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THE
ATLANTIC AND GULF COAST
TERTIARY PECTINIDAE
OF THE UNITED STATES

SECTION III
SYSTEMATIC DESCRIPTIONS

BY

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THE ATLANTIC AND GULF COAST

TERTIARY PECTINIDAE OF THE UNITED STATES ⁽¹⁾

ORDER PRIONODESMACEA DALL

SECTION ISODONTA FISCHER

SUPERFAMILY PECTINIDAE REEVE

FAMILY PECTINIDAE LAMARCK.

GENUS CHLAMYS BOLTEN, 1798.

SUBGENUS LYROPECTEN CONRAD, 1863.

Lyropecten CONRAD, Acad. Nat. Sci. Phila., Proc., **14** : 291, 1863, lists *Lyropecten* (*Pallium*) *estrellanus* CONRAD; CONRAD, Senate Exec. Doc., N° **78** : **6** : 71, pl. 3, fig. 15, 1855, describes *P. estrellanum*; CONRAD, *op. cit.*, 7 : 191, pl. 3, figs. 3, 4, 1856, describes *P. estrellanum*; CONRAD, Am. Jour. Conch., **3** : (1) : 6, 1867, lists *L. crasscardo*, *P. nodosus*, *P. fragosus*, *P. subnodosus*, *P. intermedius*, etc.; VERRILL, Conn. Acad. Sci., Trans., **10** : (2) : 63, 1897, cites as type *L. nodosus* LINNÉ; DALL, Wagner Free Inst. Sci., Trans., **3** : 695, 701, 1898, cites as type *Pallium estrellanum* CONRAD, Senate Exec. Doc., N° **78** : **6** : 71, pl. 3, fig. 15, 1855; VERRILL and BUSH, U. S. Nat. Mus., Proc., **20** : 829, 1898, cite as type *L. nodosus* (Linnaeus); ARNOLD, U. S. Geol. Surv., Prof. Paper, **47** : 49, 1906; UGOLINI, Paleont. italica, **12** : 157, 1907, cites as type *L. nodosus* LAMARCK; GARDNER, U. S. Geol. Surv., Prof. Paper, **142-A** : 45, 1926; GRANT and GALE, San Diego Soc. Nat. Hist., Mem., **1** : 175, 1931, cite as type *Pallium estrellanum* CONRAD, by subsequent designation, DALL, 1898; JOHNSON, Boston Soc. Nat. Hist., Proc., **40** : (1) : 24, 1934.

⁽¹⁾ Section I, Genus *Pecten* MÜLLER, 1776, and

Section II, Genus *Chlamys* BOLTEN, 1798 were published in *The American Midland Naturalist*, **17** : (2) : (6) : 1936, Notre-Dame, Indiana, U. S. A.

« *Lyropecten* » CONRAD, GABB, Geol. Surv. Calif., Paleo., **2** : 105, 1868-1869; STOLICZKA, Geol. Surv. India, Mem., **3** : 425, 1871, cites as type *L. nodosus* LINNÉ; CONRAD, in Kerr, Geol. Surv. N. Car., Rept. : **1** : Appendix **A** : 18, 1875; COOPER, Calif. State Mining Bur., Bull., **4** : (5) : 57, pl. 6, figs. 65, 67, 1894; FISCHER, Man. Conch. : 944, 1886, cites as type *C. nodosa* LINNÉ.

Nodipecten DALL, Wagner Free Inst. Sci., Trans., **3** : 695, 1898, type, by original designation, *Pecten nodosus* LINNÉ; ARNOLD, U. S. Geol. Surv., Prof. Paper, **47** : 1906; GARDNER, U. S. Geol. Surv., Prof. Paper, **142-A** : 46, 1926.

GEONOTYPE. — « *Pecten* » *estrellanus* Conrad, by subsequent designation, Dall, 1898.

DIAGNOSIS. — Conrad's original diagnosis :

« Inequivalve, radiately costate; hinge with a triangular pit as in *Pecten* and diverging prominent teeth on each side of the ligament cavity. »

Conrad listed as his first species *Lyropecten (Pallium) estrellanum* Conrad, Senate Exec. Doc., N° 78 : (6) : 71, pl. 3, fig. 15, 1855, clearly intending it to be the genotype of *Lyropecten*. Subsequently Dall, 1898, designated this species as the genotype of *Lyropecten*.

In 1867 Conrad made the following diagnosis of *Lyropecten* : « Inequivalved; both valves convex; ears unequal; ribs large; ribs and intervening spaces striated; hinge with irregular oblique teeth on each side of the fosset; both valves with a hump or wave on the umbo. »

Shell large, coarse, heavy. Valves equilateral; nearly equally convex. Primary ribs relatively wide, elevated, heavy, non-dichotomous; sometimes nodose; do not increase in number at the ventral margin. Secondary radials often developed in the interspaces. Auricles moderately developed; anterior auricles frequently the longer. Byssal notch usually shallow. Hinge plate commonly with three divergent cardinal crura at either end.

REMARKS. — The valve labelled « *Pallium estrellanum* type, 1856, Conr. = *Pecten heermani* Conr., 1855. Estrella valley, Calif. Dr. Newberry. Miocene » in the U. S. National Museum, Cat. N° 133009, