1883, have been referred to this species. Although younger or smaller than Jeffreys's type, they agree very closely with his figures and description. The shell is very small, very thin and transparent, polished, lustrous, but scarcely iridescent and marked only by microscopic lines of growth. It is rather compressed, nearly elliptical in form, with the beaks prominent above the dorsal margin and turned almost directly inward. Both ends are obtusely rounded and nearly equal in length, so that it is impossible to determine which is anterior and which is posterior by the external characters; one end, supposed to be the anterior, is however slightly broader than the other. There is no distinct ligament visible externally. The hinge plate is nearly straight, the two series of teeth forming but a slight angle. Interior not seen.

Our specimens measure from 1.5 to 2.5 mm. in length. South to Grenada, in 92 fathoms.—Dall.

YOLDIELLA EXPANSA (Jeffreys).

(Plate XCVII, fig. 3.)

Leda expansa JEFFREYS, Ann. Mag. Nat. Hist., p. 431, November, 1876; Proc. Zoöl. Soc., London, p. 580, pl. XLVI, fig. 4, June, 1879.

Not *Yoldia expansa* VERRILL, Trans. Conn. Acad., VI, p. 279, 1884.

Shell oblong-ovate, nearly equilateral, with the posterior end a little more broadly rounded than the anterior; both regularly obtuse. Both dorsal margins are slightly convex and slope but little. The hinge-plate is moderately wide, gently arched, with sharp dorsal margins, and is completely interrupted in the middle by a deep, angular notch for the resilium which is rather large and dark and is attached to the inner surface of the shell below the beak. In the right valve, there are nine posterior teeth, including one or two very small proximal ones, separated from the margin by a rather wide, smooth space; those in the middle of the series are long, with tapered, acute tips which are bent upward and toward the beaks, and at base are V-shaped. In the anterior series, which is a little the longer, there are ten teeth, including two or three very small, proximal ones; the larger ones are nearly erect with the tips less inclined than those in the posterior series; they are separated from the margin by a plain space about as wide as

the teeth. In the left valve, there are eleven anterior and nine posterior teeth. The surface of the shell is dull yellowish green, only slightly iridescent, and covered with irregular lines of growth which, in some places, form irregular raised lines. The umbos are but little prominent; the beaks are small and turn backward.

Length, 3.6 mm.; height, 2.5 mm.

One specimen (No. 78363), station 2697, N. lat. 47° 40′, W. long. 47° 35′ 30″, in 206 fathoms, 1886.

This species is peculiar in its nearly equilateral, elliptical form, with the dorsal margins gently convex and only slightly sloping both sides of the beaks, and especially in its large resilial notch which cuts entirely through the hinge-plate. It agrees pretty closely with Jeffreys' type, but the latter was much smaller and his figures and diagnosis are too imperfect to make its identity certain.

YOLDIELLA FRIGIDA (Torell).

(Plate LXXIX, fig. 4.)

Yoldia frigida VERRILL, Trans. Conn. Acad., V, p. 573, pl. XLIV, fig. 2, 1882; VI, p. 279, 1884 (in part); Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885 (in part).

A very few specimens, at about ten stations, between N. lat. 43° 5′, W. long. 70° 11′ 30″, and N. lat. 39° 53′ 30″, W. long. 71° 13′ 30″, in 88 to 312 fathoms, 1874–1881.

YOLDIELLA DISSIMILIS, new species.

(Plates LXXVIII, fig. 8; LXXXII, fig. 7.)

Yoldia expansa VERRILL, Trans. Conn. Acad., VI, p. 279, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885 (not of Jeffreys).

Shell small, oblong-ovate, nearly equilateral, with the anterior end the broader and bluntly rounded, the posterior end somewhat narrowed medially and bluntly rounded, without any distinct angulation. Umbos somewhat prominent; beaks small and strongly incurved. Surface straw-colored, not lustrous, covered with fine concentric lines. Antero-dorsal margin but little curved, sloping very gradually to the anterior end which is curved nearly in the arc of a circle; ventral margin very broadly rounded with a very slight obtuse angulation behind the middle; postero-dorsal margin slightly excavated just behind the beaks, then sloping very gradually to the obtuse posterior end. The hinge-margin is moderately stout; the two portions form a very wide angle at the beak with the anterior, which faces obliquely downward, considerably the more arched. In the center the margin becomes very thin and is interrupted by the resilium which occupies a deep notch and an internal shelf of considerable size, situated far back and directed downward to such an extent that it is only partially visible in a direct front view; there are about eleven or twelve anterior, and eight to ten poste-

rior acute, curved, V-shaped teeth; at the proximal end of the posterior series, in the left valve, there is an oblong, prominent, tooth-like process, much larger than the adjacent teeth. Three or four of the distal teeth, on each side, are decidedly large, prominent and acute with the tip curved outward, but the size decreases regularly toward the center. There is a well developed dark ligament, visible externally, both before and behind the beaks. The surface is covered by relatively rather large, distant, concentric ridges and furrows, easily visible under a lens, which are everywhere covered by very regular microscopic lines and grooves of about equal width.

Length of the largest valve, 4.25 mm.; height, 2.8 mm.

A few specimens, at four stations, between N. lat. 39° 49′, W. long. 68° 28′ 30″, and N. lat. 36° 47′, W. long. 73° 9′ 30″, in 1,451 to 1,685 fathoms, 1883–1886.

This species is remarkable for its oblong-ovate form and very regular concentric sculpture, consisting of fine ridges and furrows which are in turn everywhere covered with regular microscopic lines. This species was at first thought to be *Y. expansa* (Jeffreys) which it resembles in form, but additional specimens and more careful study show that the species are very distinct. In *Y. expansa* the hinge-margin is much straighter, the teeth fewer and different in form, the resilial pit very different, the two ends of the shell more nearly equal, and the sculpture quite different.

Our species differs considerably from the typical forms of *Yoldiella* in having a more oblong form with both ends evenly rounded, a well-developed ligament, and a more evident resilial fossette or chondrophore which, however, is situated decidedly below the hinge-plate. The existence of a peculiar tooth-like process adjacent to the resilial notch would be a character of considerable importance were it constant, but the specimens show great variation in its development; in some, it is even almost abortive. These distinctive characters, although important, seem hardly worthy of generic distinction.

Subfamily MALLETINÆ.

MALLETIA Desmoulins, 1832 (restricted).

Malletia VERRILL and BUSH, Amer. Journ. Sci., III, pp. 56, 63, January, 1897.

Type.—Malletia chilensis Desmoulins.

We have restricted this group to those species having a nearly smooth, somewhat compressed, oblong or elliptical shell, blunt posteriorly, without any definite rostrum or carination. The carinated and rostrated species that have been placed in it will thus be referred to *Neilo* H. and A. Adams. The resilium is wanting, or else represented by a special part of the ligament, external to the teeth. The ligament is well developed and prominent. The siphon tubes are long and united nearly to the tips.

The subgenus *Pseudomalletia*, proposed by Fischer for *M. obtusa*, was based on an erroneous description of the siphon tubes.

The following are some of the known species:

M. chilensis Desmoulins, Valparaiso (Type); *M. obtusa* (Sars) Mörch, from off Cape Fear, North Carolina, northward; *M. polita* Verrill and Bush, off Delaware Bay; *M. abyssorum* Verrill and Bush, off Chesapeake Bay; *M. cuneata* Jeffreys, North Atlantic; *M. pallida* Smith, Mid-South Atlantic; *M. arrouana* Smith and *M. dunkeri* Smith, Pacific; and *M. bellardii* Seguenza, fossil.

MALLETIA OBTUSA (M. Sars) Mörch.

(Plate XCVII, fig. 4.)

Yoldia obtusa G. O. SARS, Remarkable Forms of Animal Life, p. 23, pl. III, figs. 16–20, 1872.

Malletia obtusa G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 41, pl. 19, figs. 3, *a–b*, 1878.—JEFFREYS, Proc. Zoöl. Soc., London, p. 586, June, 1879.—VERRILL, Trans. Conn. Acad., VI, pp. 226, 280, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 245, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 46, 1889.—BUSH, Bul. Mus. Comp. Zoöl., XXIII, p. 234, 1893.—LOCARD, Campagne du *Caudan*, Annales de l'Université de Lyon, p. 202, 1896.—VERRILL and BUSH, Amer. Journ. Sci., III, p. 57, fig. 9, 1897.

The soft parts of several specimens, rather poorly preserved in alcohol, have been examined. They have a large foot with an ovate disk pointed in front and minutely crenulated. The siphon tube is rather long and slender, in some cases not entirely retracted within the shell; it appears to contain both the branchial and anal tubes which are closely united quite to the simple tips; at the inner base, there is a well-marked siphonal septum. The gills are small, elongated, pointed posteriorly, and have the structure usual in the family. The palpi are rather large, elongated, with revolute margins; the palpal tentacle is very long and slender, and in the contracted state variously bent with the edge much convoluted. No pallial tentacle was found at the base of the siphon.

In our collection there is a large series of this species; the form is pretty constant and in nearly all cases is more oblong than the European species, as figured by G. O. Sars. The small specimens are compressed while the large ones are a little swollen. The umbos are small, but slightly elevated; the beaks are very small, turned directly inward, and are almost in contact with the margin, so that they are generally worn away in the larger specimens. Directly under, and partly in the beaks, and also cutting more or less into the thickness of the external side of the hinge-margin, there is a small notch, or shallow excavation, which is occupied by a special portion of the ligament that probably represents a remnant of a degenerated resilium. The true ligament is well developed and prominent for about one-half the length of the hinge-margin, then becomes abruptly thinner and nar-

rower; its groove is narrow and inconspicuous. The hinge-margin itself is rather thin and bears very numerous, erect, V-shaped, acute teeth which number, in the large specimens, about sixteen or seventeen in the anterior series and about thirty-two or thirty-three in the posterior, including a number of small proximal ones; beneath the beaks there is a smooth, edentulous space, often a little thickened at the inner margin and projecting a little inward in the middle, and continuing inside the series of small proximal teeth on each side. In some cases this thickened border seems to arise anteriorly and to pass under the posterior series, as a slight fold; in other cases it is continued directly from one series to the other. The posterior series is nearly straight and about twice as long as the anterior which is strongly curved and distally somewhat recedes from the thin dorsal margin. The anterior end of the shell is rather short and evenly rounded; the posterior is about twice as long, a little wider owing to a slight ventral expansion, compressed and obtusely rounded or subtruncated at the margin, but without any distinct carination or angulation. The pallial sinus is very broad and deep, extending nearly to the middle of the shell. The inner surface is smooth, white or grayish white. The exterior is smooth, except for the delicate lines of growth, and covered with a thin, brilliantly iridescent epidermis which, in live specimens, is pale yellowish green, but in dead valves is pale straw color.

Our larger specimens measure about 15 or 16 mm. in length and 9 or 9.5 mm. in height.

Found at many stations between N. lat. 41° 28′, W. long. 65° 35′, and N. lat. 35° 16′, W. long. 75° 2′ 30″, in 516 to 1,781 fathoms, 1883–1887.

MALLETIA ABYSSORUM, new species.

(Plate XCVII, fig. 7.)

Shell small, not much compressed, lustrous, iridescent, subovate, not gaping, decidedly inequilateral, with the posterior end the longer, broader, obtusely rounded, without any distinct rostration. Umbos rather prominent, rising above the outline of the dorsal margin, with small beaks turned backward at the tip. Lunule and escutcheon abortive. The short antero-dorsal margin is slightly concave, and slopes rapidly to the slightly angulated anterior end; the ventral margin is very broadly and evenly convex, the curvature receding somewhat posteriorly, so that the greatest height of the shell is somewhat back of the middle, posteriorly there is a slight extension of the edge corresponding to an indistinct radial ridge; the posterior end is very broad, obtuse, not angulated, with the dorsal margin nearly horizontal, slightly convex, compressed and forming a slight angle where it joins the posterior curve. A very slight groove defines a very faint escutcheon, along the edge of which the teeth can be seen through the substance of the shell. The surface is polished, brilliantly iridescent, and is marked by faint, raised, concentric lines, or ridges parallel with the lines of growth;

near the ventral margin these become more elevated, clearly defined, and are separated by wider, slightly concave grooves. The hinge-plate is rather thin and delicate, regularly curved, without any angle at the beaks, with the posterior portion considerably the longer. There is a small, median, specialized ligament which occupies a lunate, or nearly semicircular notch in the hinge-plate directly beneath the beak, which does not extend through its entire width although it is here quite narrow. The posterior ligament is pretty well developed and extends from the beak, where it is closely connected with the median portion, nearly to the distal end of the series of teeth, and occupies a distinct marginal groove; the portion nearest the beaks, opposite the smaller teeth, is thicker and darker colored than the rest and projects slightly, in a dorsal view; a delicate, inconspicuous portion continues a little in front of the beak, in a thin groove. The median portion of the ligament is so closely connected with the posterior portion that it appears to be a specialized, thickened portion of it, but is evidently homologous with the resilium of other genera; it is situated, however, outside the series of teeth and must serve as a ligament. The larger teeth are delicate, subacute, V-shape, compressed in a direction parallel with the dorsal margin, with deep pits between them. There are about ten in the anterior series, including three or four, very small, scarcely raised ones next the beak; and fourteen in the posterior series, of which the seven distal ones are decidedly larger than the rest, the tenth to the thirteenth being the largest; about four, next the proximal end of the series, are like small, rounded tubercles or granules without a V-shape form; following these are three of intermediate form, increasing in size distally, the seventh being more or less V-shaped; these smaller teeth form a series along the inner edge of the hinge-plate. An edentulous ridge, about as long as the space occupied by the first three teeth, extends from the first tooth to the ligament-pit and is continuous with a similar, thinner ridge running below the ligament-pit to the anterior series of teeth. The pallial sinus is of moderate size and triangular in form.

Length, 5 mm.; height, 4 mm.

One live specimen (No. 52159), station 2566, off Chesapeake Bay, in 2,620 fathoms, 1885.

MALLETIA POLITA, new species.

(Plate LXXXII, fig. 10.)

Shell of moderate size, irregularly ovate, somewhat swollen, the ventral region convex and the posterior end somewhat produced with a short rostrum. Epidermis light yellow, lustrous and iridescent. Umbos not prominent, beaks small, strongly incurved, only slightly elevated above the margin. The antero-dorsal margin is slightly convex and slopes gently to the short, obtusely rounded anterior end which is slightly angulated in the middle; the ventral margin is strongly con-

vex, a little produced in the middle, and with a slight incurvature toward the posterior end, below the rostrum; the posterior end is narrowed and produced into a short obtuse rostrum with a nearly straight dorsal margin. The surface is covered with rather fine, somewhat uneven, concentric lines and undulations. The hinge-margin is but little thickened; the anterior portion is the shorter and the more curved and forms a very obtuse angle with the posterior portion which is nearly straight. There are about twelve conspicuous, rather elevated, sharp teeth in the anterior series besides three or four minute, proximal ones; and more than twenty in the posterior series, the number being indeterminable owing to an injury to the margin close to the beak. The external ligament is large and conspicuous and occupies a marginal groove extending the entire length of the posterior series of teeth. There appears to have been no chondrophore, but whether the line of teeth was continuous is uncertain.

Length, 14.5 mm.; height, 9 mm.

One valve (No. 78972), station 2718, N. lat. 38° 24′, W. long. 71° 52′, in 1,569 fathoms, 1886.

NEILO Adams, 1858.

Neilo H. and A. ADAMS, Genera of Recent Mollusca, II, p. 549; III, pl. CXXVI, figs. 7, 7*a*, 7*b*, 1858.—VERRILL and BUSH, Amer. Journ. Sci., III, pp. 57, 63, January, 1897.

Type.—Neilo cumingii Adams.

The type species of this genus has an oblong shell, with a straight postero-dorsal margin and a well-defined rostrum, bounded beneath by a pronounced furrow and a marginal indentation, while more ventrally, the margin protrudes somewhat, the pouting of the margin corresponding with special lobes of the margin of the mantle. *N. cumingii* from New Zealand is concentrically grooved, but *N. goniura* (Dall)[1] from off the coast of Ecuador is smooth or nearly so.

NEILONELLA Dall, 1881.

Saturnia SEGUENZA, Nuculidi terziarie merid. d'Ital., R. Accad. Lincei, I, p. 1178, 1877 (not Schrank, 1802).

Leda (section *Neilonella*) DALL, Bull. Mus. Comp. Zoöl., IX, p. 125, 1881; XII, p. 254, 1886. + *Saturnia* Dall, p. 263.

Neilonella VERRILL and BUSH, Amer. Journ. Sci., III, pp. 57, 63, January, 1897.

Type.—Neilonella corpulenta Dall.

Shell small, swollen, short-ovate, with both ends obtuse; the posterior somewhat the longer, blunt at tip, without any distinct rostrum or carina. Exterior usually concentrically grooved. Ligamental area not defined. Beaks usually prominent and turned inward and slightly backward. Ligament well developed, extending under and before the beaks in a distinct groove, more prominent behind. Resilium very

[1] Dall, Proc. U. S. Nat. Mus., XII, p. 251, pl. x, fig. 10, 1889.

minute or nearly abortive, occupying a slight notch in the dorsal margin under the beak, external to the series of teeth, which are interrupted only by a small, thin edentulous space. Pallial sinus small. Siphon tubes short. Labial palpi large, broad, crescent-shaped, with long tentacular appendages. Gills small, triquetral.

We consider this group worthy of generic rank. It appears to be more nearly allied to *Malletia* than to *Yoldia* or *Leda*. We can find no generic characters to distinguish Dall's typical species (*N. corpulenta*) from *N. pusio*, which was the type of the section, *Saturnia*, proposed by Seguenza. They agree closely in form, external sculpture, arrangement of the teeth, and structure of ligament and resilium. The name, *Saturnia*, being preoccupied by Schrank, 1802, we have adopted Dall's name for both of his sections.

The following species appear to belong here:

N. corpulenta Dall (type), and *N. quadrangularis* (Dall), West Indies; *N. sericea* (Jeffreys), Ireland and Portugal; *N. pusio* (Philippi), Mediterranean and West Indies; *N. subovata* Verrill and Bush, from off Cape Hatteras, North Carolina, northward.

NEILONELLA SUBOVATA Verrill and Bush.

(Plates LXXX, fig. 10; LXXXII, figs. 3, 4.)

Yoldia sericea JEFFREYS, var. *striolata* VERRILL, Trans. Conn. Acad., VI, p. 226, 1884.—VERRILL, Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.

Neilonella subovata VERRILL and BUSH, Amer. Journ. Sci., III, p. 57, figs. 7, 8, 22, January, 1897.

Shell somewhat swollen, subovate, with the dorsal margin angulated and the umbos somewhat prominent. The antero-dorsal margin is somewhat convex, pinched up at the edge, and sloped gradually to the evenly rounded anterior end; ventral margin is broadly and nearly evenly rounded throughout, without any sinuosity, and forms a blunt point at its junction with the postero-dorsal margin, which is nearly straight or slightly convex for the greater part of its length, with the edge thin and pinched up. The umbos are somewhat prominent and the beaks curve strongly inward and incline a little backward at the tip. The ligament is well developed, dark brown, and as seen in a dorsal view, fills a narrow, lanceolate excavation in the margin just behind the beaks. In an interior view it is conspicuous behind the beaks and occupies a curved notch immediately under them, and extends forward for a short distance in a thin, marginal groove. The resilium is abortive or nearly so; in many cases it appears to be represented by a minute black speck, adherent to the ligament, and occupying a minute indentation in the edge of the hinge-margin directly beneath the beak, external to the series of teeth. The hinge-margin is broad and rather strong, becoming very narrow below the beak but without a distinct notch or chondrophore; the posterior portion is

nearly straight, the less oblique and considerably the longer, and forms a broad angle with the anterior. There are in the largest examples about eleven or twelve teeth in the anterior series, counting four or five very small proximal ones; and in the posterior series, fifteen or sixteen teeth of which the five or six proximal ones are minute. In many specimens the two series are not distinctly separated under the beak, in others there is a very minute, edentulous space in line with the minute ligamental notch. The largest teeth in the middle of each series are very elongated, erect, acute, with the tips turned upward toward the margin. The surface of the shell is covered with very regular, concentric sulcations separated by narrow, evenly rounded ridges of about the same width; in most cases this sculpture is faint or nearly obsolete toward the postero-dorsal margin and on the umbos. In many specimens, a number of faint radiating striæ run from the umbos to the antero-ventral margin, similar lines sometimes occur posteriorly. The epidermis is without much luster, of either greenish yellow, light yellow, or straw color, more or less iridescent, especially near the umbos. Along the dorsal margin the outline of the teeth can be imperfectly seen through the substance of the shell. The interior in fresh specimens is lustrous bluish white and in some cases is distinctly tinged with pale flesh-color. The muscular and pallial impressions are usually indistinct but some specimens show a small, but distinct, angular pallial sinus.

The alcoholic specimens when dissected were found to have a short siphon and a large, stout foot with a broad disk having strongly crenulated edges. The labial palpi were long, crescent-shaped and the tentacle-like appendages arising from the outer bases of the external palpi were very long, slender, and coiled in a spiral. The gills were long, narrow, and prismatic, one on each side.

Length of one of the largest specimens, 6.5 mm.; height, 4.6 mm.; thickness, about 3.5 mm.

Young specimens about 2 mm. long are more equilateral than the adults and have the posterior end less produced and more evenly rounded, the umbos decidedly prominent, and the surface covered with fine, regular, concentric grooves, the epidermis showing distinct iridescence.

Found in large numbers, at many stations, between N. lat. 42° 47′, W. long. 61° 4′, and N. lat. 35° 9′ 50″, W. long. 74° 57′ 40″, in 125½ to 1,731 fathoms, 1883–1887.

This species shows considerable variation in form when a large series of specimens from the same locality are compared. Some are decidedly more elongated and tapered posteriorly than the typical form, others are somewhat shorter and more regularly ovate with the posterior end blunter or more rounded; all agree essentially in sculpture and in the peculiar structure of the hinge and ligament.

This species has some resemblance to *N. sericea* Jeffreys, of which it

was formerly thought to be a variety. It differs, however, in its larger size, more ovate form, the posterior end being more produced and tapered, and in its stronger sculpture. *N. corpulenta* Dall is narrower, more elongated, with more prominent beaks. *N. quadrangularis* (Dall) is shorter and more triangular in form, with the postero-dorsal margin more oblique.

Subfamily TINDARINÆ Verrill and Bush.

Cucullellinæ FISCHER, Manuel Conch., p. 981, 1887 (in part).
Tindarinæ VERRILL and BUSH, Amer. Journ. Sci., III, pp. 58, 63, January, 1887.

The genus *Tindaria* differs so widely from *Malletia* and other genera that it seemed necessary to establish a new subfamily for it.

In this group the shell is rather thick, short-ovate or veneriform, with the posterior end the longer, and with the beaks turned forward. The resilium is wanting. The ligament is well developed and prominent. The teeth are numerous, V-shaped, in two series which are frequently continuous proximally. There is neither pallial sinus nor true siphons. The mantle is broadly open ventrally, but there is a separate anal or efferent orifice surrounded by small sense papillæ. The palpi are large, with long, slender appendages. The foot has a large, terminal, crenulated disk.

This group agrees with Malletinæ in having no resilium, but the latter has well developed siphons and a pallial sinus.

TINDARIA Bellardi, 1875.

Tindaria VERRILL and BUSH, Amer. Journ. Sci., III, pp. 58, 63, January, 1897.

Type.—*Tindaria arata* Bellardi.

Several recent writers on these shells have regarded *Tindaria* as a subgenus of *Malletia*. In reality they form two widely diverse genera and have little resemblance except that in both the resilium is wanting. In typical *Tindaria* the shell is swollen, short-ovate or subcordate, without any rostration, with prominent umbos and with the beaks turned forward. In fact the shell may be described as veneriform. The surface is usually concentrically grooved. The series of teeth are often continuous medially. There is no pallial sinus.

A specimen of *T. amabilis* Dall[1] from station 2385, among Foraminifera, in 730 fathoms, not very well preserved in alcohol, has the mantle closed for a short distance behind the anal orifice which is large and surrounded by twelve or more, rather large, unequal papillæ, but does not appear to be capable of being protruded in a tubular form, unless a very short one. The mantle is otherwise freely open along the whole ventral margin to the oral area, with its edges nearly plain,

[1] *Malletia* (*Tindaria*) *cytherea* Dall, Bull. Mus. Comp. Zoöl., XII, p. 254, 1886; XVIII, p. 438, 1889; = *Malletia amabilis* Dall, p. 438; = *Tindaria amabilis* Dall, pl. XL, fig. 8.

showing only very minute papillæ posteriorly. The foot is large and strong, with a broad, strongly crenulated and striated, concave disk, pointed in front. The gills are well developed and somewhat triquetral, The palpal tentacles are rather large, long, tapered, triquetral, strongly grooved, curved in sickle-shape. The palpi are rather broad and short.

The following are some of the known species:

T. arata Bellardi, and *T. solida* Seguenza, fossil, in the Italian tertiary formation; *T. cytherea* Dall = *T. veneriformis* (Smith), *T. amabilis* Dall, *T. virens* Dall, *T. acinula* Dall, *T. cuneata* (Smith) = *T. smithii* Dall, *T. lata* Verrill and Bush, all Florida and West Indian species; and *T. callistiformis* Verrill and Bush, off Chesapeake Bay.

TINDARIA CALLISTIFORMIS Verrill and Bush.

(Plates LXXVIII, fig. 1; LXXX, figs. 6, 7.)

Tindaria callistiformis VERRILL and BUSH, Amer. Journ. Sci., III, p. 59, figs. 10, 20, 21, January, 1897.

Shell small, stout, thick, regularly ovate, sculptured with very regular, fine, concentric grooves, and having a broad, thick hinge-margin with a continuous line of teeth and no chondrophore. Umbos swollen, beaks prominent, strongly curved inward and somewhat forward, with the nuclear shell (prodissoconch) smooth and glossy. The lunular area is somewhat excavated but has no definite boundary. Anterior end considerably shorter than the posterior, both equally and evenly rounded. Antero-dorsal margin convex, sloping rather rapidly and forming a continuous curve with the anterior margin which is also continuous with the more broadly convex ventral margin; the posterior end is evenly rounded, with the dorsal margin strongly convex, sloping gradually, without any definite angulation. The surface is covered with very regular, fine, close, concentric, rounded ridges, separated by semicircular furrows about twice their width, except on the umbos where the two are about equal. The inner ventral margin is plain, sharp, and slightly beveled. The hinge-margin is wide and thick, narrowest just behind the beaks, gradually widening and thickening toward both ends. The anterior portion is much the shorter and somewhat the wider and slopes more rapidly; along the narrow middle portion the teeth are quite small, but regular, transverse, and separated by narrow intervals; owing to the absence of a chondrophore, there is no definite center, but in front of the tip of the beaks there are about eight teeth which increase rapidly in size and prominence, the four distal ones being large, elevated, and somewhat V-shaped; behind the beak there are about twenty-three teeth, of which nine or ten proximal ones are small; they then commence to increase in size and length so that eight or nine are larger and higher than the rest; these are, however, smaller and more acute than the larger ones in the anterior portion; two or three distal ones are a little less elevated than

those which precede them and a little different in form. Above the teeth there is a distinct and rather deep submarginal groove for the ligament which extends continuously both in front of, and behind the beaks. Behind the beaks there is a distinct rounded ridge running outside of, and parallel with the ligamental groove and terminating at the distal end of the row of teeth. Pallial line entire; no siphon; anal opening separated, surrounded by about twelve unequal papillæ; elsewhere the open mantle edge is nearly plain; foot large with a crenate disk.

Epidermis pale yellowish brown; interior glossy bluish white without pearly luster.

Length, 8 mm.; height, 6 mm.; thickness, about 4.5 mm.

A small specimen (3 mm. long, 2.5 mm. high) from station 2714, is doubtfully referred to this species. Externally it is covered with very fine regular, concentric, raised lines and grooves, agreeing well with the corresponding umbonal portion of the type. The epidermis is thin, pale straw color. The outline is also similar but the posterior half of the shell is relatively a little broader, owing to a slight expansion of the postero-ventral margin. The beaks appear to be relatively less prominent. The external ligament is well developed both sides of the beaks, and is slightly thickened just under them, and fills a very slight notch in the edge of the hinge margin above the teeth. The hinge-plate is relatively broad and strong, especially anteriorly. There are thirteen posterior and nine anterior teeth, the two series separated by a small edentulous space. Some of the distal teeth in the anterior series are unusually large and stout and exceed any of those in the posterior series. The pallial line is distinct and entire.

One live specimen (station 2566), N. lat. 37° 23′, W. long. 63° 8′, in 2,620 fathoms, 1885. One, very young, live specimen (station 2714), N. lat. 38° 22′, W. long. 70° 17′ 30″, in 1,825 fathoms, 1886.

This species is remarkable for its thick, firm shell, regular ovate form, and very even, concentric sculpture. In form and general appearance it resembles some species of *Callista*.

TINDARIA LATA, new species.

Shell rather thick, somewhat compressed, broad-ovate, equilateral, narrowest in front of the beaks, the posterior end somewhat produced and very broad. Umbos only slightly prominent. Beaks small, rather acute, turned directly forward and closely appressed to the margin. No lunule nor escutcheon. The antero-dorsal margin is nearly straight and slopes but little, but becomes a little convex and passes insensibly into the evenly rounded curvature of the anterior end; the ventral margin is very evenly and broadly rounded but the curve recedes as it passes backward so that the highest part of the shell is distinctly behind the middle; the posterior end is very evenly and broadly rounded without any angulation; the postero-dorsal margin is consid-

erably longer than the anterior and slopes pretty regularly and gradually from the beaks to the posterior extremity. The surface is covered with very regular, rather coarse, rounded, concentric ridges separated by deep furrows of about the same breadth. The epidermis is light straw color, only slightly lustrous and scarcely iridescent. The hinge-plate is large and strong, much elongated posteriorly, the two parts forming a very obtuse, curved angle at the beaks. The anterior portion is the broader, much the shorter, and bears about nine teeth, of which the three distal ones are much the larger and occupy about one-half the length of the series, the proximal ones being very small. The posterior portion is narrower and curved throughout; it bears seventeen or eighteen teeth of which seven or eight proximal ones are very small and acute. The hinge-plate becomes quite narrow under the beaks where the two series of teeth are interrupted by a very small edentulous space, scarcely wider than the adjacent teeth. All the larger teeth are rather crowded and compressed in the direction at right angles to the line of the hinge so that they are only slightly V-shaped. Seen in a dorsal view they appear thin and not very prominent above the margin of the shell, when the tips are broken they often appear three-lobed. The ligament is well developed and occupies a distinct, submarginal furrow behind the beaks. The muscular scars are well marked, small and nearly round; the pallial line is interrupted at a point a short distance from the posterior muscular scar but there is no visible sinus. The interior of the shell is grayish white but not pearly; the ventral edge is slightly beveled.

Length of the largest specimen, 7 mm.; height, 5.5 mm.

Two specimens, among Foraminifera, at station 2385, N. lat. 28° 51′, W. long. 88° 18′, in 730 fathoms, 1885.

TINDARIA CUNEATA (Smith) Dall.

Malletia cuneata SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 247, pl. XX, figs. 10, 10*a*, 1885 (not Jeffreys).

Malletia (*Tindaria*) *smithii* DALL, Bull. Mus. Comp. Zoöl., XII, p. 255, 1886.

A single young valve, among Foraminifera, at station 2655, N. lat. 27° 22′, W. long. 78° 7′ 30″, in 338 fathoms, 1886. Off Grenada and the West Indies, in 390 to 1,140 fathoms.—Smith and Dall.

As the species described and figured by Mr. Smith under the name of *Malletia cuneata* is a true *Tindaria*, his name does not conflict with the *Malletia cuneata* of Jeffreys which is a true *Malletia*, and therefore should remain unchanged.

Subgenus TINDARIOPSIS Verrill and Bush, 1897.

Tindariopsis VERRILL and BUSH, Amer. Journ. Sci., III, pp. 59, 63, January, 1897.

Type.—Tindariopsis agathida (Dall).[1]

[1] *Malletia* (*Tindaria*) *agathida* Dall, Proc. U. S. Nat. Mus., XII, p. 252, pl. XIII, fig. 10, 1889.

This division was proposed for those species which have a short rostrum, defined by a radial ridge and a furrow. The type has a well-marked dorsal ligamental furrow and a small notch or "socket" under the beak for the specialized part of the ligament. It is uncertain whether it has a siphon and a pallial sinus. In case these are present, it should form a distinct genus and be placed under Malletinæ.

ANALYTICAL TABLE OF RECENT SUBFAMILIES, GENERA, AND SUBGENERA OF LEDIDÆ AND NUCULIDÆ HERE ADOPTED.

A. Shell not gaping, short-ovate, subtrigonal, or rounded; posterior end without a rostrum; beaks usually curved backward; no siphon tubes nor pallial sinus. *Nuculidæ* d'Orbigny.

B. Shell more or less trigonal, usually oblique; posterior end usually shorter; beaks turned backward..... *Nuculinæ* Verrill and Bush.

c. Teeth numerous, transverse, V-shaped, forming two convexly arched or angulated series; a distinct median chondrophore; no lateral teeth. *Nucula* Lamarck.

cc. Teeth few, not forming long series; a long lateral tooth in each valve; no median chondrophore..... *Nuculina* d'Orbigny

AA. Shell ovate, oblong or lanceolate; posterior end generally the longer and usually more or less rostrated; siphon tubes and pallial sinus generally present. *Ledidæ* H. and A. Adams.

C. Cartilage or resilium present, not closely united with the external ligament. *Ledinæ* H. and A. Adams.

a. Resilium supported by a definite concave chondrophore extending inward to, or beyond, the inner edge of the hinge-plate.

b. Shell not gaping unless at the end of the rostrum.

c. Shell distinctly rostrated and carinated posteriorly. *Leda* Schumacher (sense extended).

d. Shell elongated and tapered posteriorly, rostrum long, bicarinate, blunt; ligamental area or escutcheon long and well-defined; pallial sinus and siphon tubes developed..... *Leda* (sense restricted).

dd. Shell shorter, swollen, ovate or oblong, posteriorly not much elongated; rostrum short, usually acute, unicarinate.

e. Shell ovate, rostrum small, acute; ligamental area or escutcheon distinctly bordered by a carina.

f. Rostrum short, subacute, submedian, defined below by a ventral sinuosity or emargination..... *Junonia* Seguenza = *Ledella* Verrill and Bush.

ff. Rostrum short, dorsal, not defined below by a ventral sinuosity; postero-dorsal margin concave; escutcheon sunken..... *Jupiteria* Bellardi.

ee. Shell oblong, angular, subtruncate, rostrum short, angular, dorsal, defined below by a marginal sinuosity; escutcheon well-defined.... *Portlandia* Mörch.

ccc. Shell not rostrated, small, ovate or elliptical, rounded at both ends, anterior end the shorter, no carina, lunule, nor escutcheon; cartilage posterior, internymphal..... *Microyoldia* Verrill and Bush.

bb. Shell oblong or lanceolate, compressed, nearly plain, more or less gaping at both ends; rostrum not well-defined; pallial sinus large and broad; tubes long, united.

g. Teeth transverse, -shaped, numerous, in two long series; chondrophore large, concave, projecting strongly inside the hinge-plate. *Yoldia* Möller (sense extended).

h. Shell large, compressed, rounded anteriorly, broadest posteriorly with a postero-ventral protrusion and radial ridge; rostrum short, broad, poorly defined; external ligament well developed, prominent both sides of the beaks, occupying a continuous furrow; no lunule nor escutcheon. *Megayoldia* Verrill and Bush.

hh. Shell lanceolate or long-ovate, posteriorly narrowed and somewhat elongated, more or less sinuous below; rostrum slightly defined, smooth or slightly carinate; external ligament feebly developed..... *Yoldia* (sense restricted).

hhh. Shell oblong, smooth, plain, blunt and rounded at both ends, without any distinct carina, sinuosity or rostrum ..... *Orthoyoldia* Verrill and Bush.

hhhh. Shell thin, compressed, narrow-lanceolate or long-elliptical, nearly equilateral, and gaping at both ends; sculpture oblique.

Adrana H. and A. Adams.

hhhhh. Shell hyaline, oblong-ovate, broad posteriorly, concentrically sculptured, rostrum nearly obsolete ..... *Adranella* Verrill and Bush.

gg. Shell thin, oblong, inequilateral, blunt at both ends, not rostrated nor carinated; teeth few, lamellar, very oblique. Type, *S. fragilis* Jeffreys.

Silicula Jeffreys.

aa. Shell small, nearly plain, not much rostrated nor carinated; resilium without a prominent chondrophore, situated in a notch in the hinge-margin, interrupting the series of teeth.

l. Teeth V-shaped, numerous in both series.

m. Shell oblong or subovate, blunt posteriorly, with a slightly sinuous margin, sometimes subrostrate, not carinate..... *Yoldiella* Verrill and Bush.

mm. Shell regularly ovate, rounded at both ends, not sinuous nor carinate, (?) no pallial sinus..... *Sarepta* A. Adams.

ll. Shell short-ovate, not sinuous nor angulated; teeth few, oblique, not regularly V-shaped. Type, *P. ovatus* Seguenza..... *Phaseolus* Seguenza.

CC. No true resilium; ligament well developed, often prominent behind the beaks which are usually turned forward.

D. Siphon tubes and pallial sinus present; teeth mostly V-shaped, in two long series, often interrupted by a median edentulous space.

Malletinæ H. and A. Adams.

o. Siphon tubes long; pallial sinus large; shell elongated, gaping.

p. Shell oblong or elliptical, blunt posteriorly, not distinctly rostrate; series of teeth unequal; those in the anterior series fewer..... *Malletia* Desmoulins.

pp. Shell long-ovate or oblong, broadly angulated and sinuous posteriorly; distinctly rostrate and carinate; two series of teeth nearly equal.

Neilo H. and A. Adams.

oo. Siphon and pallial sinus small, shell ovate, not gaping; a rudimentary marginal resilium ..... *Neilonella* Dall.

DD. Shell short-ovate or subcordate, closed at both ends, umbos prominent; ligament entirely external; series of teeth generally continuous.

Tindarinæ Verrill and Bush.

s. Shell regularly ovate, grooved, without rostrum or carina; beaks turned forward; no pallial sinus..... *Tindaria* Bellardi.

ss. Shell ovate, with a distinct posterior sinuosity and a short rostrum.

Tindariopsis Verrill and Bush.

Family SOLENOMYIDÆ.

SOLEMYA GRANDIS, new species.

(Plate LXXXVI, figs. 1, 2.)

Shell large, considerably broader anteriorly than posteriorly, dorsal margin in front of the beaks straight and thickened by an internal ridge and a strong epidermal fold. At the anterior end the valves gape widely, and the edge of each is divided into six or seven long, nearly regular, digitate processes of nearly uniform width, and obtusely rounded at the ends, separated by notches, rounded proximally. The

general outline of this end is broadly truncate; the ventral margin is somewhat convex but slopes upward toward the posterior end and is nearly straight along the middle; the posterior end is short, evenly rounded, with the dorsal margin, behind the beaks, strongly incurved; the large black ligament which occupies this area is continuous with the epidermis, so that its outline forms a curve nearly in line with that of the anterior end, and shows but a slight angle, or lobe, at the outer end of the dorsal line. The umbos are flattened, and scarcely prominent. The whole surface is covered with a thick, smooth, glossy epidermis, chestnut-brown in the young and brownish black in adult, which anteriorly is divided into several rather broad digitations that are shorter and somewhat wider ventrally, their length diminishing from the middle of the anterior end to the ventral margin, along the middle of which there are no digitations, but short and broad ones again appear posteriorly. The shell is sculptured by radiating ribs and furrows which are but slightly developed on the middle region but become large and strong anteriorly and smaller and closer posteriorly. On the anterior part these ribs are broad and flat, separated by wide, flat-bottomed, furrows often nearly as wide as the ribs; on the middle area, the furrows are shallow and rounded while the intervening spaces are flat, sometimes broad, at others narrow, this region appearing comparatively smooth, some specimens showing but slight indications of grooves and ribs; posteriorly these are somewhat more numerous, narrower, often about equal in width. In specimens of medium size, there are from six to eight of the large anterior furrows and as many ribs; the edges of the latter are somewhat elevated above the middle portion and these thickened margins extend out along the edges of the digitations which otherwise correspond to the furrows. Internally the shell is white, moderately thick, the anterior portion oblong with obtusely truncated end, the dorsal and ventral margins nearly parallel, and the posterior much narrower and tapered to an obtusely rounded end, with the dorsal margin excavated for the ligamental area. The surface shows distinct but not very prominent grooves and ridges corresponding to the exterior ones; at the anterior end the margin shows slight lobes, corresponding to the intervals between the epidermal digitations. The anterior muscular scar is large and rounded, the posterior one is smaller and subovate. Anteriorly the hinge-margin is thickened in both valves, running from near the beak nearly to the end; posteriorly it is more strongly thickened by a sinuous callus to which the ligament is attached, while under and just in front of the beak the margin is excavated for the reception of the cartilage which continues forward in a groove and is continuous with the broad, dorsal, epidermal margin which unites the two valves throughout their length. The posterior ligament and anterior cartilage appear to blend just beneath the beaks; the commencement of the cartilage is, however, indicated by a slight notch in the callus-margin, in both valves, and the ligament appears

to extend forward in a point between the two sides of the cartilage. There are no transverse costæ or buttresses for strengthening the hinge-margin.

Entire length, including epidermal lobes, 54 mm.; entire height, opposite the beaks, 22 mm.; height of the anterior third, 26 mm.; breadth, in the middle, 12 mm.; length of longest digitations, about 10 or 12 mm.; length of the shell itself, 42 mm.; height at the middle, 15 mm.; length from beak to anterior end, 30 mm.; to posterior end, 14 mm. Fragments of specimens more than twice as large as the one measured have been taken. In one of these the height of the shell without the epidermis is 25 mm.

Two good specimens and some fragments, at four stations, between N. lat. 39° 58′ 30″, W. long. 70° 30′, and N. lat. 37° 24′, W. long. 74° 17′, in 300 to 1,600 fathoms, 1880–1884.

EXPLANATION OF PLATES.

The figures on Plate IV, fig. 2, Plate VI, figs. 1, 2, Plate VII, fig. 9, Plate XXI, figs. 1, 2, and Plate XXV, fig. 8, were drawn by Mr. J. H. Blake. Plate XV, figs. 9, 10, 11, were drawn by Mr. J. H. Emerton. The other figures are all camera-lucida drawings by Mr. A. H. Verrill.

PLATE LXXI.

Fig. 1. *Cardiomya glypta* Bush, p. 810. Dorsal view of type specimen No. 35362; × 10 diameters.

2. *Cuspidaria arctica* (M. Sars) Dall, p. 803. Interior of a left valve from station 70; × about 3. Broken outline restored by lines of growth.
3. *Cardiomya gemma* Verrill and Bush, p. 809. Dorsal view of specimen No. 41456; × 10.
4. The same. Interior of left valve of the same specimen; × about 13.
5. *Cuspidaria media* Verrill and Bush, p. 800. Dorsal view of specimen No. 49020; × 5.
6. The same. Interior of left valve of type specimen No. 49018; × 5.
7. *Cuspidaria fraterna* Verrill and Bush, p. 803. Dorsal view of specimen No. 48962; × 5.
8. The same. Interior of left valve of type specimen from station 892; × 5.
9. *Cuspidaria glacialis* (G. O. Sars) Dall, p. 800. Dorsal view of specimen No. 49023; × 5.

PLATE LXXII.

Fig. 1. *Cuspidaria undata* Verrill, p. 798. Hinge of both valves of specimen No. 52547; × about 3.

2. *Halonympha striatella* Verrill and Bush, p. 810. Hinge of a right valve from station 2655; × 25.
3. The same. Turned up to show anterior tooth; × 25.
4. *Myonera ruginosa* (Jeffreys) Verrill and Bush, p. 811. Hinge of right valve of specimen No. 52544; × about 16.
5. *Cuspidaria ventricosa* Verrill and Bush, p. 802. Hinge of a right valve No. 52548; × 5.
6. *Cuspidaria rostrata* (Spengler) Dall, p. 800. Hinge of both valves of specimen No. 49067; × 5.
7. *Cuspidaria turgida* Verrill and Bush, p. 799. Hinge of both valves of type specimen No. 78789; × about 6.

PLATE LXXIII.

Fig. 1. *Cuspidaria subtorta* (Sars), p. 806. Hinge of both valves of specimen No. 52545; × 9.

2. *Cardiomya perrostrata* Dall, p. 809. Hinge of both valves of specimen No. 48933; × 22.
3. *Cardiomya multicostata* Verrill and Smith, p. 808. Hinge of both valves of specimen No. 48947; × 4½.
4. *Cardiomya abyssicola* Verrill and Bush, p. 806. Hinge of two separate valves No. 78896; × 4½.
5. *Cuspidaria glacialis* (G. O. Sars) Dall, p. 800. Hinge of right valve of specimen No. 49011; × 4½.
6. *Cuspidaria media* Verrill and Bush, p. 800. Hinge of both valves of type specimen No. 49018; × 9.

PLATE LXXIV.

Fig. 1. *Cardiomya abyssicola* Verrill and Bush, p. 806. Exterior of right valve of a young specimen No. 78935; × 9.

2. *Myonera ruginosa* (Jeffreys) Verrill and Bush, p. 811. Exterior of right valve of specimen No. 52544; × about 8.

3. *Cardiomya perrostrata* Dall, p. 809. Interior of right valve of specimen No. 78933; × 9.

4. *Cuspidaria subtorta* (Sars), p. 806. Hinge of left valve of specimen No. 52545; × 9. Turned up to show posterior tooth.

5. The same. Interior of the same valve; × 4½.

6. *Cuspidaria formosa* Verrill and Bush, p. 803. Hinge of both valves of type specimen No. 78313; × 4½. The right valve is badly broken.

7. *Cuspidaria arctica* (M. Sars) Dall, p. 803. Hinge of a left valve from station 70; × 4½.

8. *Myonera limatula* Dall, p. 812. Dorsal view of specimen No. 38171; × 9.

9. *Cuspidaria parva* Verrill and Bush, p. 801. Hinge of both valves of type specimen from station 2203; × 30.

10. *Cuspidaria lamellosa* (M. Sars) Dall, p. 799. Hinge of both valves of specimen No. 51292; × 30. Resilium and ossicle are attached in the right valve.

11. *Cardiomya gemma* Verrill and Bush, p. 809. Hinge of both valves of type specimen No. 41456; × 22. Resilium and ossicle attached in the left valve.

PLATE LXXV.

Fig. 1. *Limopsis minuta* (Philippi), p. 846. Hinge of right valve of specimen No. 76320; × 9.

2. *Limopsis affinis* Verrill, p. 846. Hinge of right valve of specimen No. 44829; × 9.

3. *Limopsis aurita* (Brocchi), p. 846. Hinge of a right valve from station 2385; × about 11.

4. *Limopsis profundicola* Verrill and Bush, p. 847. Hinge of right valve of a young specimen No 52410; × 9.

5. *Limopsis plana* Verrill, p. 846. Hinge of right valve of specimen No. 35238; × 9.

6. *Cuspidaria fraterna* Verrill and Bush, p. 803. Hinge of both valves of type specimen from station 892; × 9.

7. *Cuspidaria obesa* (Lovén) Smith, p. 804. Hinge of right valve of specimen No. 48967; × 9.

8. *Cuspidaria pellucida* (Stimpson) Verrill and Bush, p. 805. Hinge of both valves of specimen No. 48977 from Grand Manan; × 22.

9. *Cuspidaria glacialis* (G. O. Sars) Dall, p. 800. Hinge of right valve of a fully grown specimen No. 49032 to show truncated end of tooth; × 4½.

PLATE LXXVI.

Fig. 1. *Poromya sublevis* Verrill, variety *microdonta* Dall, p. 813. End view of right valve of specimen No. 52533; × 3.

2. The same. Interior of the same; × 3.

3. *Cardiomya glypta* Bush, p. 810. Hinge of right valve of an adult specimen from station 2108; × 22.

4. *Myonera gigantea* Verrill, p. 811. Hinge of right valve of type specimen No. 35255; × 1½.

5. The same. Exterior of the same; × 1½.

6. *Cuspidaria ventricosa* Verrill and Bush, p. 802. Interior of a left valve No. 78783; × 3.

Fig. 7. *Cardiomya glypta* Bush, p. 810. Hinge of both valves of a young specimen No. 35362; × 22.

8. *Cuspidaria pellucida* (Stimpson) Verrill and Bush, p. 805. Interior of left valve of specimen No. 48977; × 12.

9. *Bathyarca abyssorum* Verrill and Bush, p. 843. Interior of left valve of specimen No. 78793; × 6.

PLATE LXXVII.

Fig. 1. *Macoma inflata* Dawson, p. 778. Hinge of both valves of specimen No. 52429; × 5½.

2. *Yoldiella lucida* (Lovén) Verrill and Bush, p. 861. Hinge of right valve of specimen No. 73173; × about 13.

3. *Yoldiella subangulata* Verrill and Bush, p. 865. Hinge of left valve of type specimen from station 46 *Bache*; × about 13.

4. *Cuspidaria turgida* Verrill and Bush, p. 799. Interior of left valve of type specimen No. 78789; × 4.

5. *Myonera* (?) *pretiosa* Verrill and Bush, p. 812. Exterior of a left valve from station 2655; × 10.

6. *Bathyarca pectunculoides* (Scacchi) Kobelt, variety *septentrionalis* Sars, p. 845. Hinge of left valve of specimen No. 74116; × 10.

7. *Cuspidaria parva* Verrill and Bush, p. 801. Interior of right valve of type specimen from station 2203; × about 26.

8. *Bathyarca anomala* Verrill and Bush, p. 844. Hinge of right valve of type specimen No. 74081; × 10.

9. *Cardiomya abyssicola* Verrill and Bush, p. 806. Exterior of left valve of specimen No. 52396; × 6½.

10. *Halonympha striatella* Verrill and Bush, p. 810. Exterior of a right valve from station 2655; × 10.

PLATE LXXVIII.

Fig. 1. *Tindaria callistiformis* Verrill and Bush, p. 881. Exterior of right valve of type specimen No. 52536; × 6.

2. *Bathyarca profundicola* (Verrill), p. 844. Interior of right valve of specimen No. 52174; × 6.

3. *Cuspidaria undata* Verrill, p. 798. Exterior of right valve of specimen No. 52547; × 2.

4. The same. Dorsal view of the same specimen.

5. *Microyoldia regularis* (Verrill), p. 860. Exterior of left valve of type specimen No. 38420; × 20.

6. The same. Interior of right valve of the same specimen.

7. *Limopsis minuta* (Philippi), p. 846. Interior of right valve of specimen No. 76320; × 4.

8. *Yoldiella dissimilis* Verrill and Bush, p. 872. Exterior of left valve of type specimen No. 38416; × 15.

PLATE LXXIX.

Fig. 1. *Periploma undulata* Verrill, p. 823. Hinge of left valve of type specimen No. 44840; × 7½.

2. *Yoldiella minuscula* Verrill and Bush, p. 870. Exterior of right valve of specimen No. 38415; × 12.

3. *Yoldiella inconspicua* Verrill and Bush, p. 869. Exterior of right valve of a specimen from station 947; × 9.

4. *Yoldiella frigida* (Torell), p. 872. Interior of left valve of a specimen from station 943; × 16.

Fig. 5. *Yoldiella inconspicua* Verrill and Bush, p. 869. Interior of left valve of a specimen from station 947; × 15.

6. *Yoldiella subangulata* Verrill and Bush, p. 865. Exterior of right valve of type specimen from station 46 *Bache*; × 7½.

7. *Yoldiella minuscula* Verrill and Bush, p. 870. Interior of left valve of specimen No. 38415; × 22.

8. *Leda bushiana* Verrill and Smith, p. 854. Exterior of right valve of type specimen No. 35729; × about 3.

9. *Cuspidaria formosa* Verrill and Bush, p. 803. Interior of left valve of type specimen No. 78313; × 3.

10. *Martesiella fragilis* Verrill and Bush, p. 777. Exterior of right valve of a specimen from near station 2566; × 6.

PLATE LXXX.

Fig. 1. *Yoldiella iris* Verrill and Bush, variety *stricta* Verrill and Bush, p. 864. Exterior of right valve of type specimen No. 74325; × about 13.

2. *Yoldiella iris* Verrill and Bush, p. 863. Interior of a left valve from station 895; × 11.

3. *Yoldiella lucida* (Lovén) Verrill and Bush, p. 861. Exterior of left valve of specimen No. 73173; × about 6½.

4. *Adranella casta* Verrill and Bush, p. 858. Interior of a left valve from station 2150; × 11.

5. *Yoldiella fraterna* Verrill and Bush, p. 867. Exterior of left valve of type specimen from station 947; × about 13.

6. *Tindaria callistiformis* Verrill and Bush, p. 881. Hinge of right valve of type specimen No. 52536; × 8.

7. The same. Turned up to show shape of teeth.

8. *Yoldiella inflata* Verrill and Bush, p. 864. Exterior of left valve of type specimen No. 38417; × about 5½.

9. *Yoldiella lenticula* (Möller) variety *amblia* Verrill and Bush, p. 866. Exterior of left valve of a specimen from station 186; × 10.

10. *Neilonella subovata* Verrill and Bush, p. 878. Exterior of left valve of specimen No. 34826; × 11.

PLATE LXXXI.

Fig. 1. *Ledella parva* Verrill and Bush, p. 857. Interior of a right valve No. 78365; × 25.

2. *Nucula granulosa* Verrill, p. 853. Hinge of right valve of type specimen No. 38451; × about 16.

3. *Nucula cancellata* Jeffreys, p. 854. Hinge of right valve of specimen No. 45795; × about 13.

4. *Yoldiella lenticula* (Möller) variety *amblia* Verrill and Bush, p. 866. Interior of a right valve from station 186; × 12.

5. *Yoldiella jeffreysi* (Hidalgo), p. 866. Interior of right valve of specimen No. 78958; × about 13.

6. *Nucula proxima* Say (?) variety *ovata* Verrill and Bush, p. 852. Hinge of right valve of specimen No. 73467; × about 16.

7. *Ledella messanensis* (Seguenza) variety *sublevis* Verrill and Bush, p. 856. Hinge of left valve of specimen No. 35212; × about 16.

8. *Nucula subovata* Verrill and Bush, p. 852. Interior of left valve of type specimen No. 40474; × about 13. Showing resilium attached to pit.

9. *Ledella messanensis* (Seguenza), p. 856. Hinge of left valve of specimen No. 52156; × about 16.

PLATE LXXXII.

Fig. 1. *Leda caudata* (Donovan), p. 855. Interior of right valve of specimen No. 38205; × about 5½.
2. *Leda pernula* (Müller), p. 855. Hinge of right valve of specimen No. 73077; × about 5½.
3. *Neilonella subovata* Verrill and Bush, p. 878. Hinge of left valve of specimen No. 34326; × about 10.
4. The same. Turned up to show shape of teeth.
5. *Yoldiella inflata* Verrill and Bush, p. 864. Hinge of a left valve No. 35575; × about 10. Turned up to show shape of teeth.
6. The same. Front view.
7. *Yoldiella dissimilis* Verrill and Bush, p. 872. Hinge of a left valve No. 38416; × 20.
8. *Yoldiella fraterna* Verrill and Bush, p. 867. Hinge of right valve of type specimen from station 947; × 20.
9. *Leda bushiana* Verrill, p. 854. Hinge of both valves of type specimen No. 35729; × about 6½.
10. *Malletia polita* Verrill and Bush, p. 876. Hinge of a left valve No. 78792; × about 6½. Some of the teeth are broken away just behind the beak.
11. *Yoldiella iris* Verrill and Bush, p. 863. Hinge of left valve of a young specimen; × 20.

PLATE LXXXIII.

Fig. 1. *Crenella fragilis* Verrill, p. 847. Interior of right valve of type specimen No. No. 41543; × about 3.
2. The same. Hinge of another larger, imperfect specimen No. 40676; × about 3.
3. *Yoldiella jeffreysi* (Hidalgo), p. 866. Exterior of a left valve No. 78958; × about 13.
4. *Limopsis profundicola* Verrill and Bush, p. 847. Interior of a right valve of a young specimen No. 38143; × about 3.
5. *Nucula subovata* Verrill and Bush, p. 852. Exterior of left valve of type specimen No. 40476; × about 13.
6. *Abra longicallis* (Scacchi) variety *americana* Verrill and Bush, p. 778. Interior of right valve of specimen No. 52170; × about 3.
7. The same. Hinge of both valves of the same specimen; × about 8.

PLATE LXXXIV.

Figs. 1 and 2. *Chlamys benedicti* Verrill and Bush, p. 834. Exterior of both valves of a young specimen found among Foraminifera; × 20.

PLATE LXXXV.

Fig. 1. *Cyclopecten leptaleus* Verrill, p. 839. Portion of upper or left valve of type specimen No. 38413 to show character of sculpture; × 10.
2. *Cyclopecten nanus* Verrill and Bush, p. 837. Exterior of lower or right valve of a young specimen from station 2265; × 5.
3. The same. Exterior of left valve of a larger specimen from the same station; × 5.
4. The same. Hinge of the same valve; × 13.
5. *Cyclopecten pustulosus* Verrill, p. 839. Portion of left valve of specimen No. 48765 to show character of sculpture; × 10.
6. The same. Piece of a left valve of another specimen No. 48761 to show variation in form of pustules; × about 13.
7. *Camptonectes grœnlandica* (Sowerby) Verrill, p. 837. Exterior of right valve of specimen No. 78387; × 5.

Fig. 8. *Cyclopecten subimbrifer* Verrill and Bush, p. 840. Portion of left valve of specimen No. 48762 to show character of sculpture; × 10;

9. The same. Exterior of left valve of specimen No. 48766 from off Nova Scotia, in 190 fathoms; × 3.

10. *Cyclopecten pustulosus* Verrill, p. 839. Exterior of left valve of type specimen No. 48764; × 3.

11. The same. Exterior of right valve of another specimen; × 3.

PLATE LXXXVI.

Fig. 1. *Solemya grandis* Verrill and Bush, p. 885. Exterior of left valve of type specimen No. 51345; × 1½.

2. The same. Interior of right valve of an imperfect specimen No. 40103; × 1½. Epidermal fringe restored from other specimen.

3. *Cryptodon* (*Axinulus*) *pygmæus* Verrill and Bush, p. 792. Exterior of left valve of specimen No. 78368 from station 2697; × 22.

4. The same. Interior of right valve of a smaller specimen from the same station; × 22.

5. *Nucula cancellata* Jeffreys, p. 854. Exterior of left valve of specimen No. 45795; × 12.

6. *Chlamys costellata* Verrill and Bush, p. 835. Exterior of right valve of type specimen No. 52471; × 9.

PLATE LXXXVII.

Fig. 1. *Poromya sublevis* Verrill, variety *microdonta* Dall, p. 813. Hinge of a left valve No. 78799; × 5.

2. *Verticordia granulifera* (Verrill) Dall, p. 816. Interior of a left valve (type specimen) No. 44838; × 4.

3. *Lyonsiella subquadrata* (Jeffreys), p. 817. Interior of a left valve No. 78800; × 10.

4. *Periploma affinis* Verrill and Bush, p. 822. Exterior of right valve of type specimen from station 873; × 4.

5. *Periploma undulata* Verrill, p. 823. Exterior of left valve of type specimen No. 44840; × 4.

6. *Propeamusium thalassinum* (Dall) Verrill, p. 841. Exterior of upper or left valve of a specimen from station 949; × 16.

7. *Cryptodon* (*Axinulus*) *ferruginosus* (Forbes), p. 793. Interior of right valve of specimen No. 34860; × 12.

8. The same. Interior of left valve of the same specimen.

PLATE LXXXVIII.

Fig. 1. *Cryptodon croulinensis* (Jeffreys) Smith, variety *altus* Verrill and Bush, p. 787. Exterior of a left valve from Eastport, Maine, 1870; × about 8.

2. The same. Interior of a right valve from the same locality; × about 8.

3. *Cryptodon planus* Verrill and Bush, p. 788. Interior of left valve of type specimen from station 254; × 14.

4. The same. Exterior of right valve of the same specimen.

5. *Nucula proxima* Say (?) variety *ovata* Verrill and Bush, p. 852. Exterior of left valve of specimen No. 73467; × about 12.

6. *Macoma inflata* Dawson, p. 778. Exterior of left valve of specimen No. 52427; × 3.

7. *Kennerlia brevis* Verrill and Bush, p. 821. *a*, Exterior of left valve of specimen No. 40232; *b*, interior of right valve of another specimen No. 45884; × 4.

8. *Nucula granulosa* Verrill, p. 853. Exterior of left valve of type specimen No. 38451; × about 26.

PLATE LXXXIX.

Fig. 1. *Cryptodon obsoletus* Verrill and Bush, p. 789. Exterior of right valve of a specimen from station 949; × about 20.
2. The same. Interior of left valve of the same specimen.
3. *Leptaxinus minutus* Verrill and Bush, p. 797. Hinge of left valve of type specimen No. 45686; × 45.
4. The same. Hinge of right valve of the same specimen.
5. The same. Interior of the same valve; × 30.
6. *Cryptodon plicatus* Verrill, p. 786. Interior of left valve of a young specimen No. 44826; × 9.
7. *Cryptodon* (*Axinulus*) *brevis* Verrill and Bush, p. 790. Exterior of left valve of type specimen from station 2208; × about 22.
8. The same. Interior of right valve of the same specimen.

PLATE XC.

Fig. 1. *Cryptodon* (*Axinulus*) *inequalis* Verrill and Bush, p. 791. Exterior of right valve of type specimen from stations 98–99; × about 10.
2. The same. Interior of left valve of the same specimen.
3. *Cryptodon croulinensis* (Jeffreys) Smith, p. 786. Interior of left valve of a specimen from stations 62–65; × about 13.
4. The same. Exterior of right valve of the same specimen.
5. *Axinodon ellipticus* Verrill and Bush, p. 796. Exterior of right valve of type specimen No. 35175; × about 13.
6. The same. Interior of left valve of the same specimen.
7. *Tellimya ferruginosa* (Montagu), p. 783. Interior of left valve of specimen No. 49588; × 20. *a*, Cartilage.
8. The same. Interior of right valve of the same specimen.

PLATE XCI.

Fig. 1. *Cryptodon insignis* Verrill and Bush, p. 785. Interior of a left valve No. 52733 from station 2499; × about 1½.
2. The same. Exterior of a left valve from the same station; × about 1½.
3. *Montacuta triquetra* Verrill and Bush, p. 782. Interior of right valve of type specimen from station 2307; × 24.
4. *Montacuta cuneata* Verrill and Bush, p. 782. Exterior of right valve of a specimen from station 2278; × 17.
5. *Cryptodon equalis* Verrill and Bush, p. 788. Hinge of both valves of a specimen from station 18 *Bache;* × about 5.
6. The same. Exterior of left valve of specimen No. 74302; × about 5.
7. *Cryptodon* (*Axinulus*) *ovatus* Verrill and Bush, p. 793. Interior of left valve of type specimen from station 949; × 35.
8. *Kelliella nitida* Verrill, p. 778. Interior of left valve of specimen No. 37971; × 14.

PLATE XCII.

Fig. 1. *Axinodon ellipticus* Verrill and Bush, p. 796. Hinge of left valve of type specimen No. 35175; × about 26½.
2. *Limopsis sulcata* Verrill and Bush, p. 845. Interior of a right valve from station 2199; × 4.
3. *Cryptodon* (*Axinulus*) *simplex* Verrill and Bush, p. 791. Hinge of right valve of type specimen from station 1093; × about 13.
4. The same. Interior of left valve of the same specimen.
5. *Axinopsis orbiculata* Sars, variety *inequalis* Verrill and Bush, p. 794. Interior of left valve of type specimen from Eastport, Maine, 1872; × about 13.

Fig. 6. The same. Hinge of both valves of the same specimen; × about 26.
7. *Montacuta bidentata* (Montagu) variety *tenuis* Verrill and Bush, p. 779. Interior of a right valve from station 2277; × about 13.
8. *Montacuta bidentata* (Montagu) variety *fragilis* Verrill and Bush, p. 780. Interior of a right valve No. 46134; × 17.
9. *Montacuta ovata* Jeffreys, p. 781. Interior of a right valve No. 46136; × 20.
10. The same. Interior of a left valve No. 46137; × 20.

PLATE XCIII.

Fig. 1. *Cryptodon* (*Axinulus*) *ovatus* Verrill and Bush, p. 793. Hinge of both valves of type specimen from station 949; × 45.
2. *Kelliopsis elevata* (Stimpson) Verrill and Bush, p. 784. Hinge of a right valve No. 74333 from Naushon; × 30. *a*, Resilium and ossicle.
3. The same. Hinge of another right valve from the same station, to show variation; × 30.
4. The same. Hinge of both valves of another specimen from the same station; × 30.
5. *Montacuta cuneata* Verrill and Bush, p. 782. Hinge of both valves from station 2278; × 30.
6. *Montacuta tumidula* Jeffreys, p. 781. Hinge of a left valve No. 35412; × 30. *a*, Resilium and ossicle.
7. *Montacuta bidentata* (Montagu), p. 779. Hinge of a right valve No. 74328 from Naushon; × 30.
8. The same. Hinge of both valves of a smaller specimen from the same station; × 30.
9. *Montacuta striatula* Verrill and Bush, p. 780. Hinge of a left valve from station 2276; × 30. Hinge of a right valve from station 2273; × 30.
10. *Kelliella nitida* Verrill, p. 778. Hinge of both valves of specimen No. 37971; × 12. Right valve turned down, left turned up

PLATE XCIV.

Fig. 1. *Montacuta tumidula* Jeffreys, p. 781. Interior of a left valve No. 35412 from station 2103; × 20. *a*, Resilium and ossicle.
2. The same. Interior of a right valve from the same station; × 20.
3. *Kellia suborbicularis* (Montagu), p. 779. Interior of left valve of a specimen from off Salem, Massachusetts, 1877; × 10.
4. The same. Interior of right valve of the same specimen.
5. *Montacuta casta* Verrill and Bush, p. 781. Exterior of a left valve from station 2283; × 20.
6. *Montacuta bidentata* (Montagu), p. 779. Interior of a right valve No. 74328; × about 13.
7. *Kelliopsis elevata* (Stimpson) Verrill and Bush, p. 784. Interior of a right valve No. 74333 from Naushon; × about 13. *a*, Resilium and ossicle.
8. The same. Exterior of a left valve from the same station; × about 13.

PLATE XCV.

Fig. 1. *Lyonsia granulifera* Verrill and Bush, p. 818. Exterior of a left valve (type specimen) No. 52561; × about 2½.
2. *Verticordia granulifera* (Verrill) Dall, p. 816. Hinge of a left valve (type specimen) No. 44838; × 8.
3. The same. Hinge of both valves of a fully grown specimen No. 78679; × 4. Turned up to show ossicle, *a*.
4. The same. Hinge of a right valve of another specimen No. 78929; × 6½.

Fig. 5. *Clidiophora inornata* Verrill and Bush, p. 819. Hinge of both valves of specimen No. 49760 from station 327; × about 2½.

6. The same. Exterior of a left valve of a specimen from the same station; × about 2½.

7. *Lyonsiella cordata* Verrill and Bush, p. 818. Hinge of left valve of type specimen No. 52540; × 8. *a*, Ossicle; *b*, ligament.

8. The same. Exterior of right valve of the same specimen; × about 4.

9. *Limopsis sulcata* Verrill and Bush, p. 845. Hinge of a right valve from station 2199; × about 10½.

10. *Nucula verrillii* Dall, p. 853. Hinge of left valve of specimen No. 45752; × about 26.

PLATE XCVI.

Fig. 1. *Limopsis sulcata* Verrill and Bush, p. 845. Exterior of a right valve from station 2199; × 16.

2. *Choristodon* (?) *cancellatus* Verrill, p. 778. Hinge of a left valve (type specimen) No. 44839; × 16.

3. The same. Exterior of the same valve; × 6.

PLATE XCVII.

Fig. 1. *Glomus nitens* Jeffreys, p. 848. Interior of left valve of specimen No. 78784; × 12.

2. The same. Hinge of the same; × 20.

3. *Yoldiella expansa* (Jeffreys), p. 871. Interior of right valve of specimen No. 78363; × 16.

4. *Malletia obtusa* (M. Sars) Mörch, p. 874. Interior of left valve of a very young specimen from station 2706; × 20.

5. *Axinopsis cordata* Verrill and Bush, p. 795. Interior of a left valve from station 2307; × 16.

6. The same. Interior of a right valve from station 1092; × 16.

7. *Malletia abyssorum* Verrill and Bush, p. 875. Interior of right valve of type specimen No. 52159; × 12.

8. *Yoldiella curta* Verrill and Bush, p. 868. Interior of right valve of type specimen No. 38457; × 20.

9. *Hyalopecten dilectus* Verrill and Bush, p. 836. A portion of the exterior of both valves of type specimen No. 52539; × 8.

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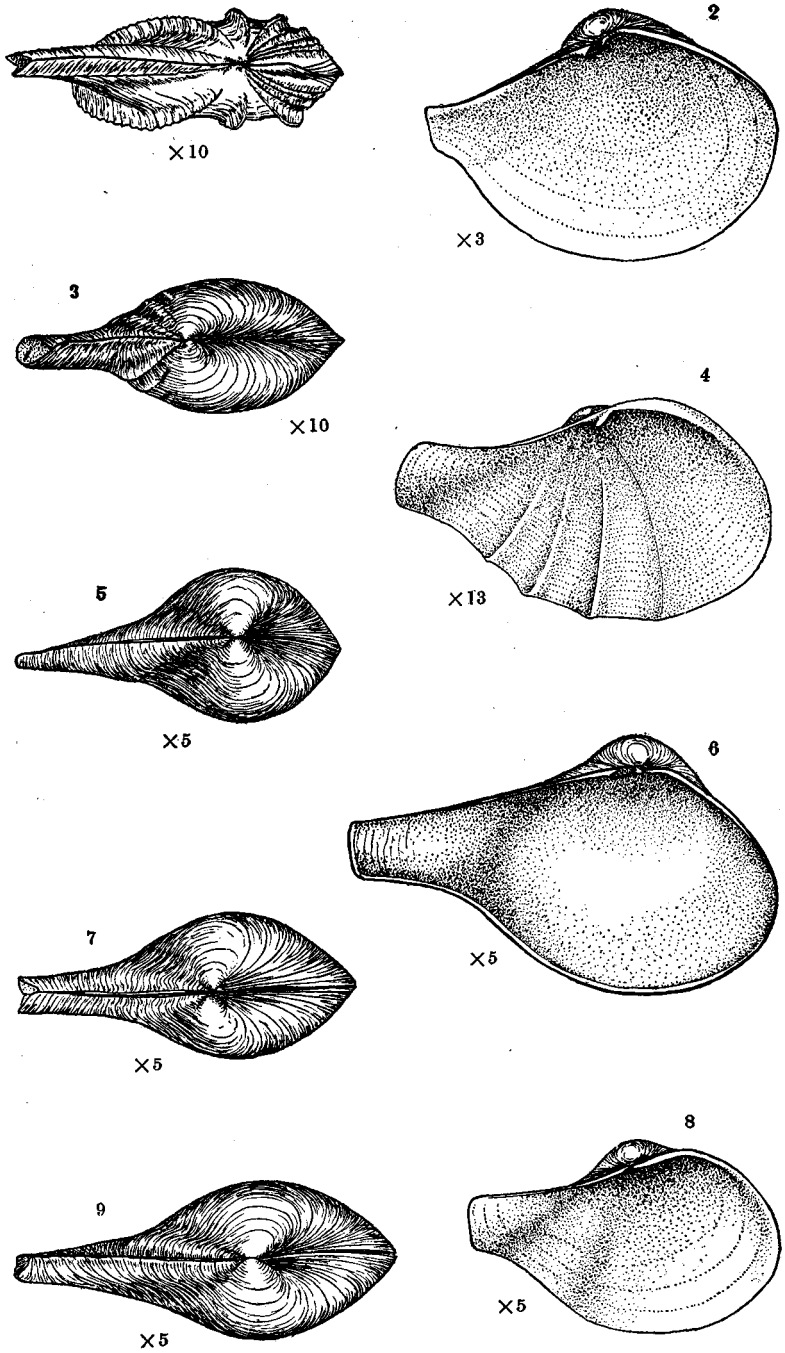

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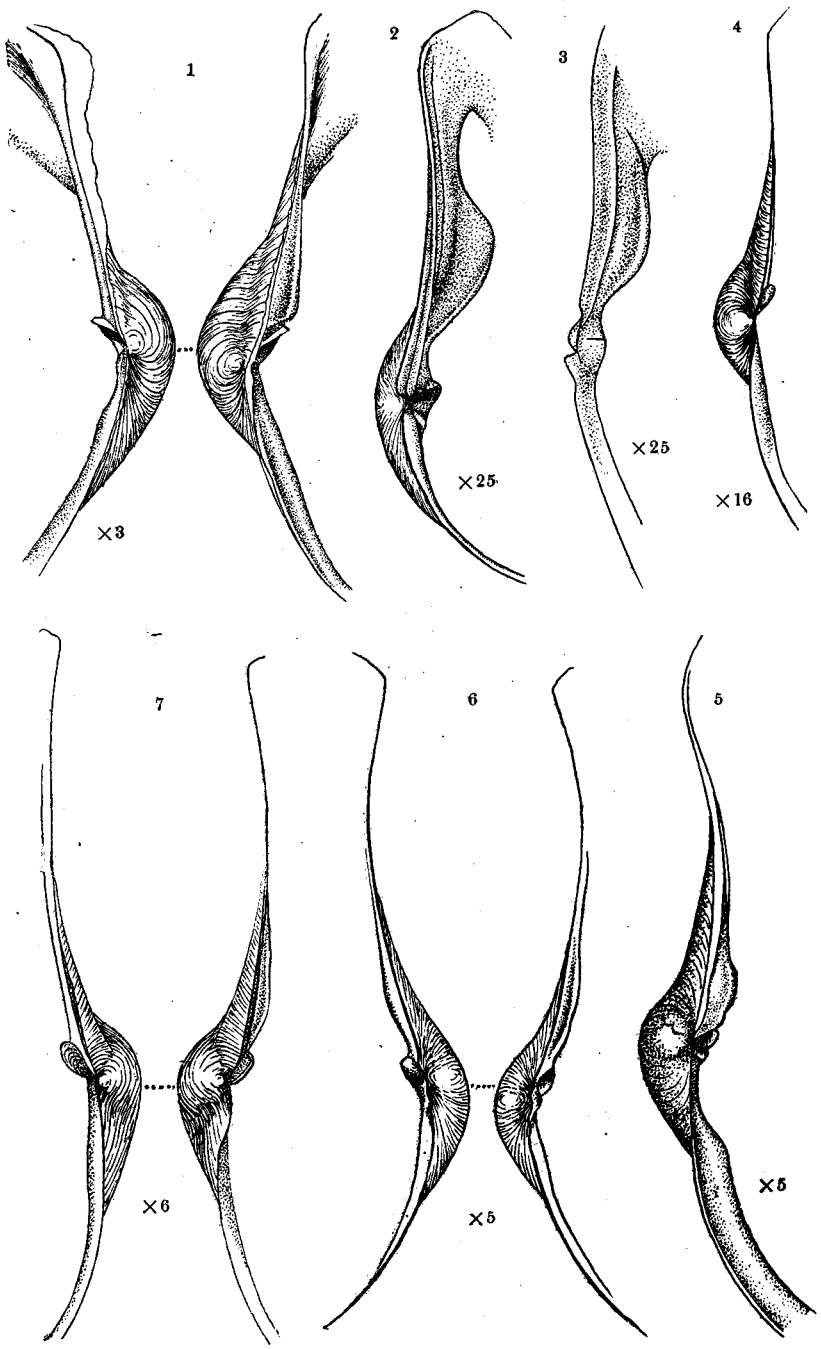
FOR EXPLANATION OF PLATE SEE PAGE 888.



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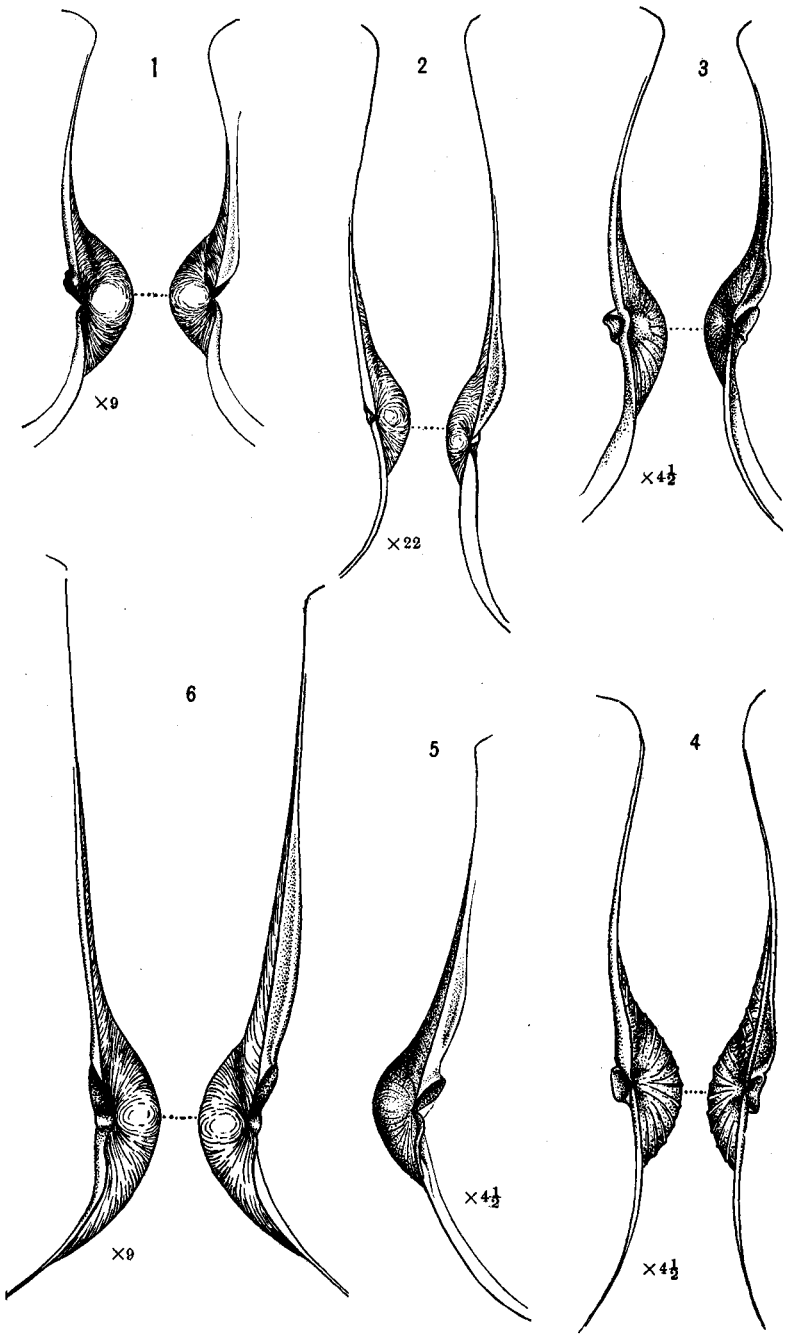

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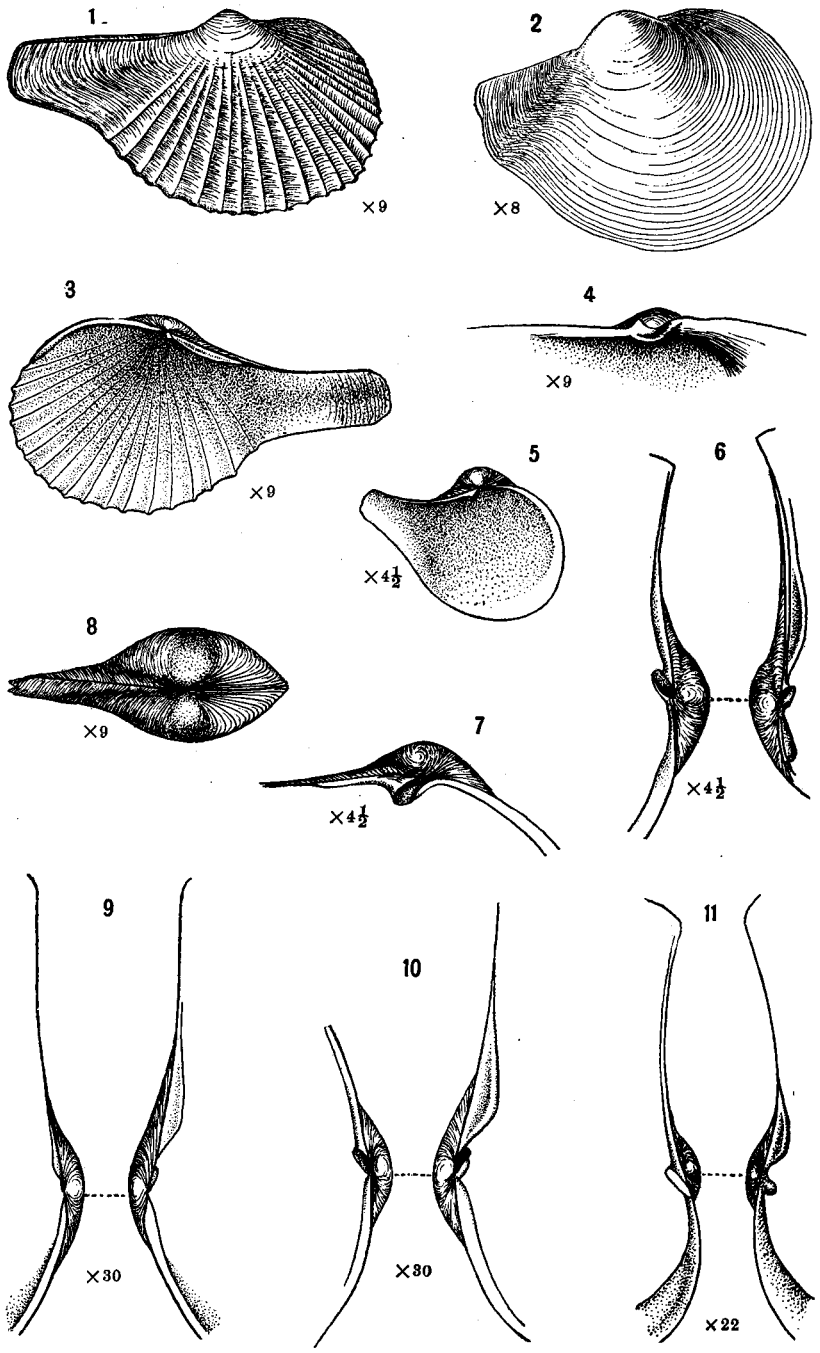

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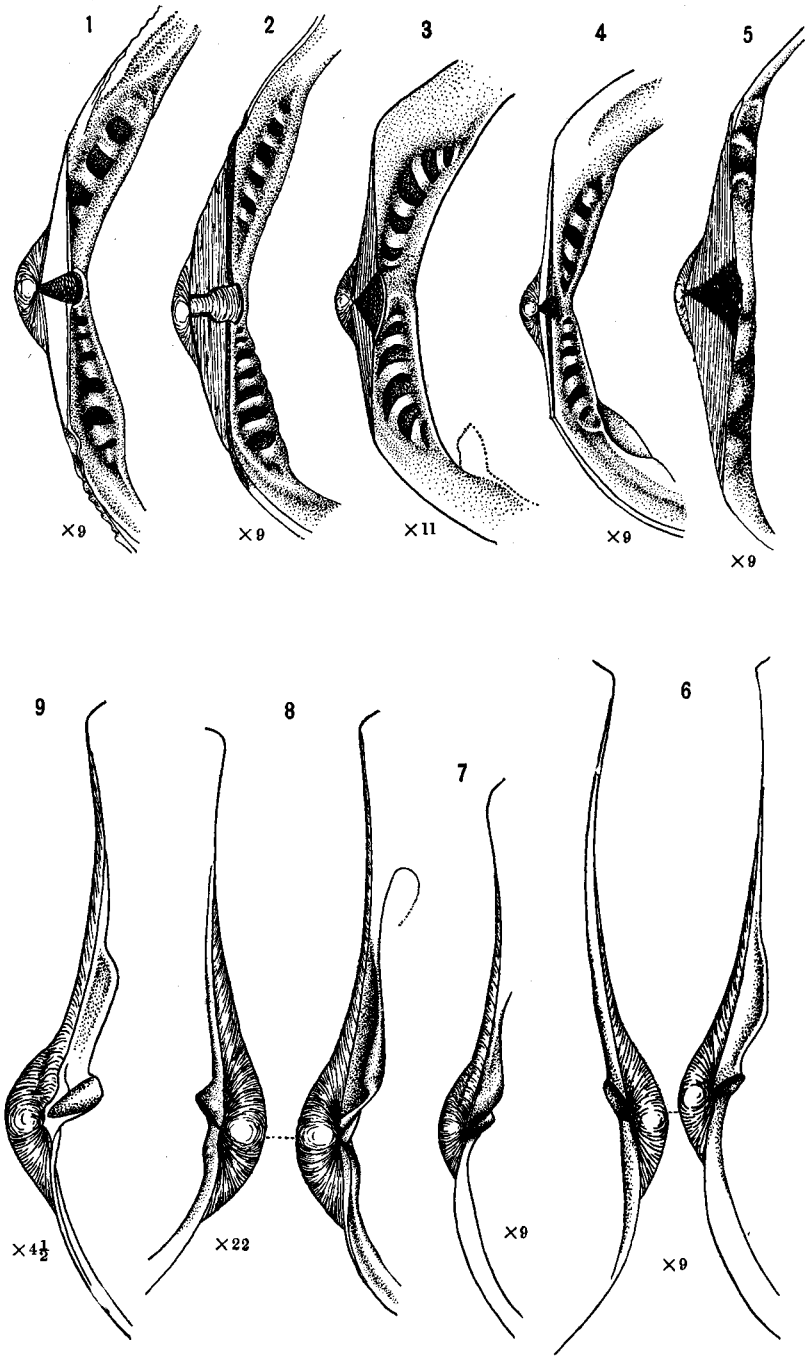
FOR EXPLANATION OF PLATE SEE PAGE 889.



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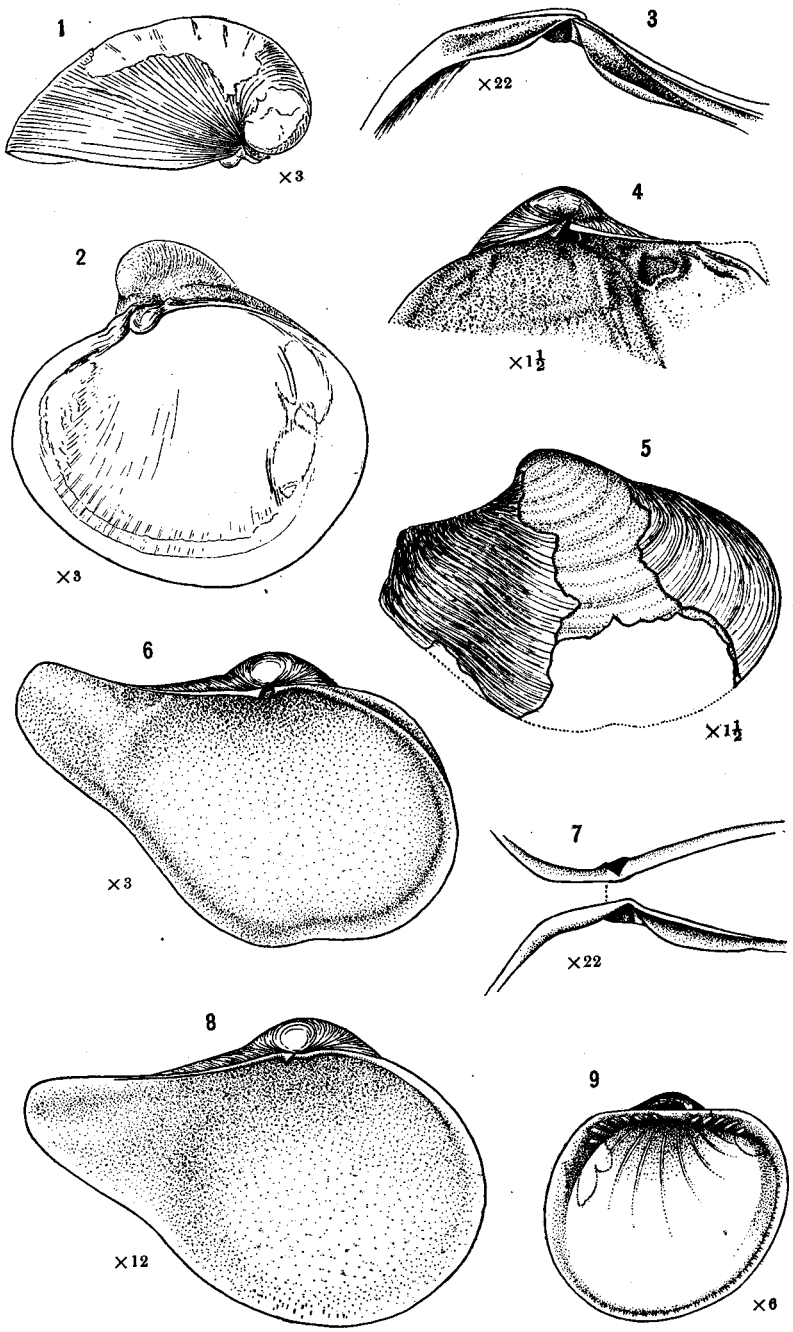

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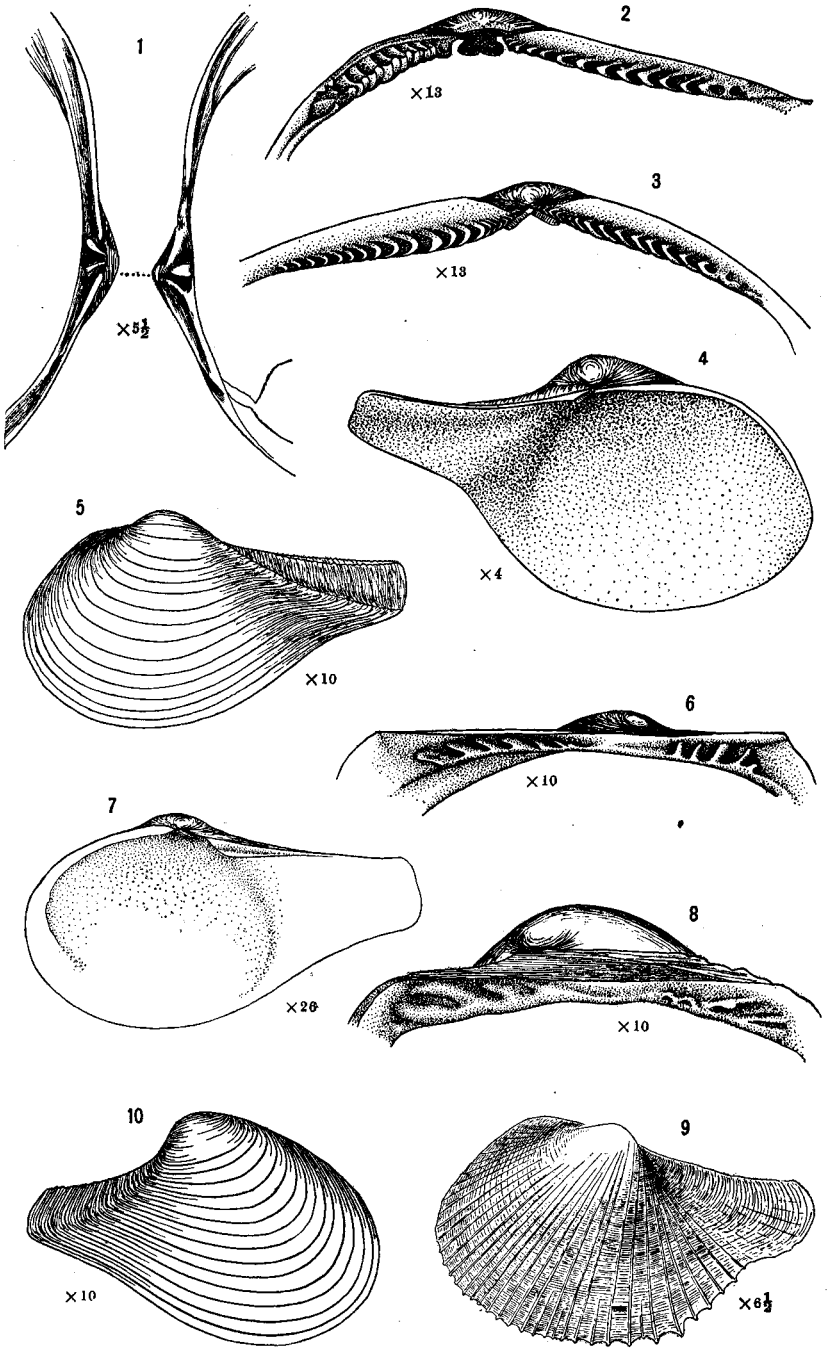
FOR EXPLANATION OF PLATE SEE PAGES 889, 890.



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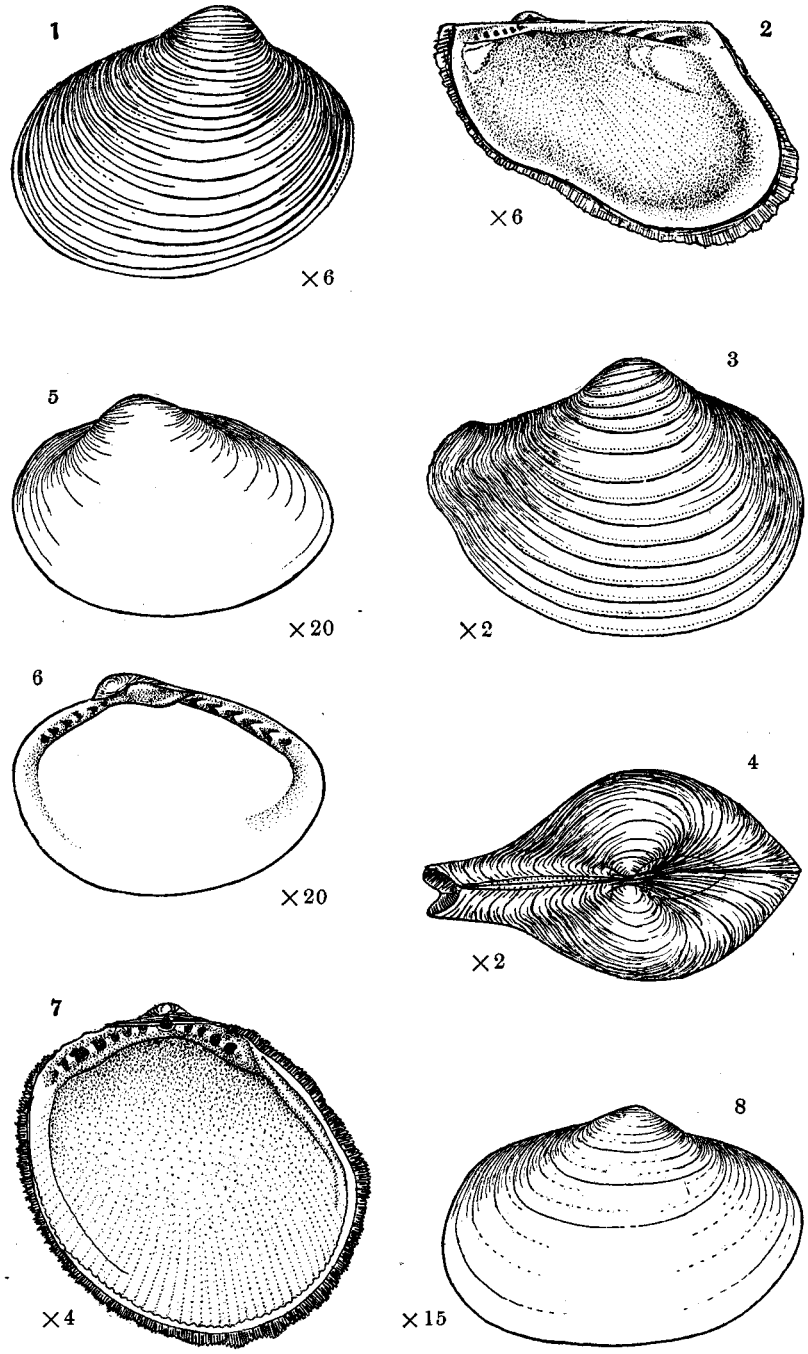

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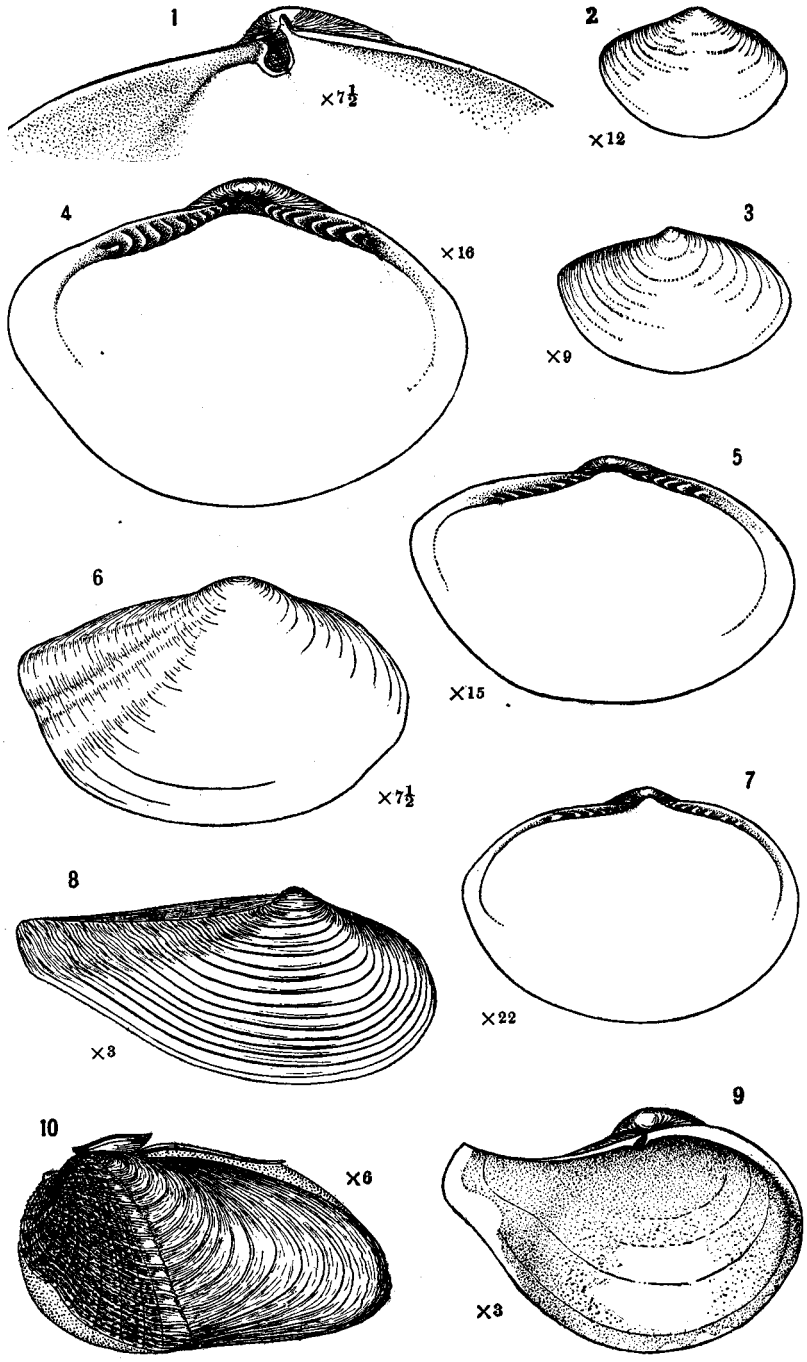

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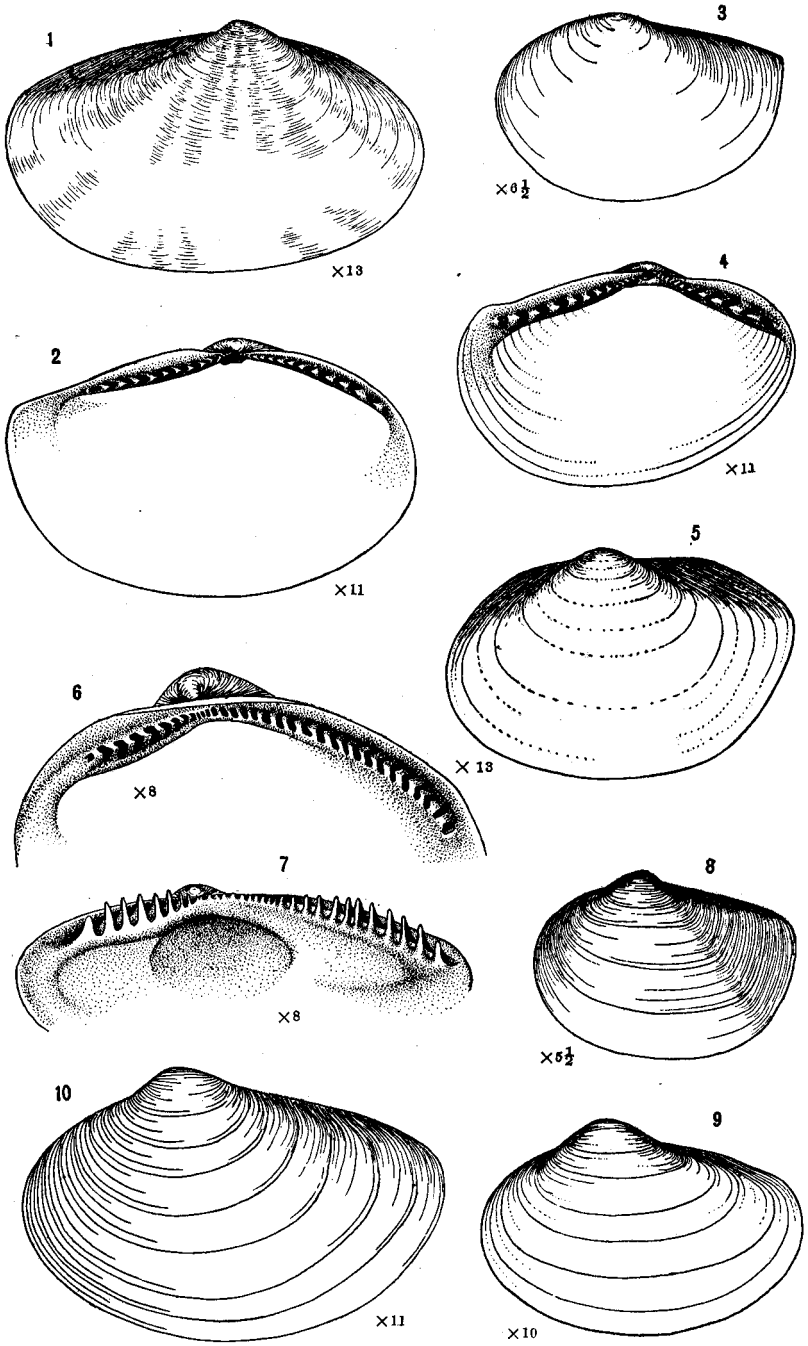
FOR EXPLANATION OF PLATE SEE PAGES 890, 891.



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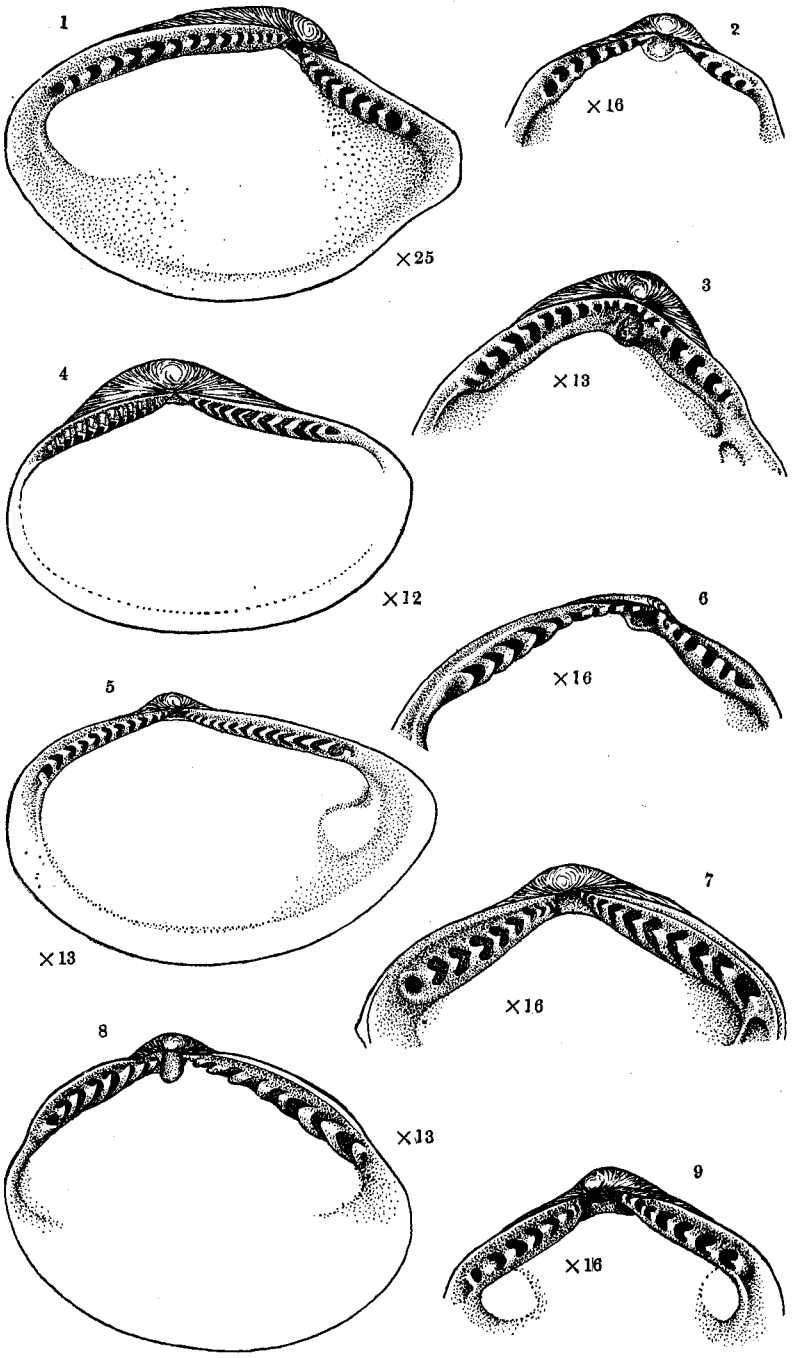

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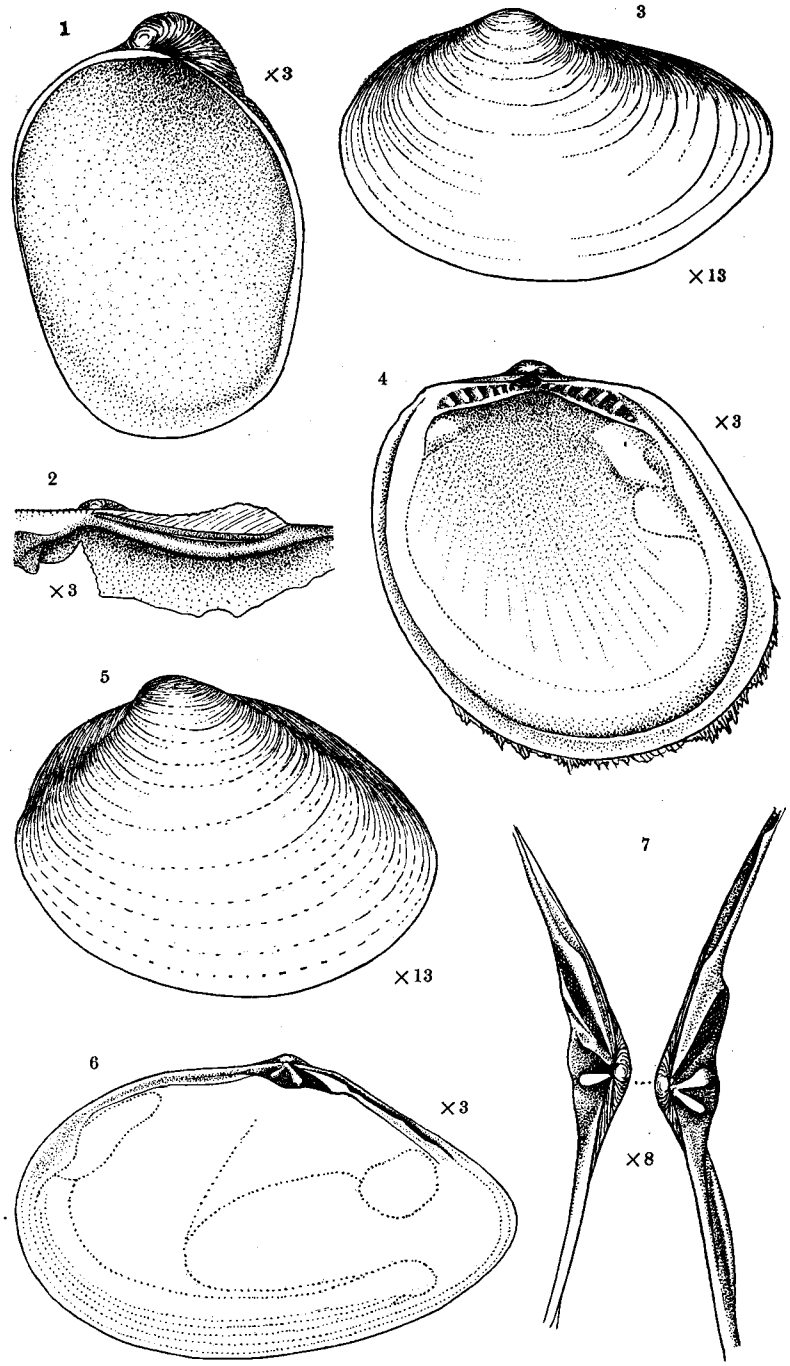

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FOR EXPLANATION OF PLATE SEE PAGE 892.

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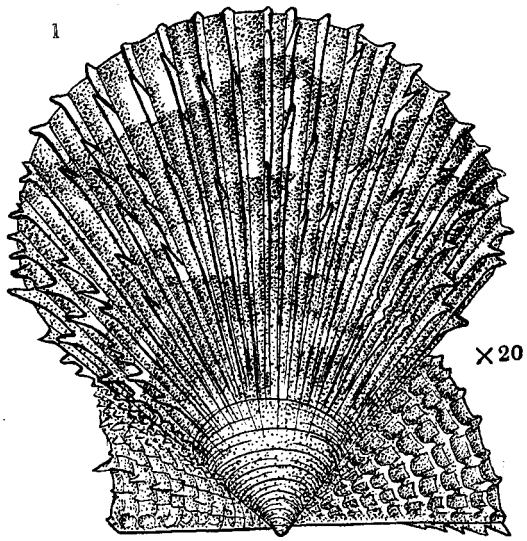

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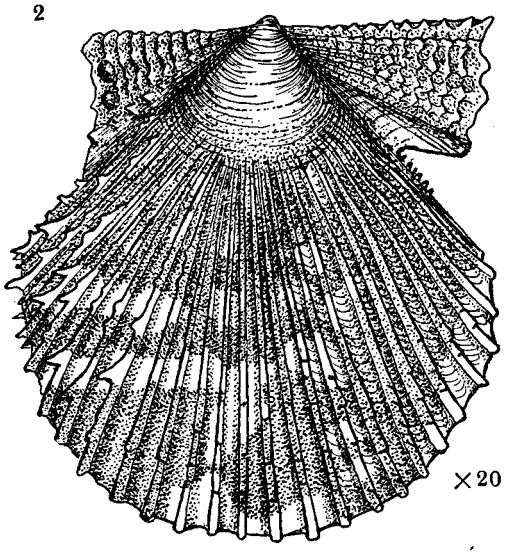

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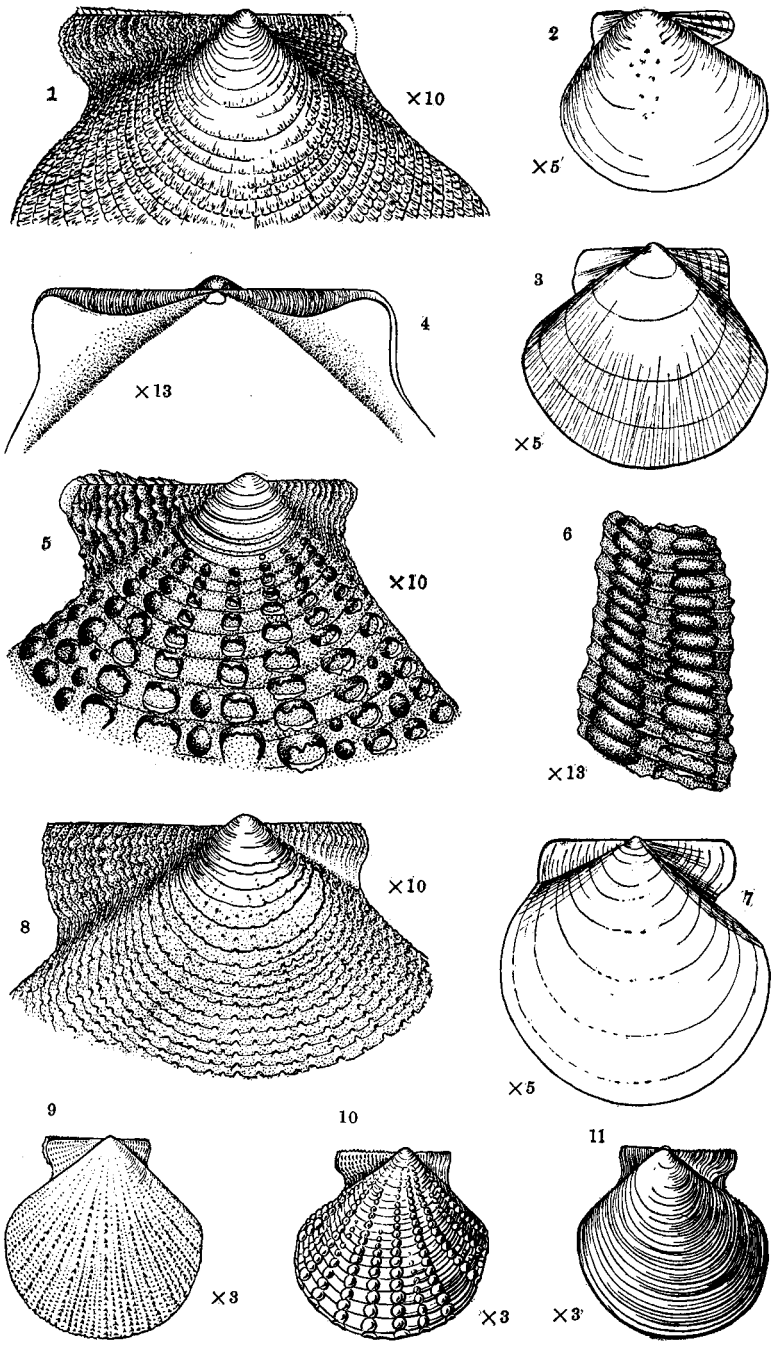
FOR EXPLANATION OF PLATE SEE PAGE 892.



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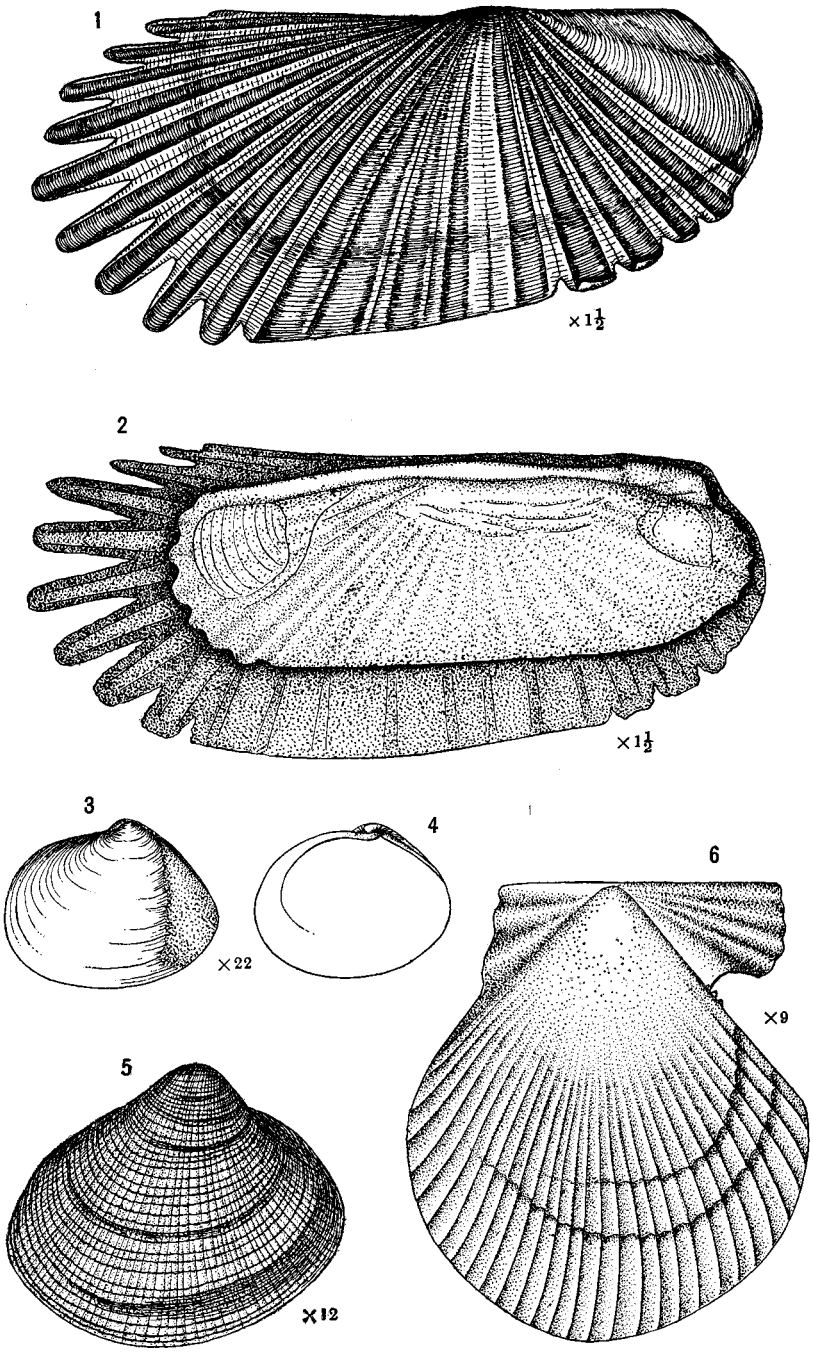
FOR EXPLANATION OF PLATE SEE PAGES 892, 893.



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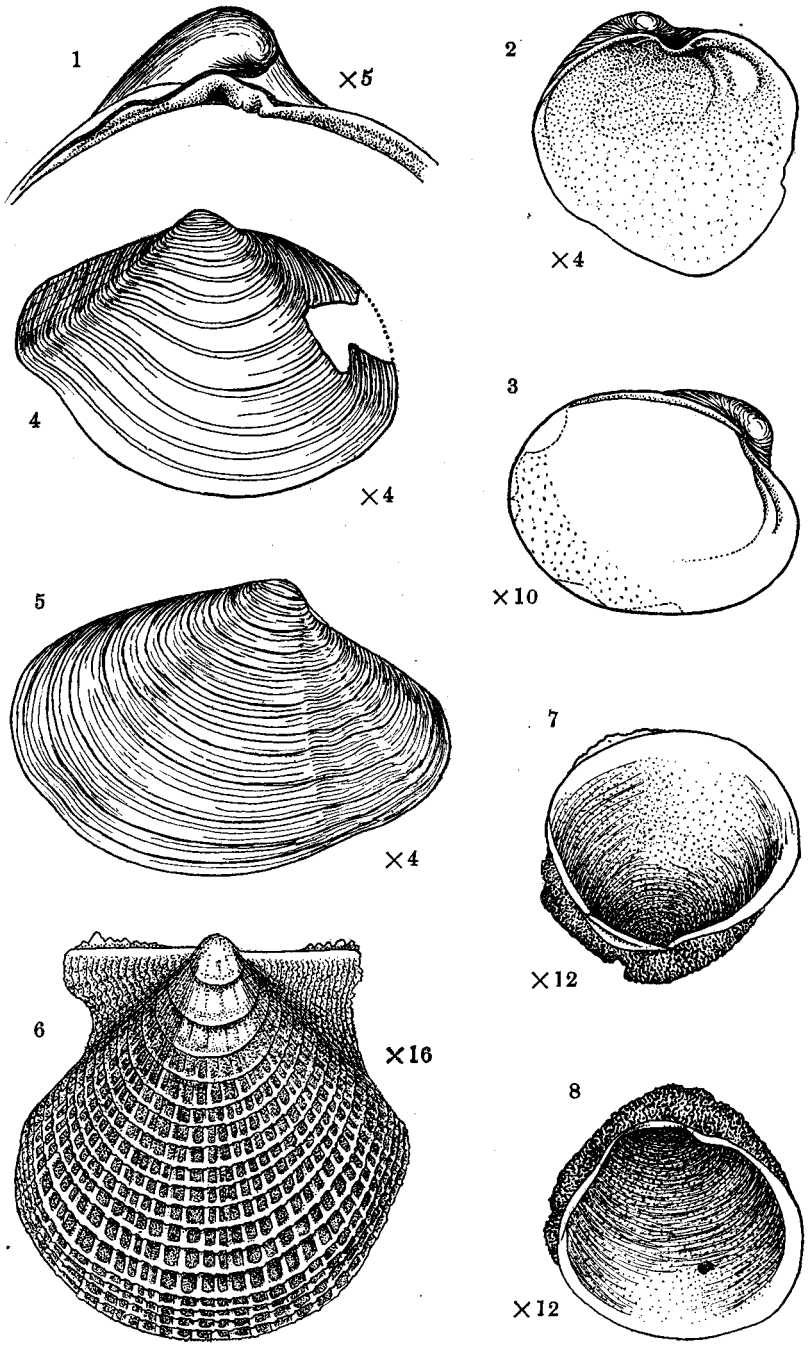

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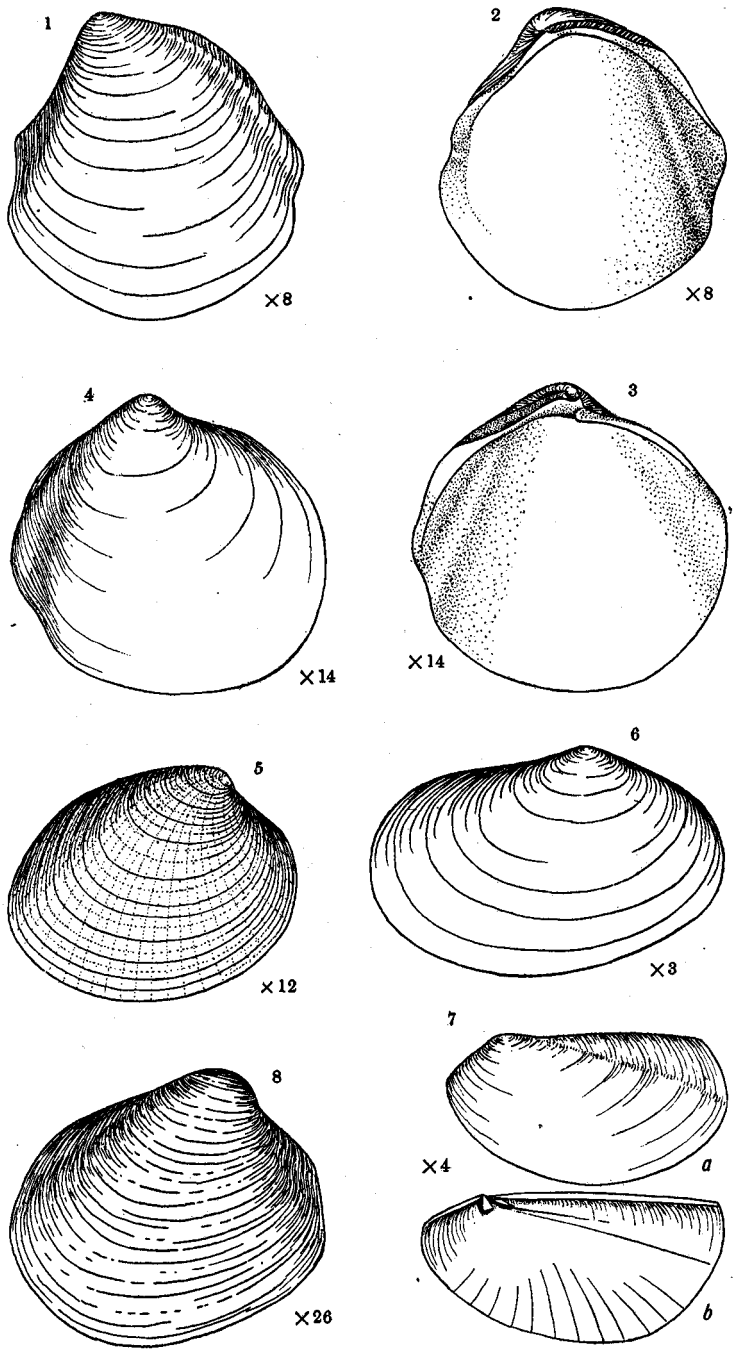

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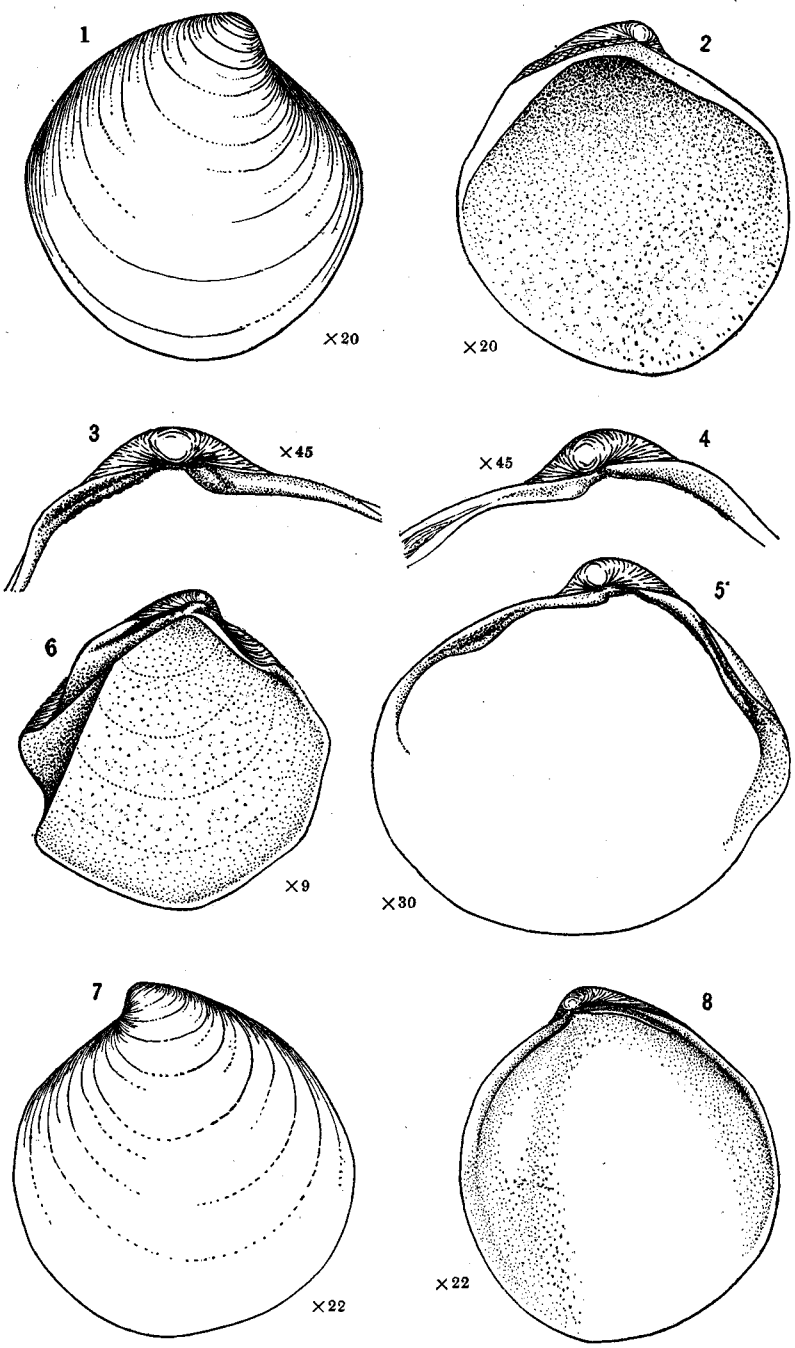

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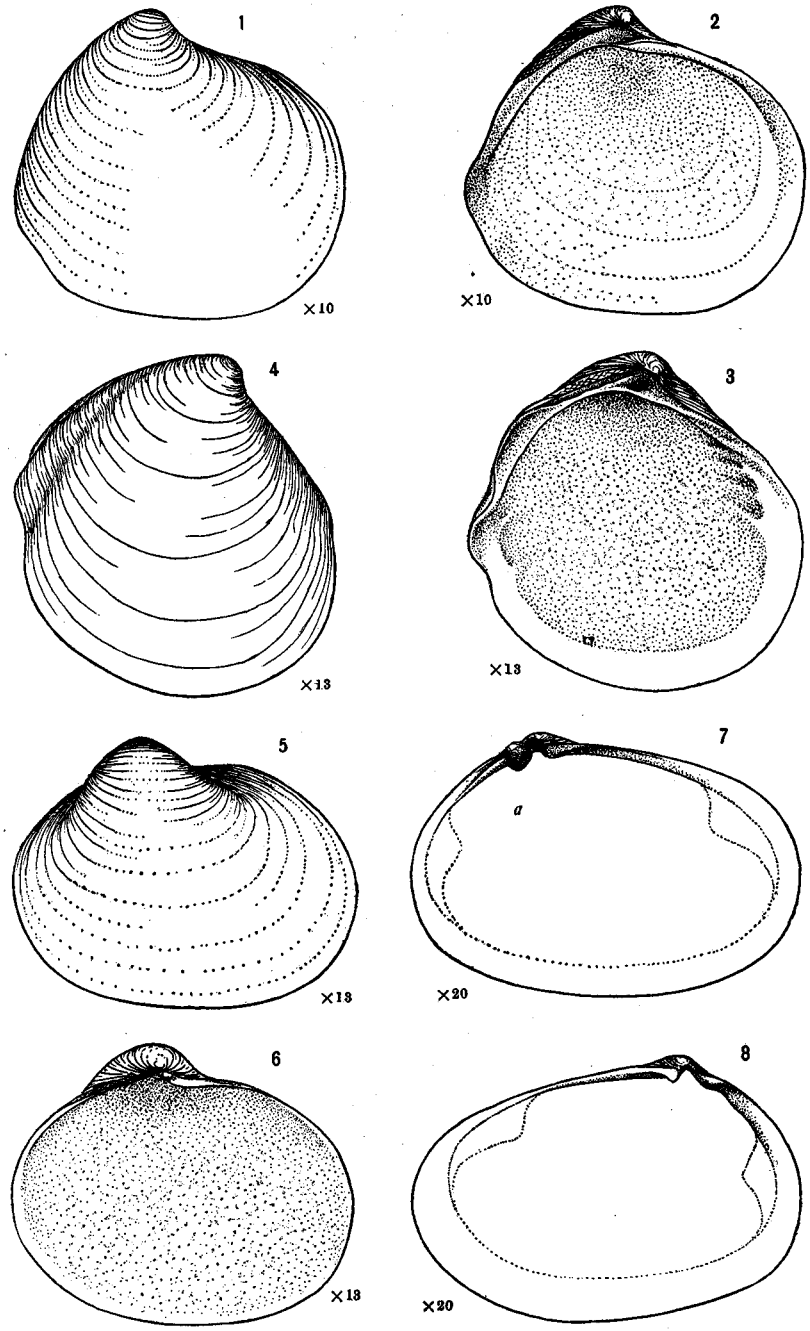

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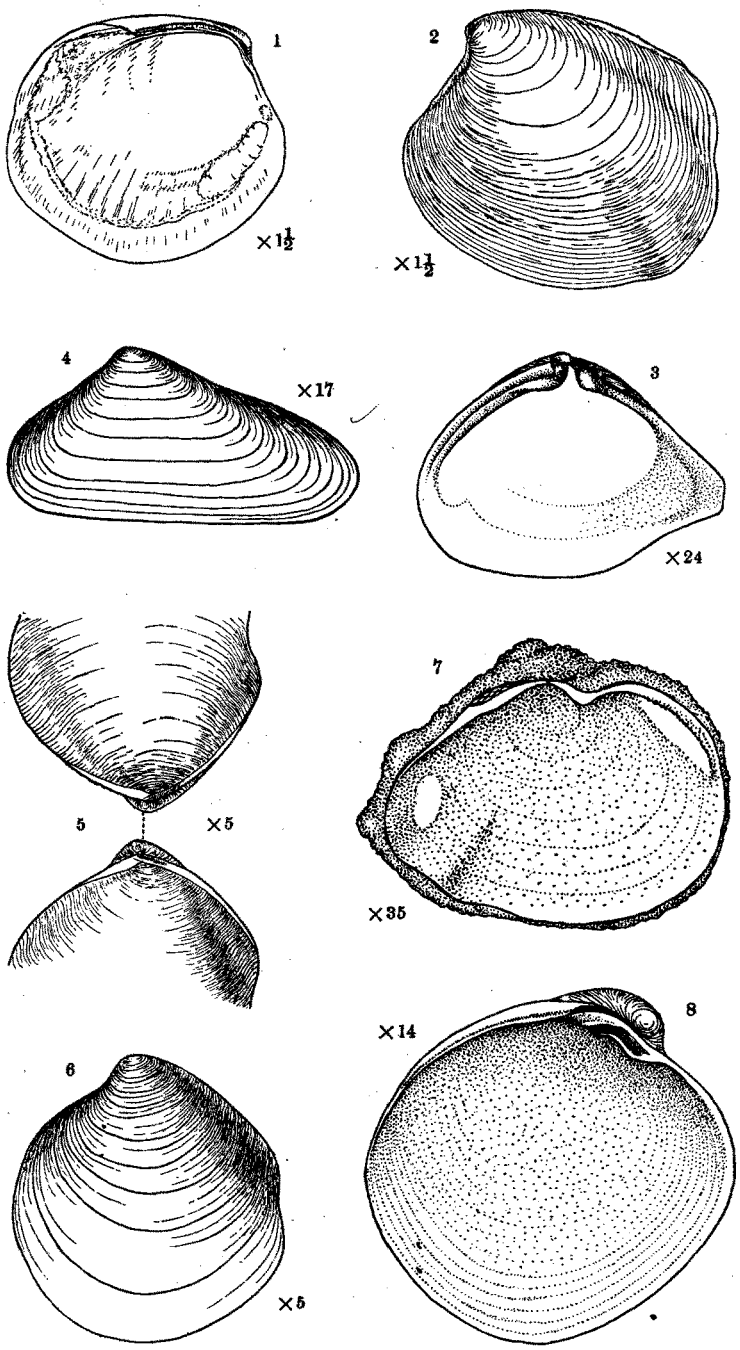

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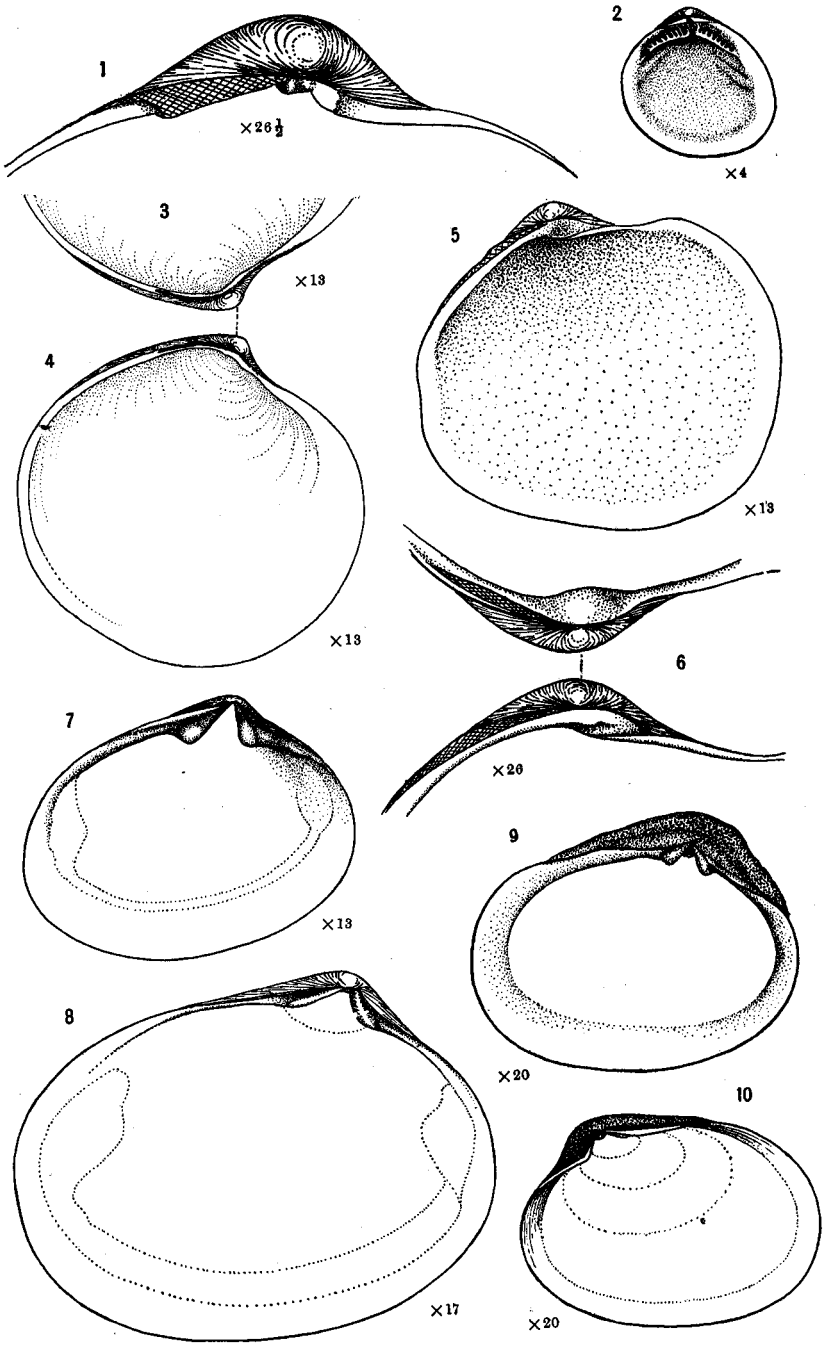

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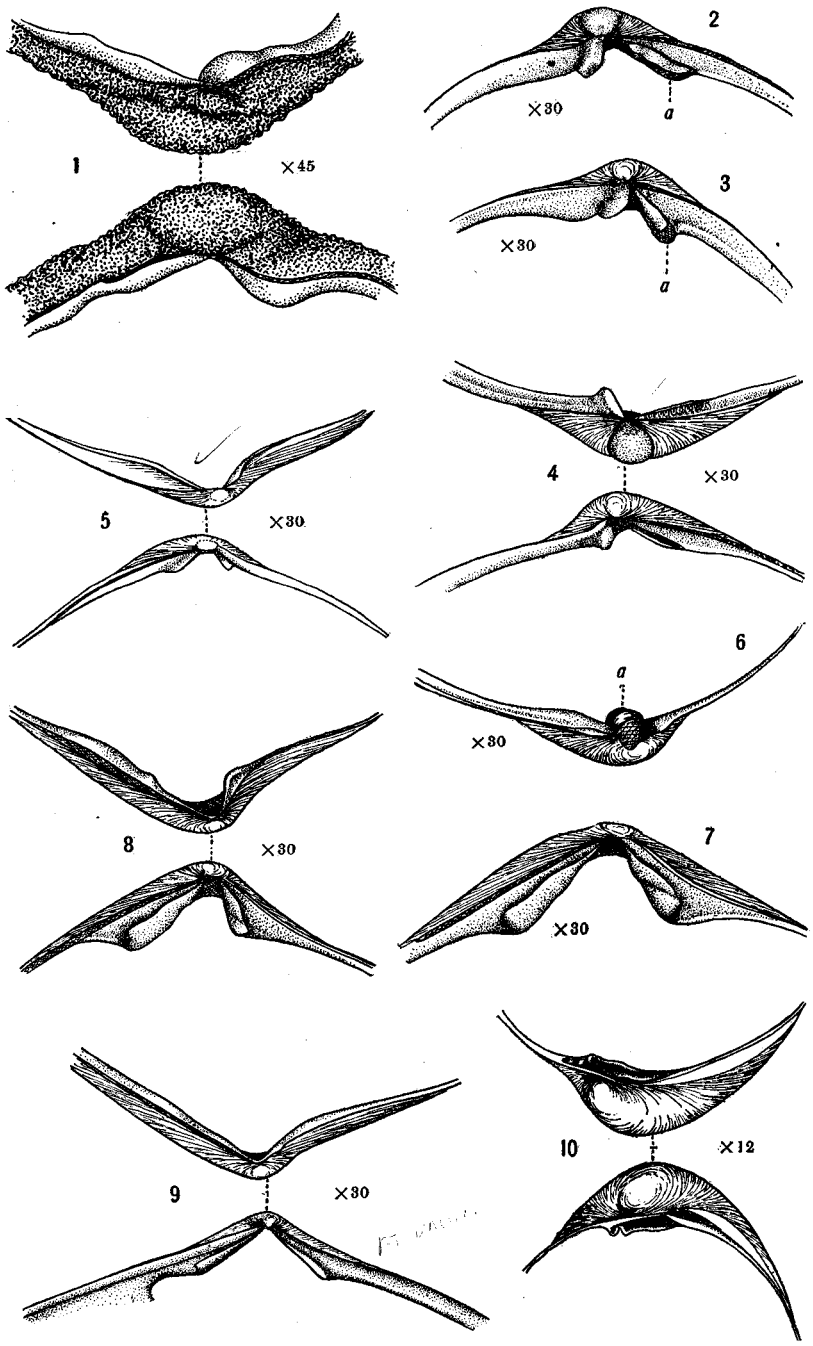
FOR EXPLANATION OF PLATE SEE PAGES 894, 895.



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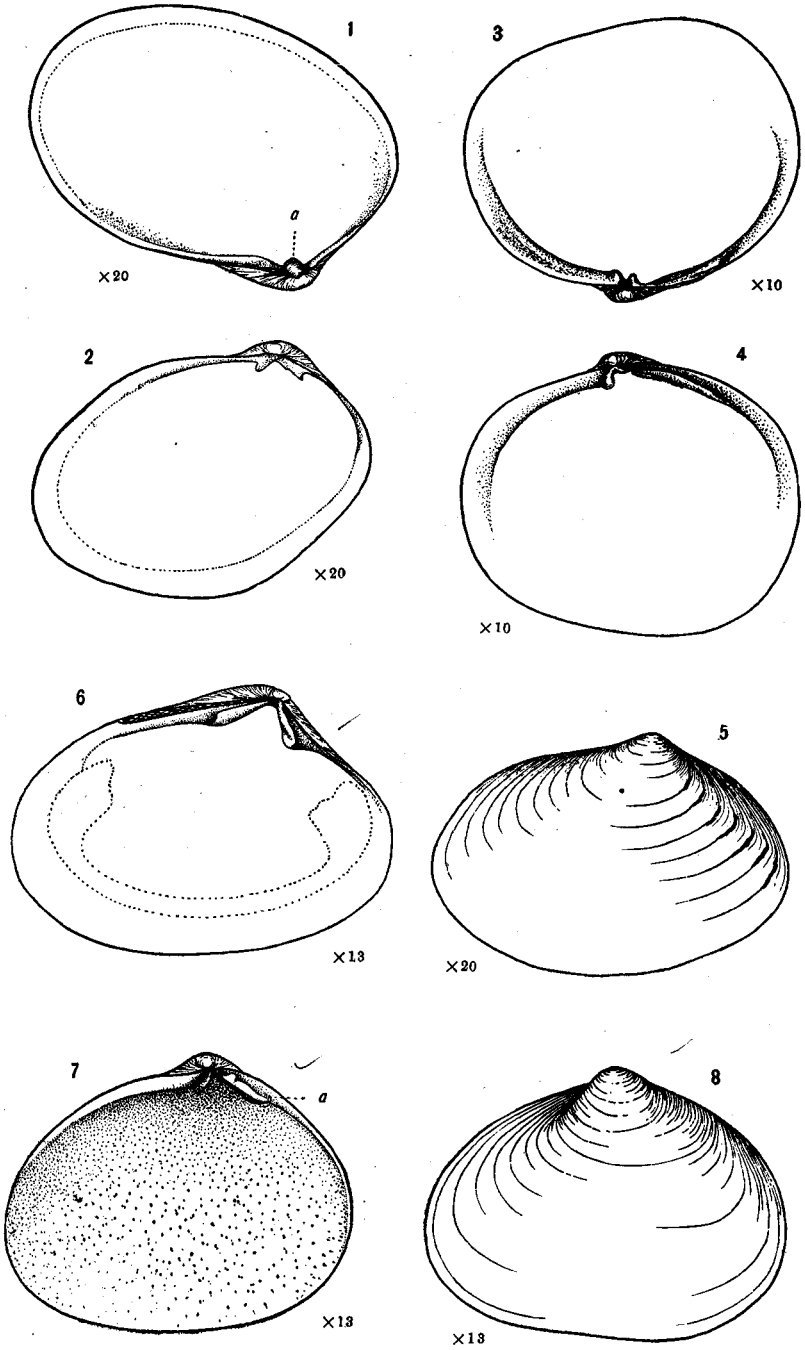

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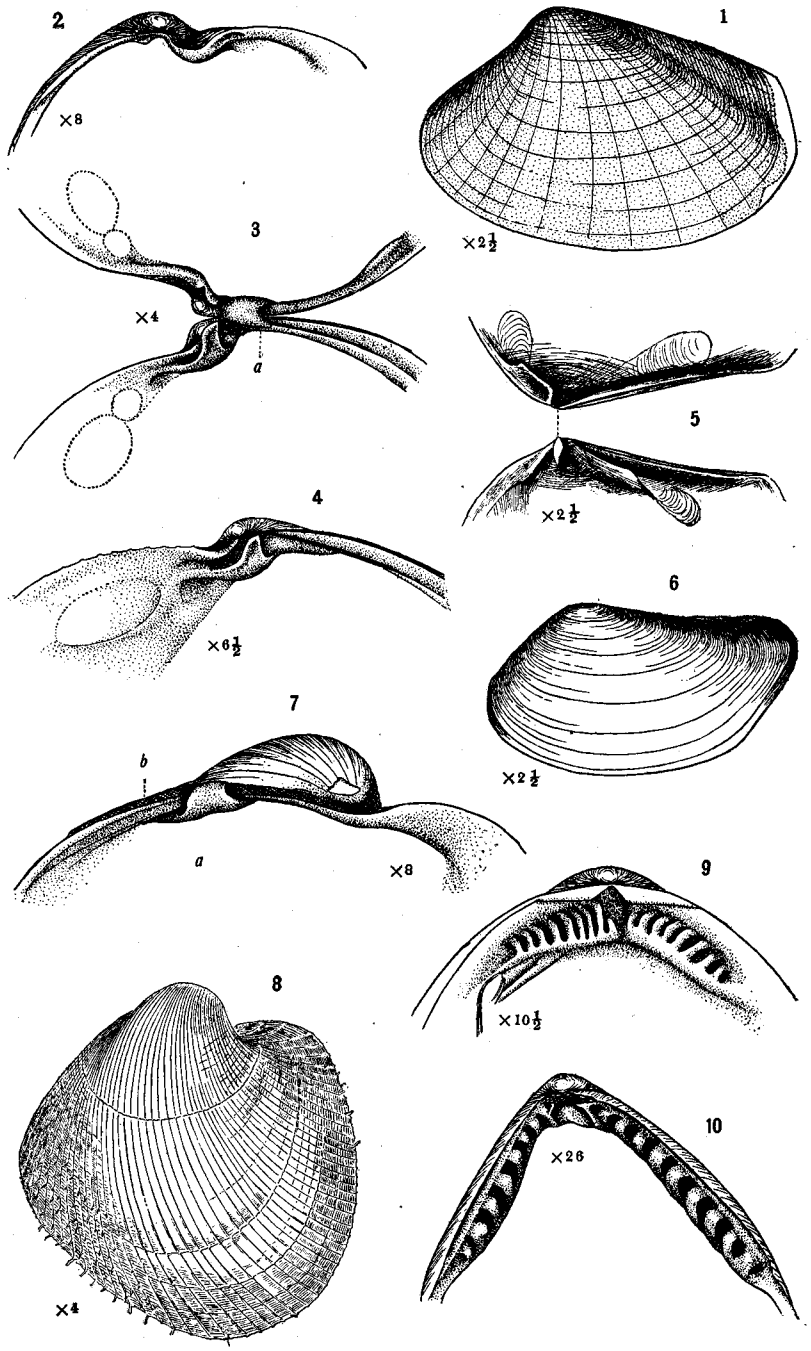

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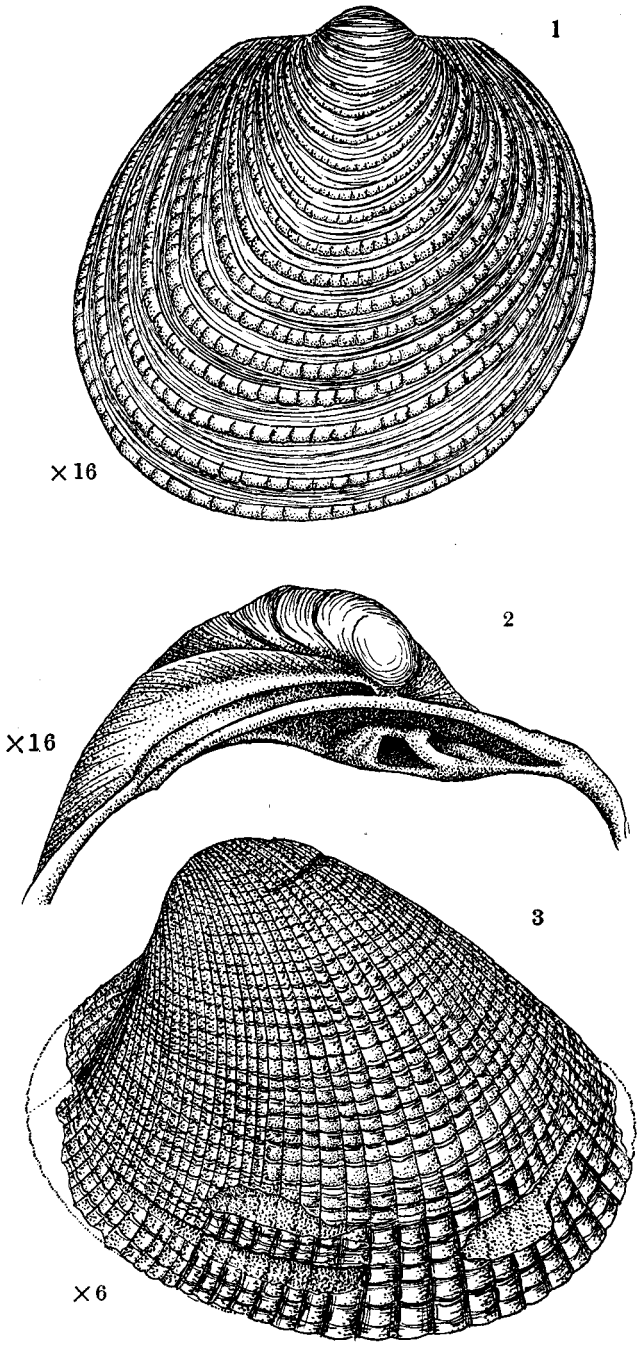
FOR EXPLANATION OF PLATE SEE PAGES 895, 896.



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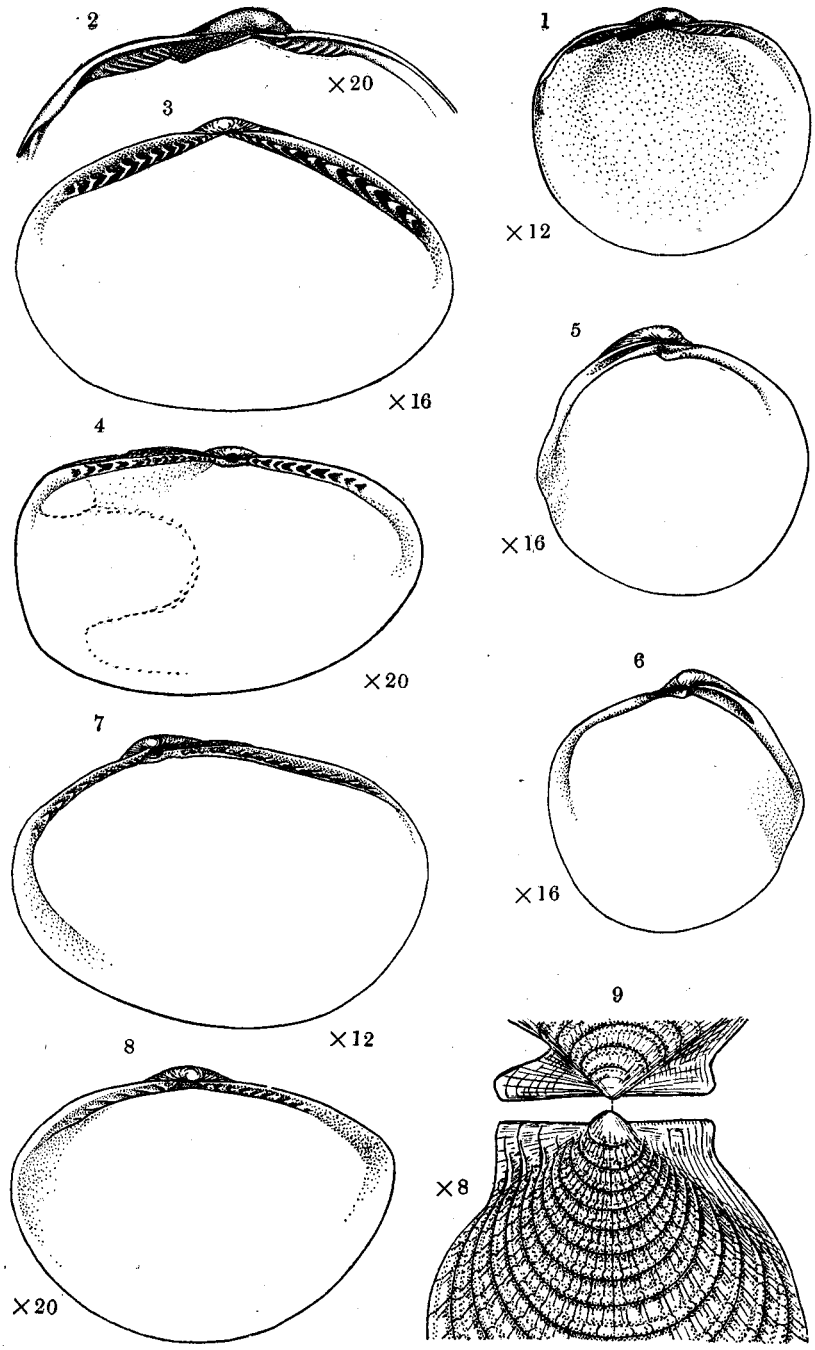

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FOR EXPLANATION OF PLATE SEE PAGE 896.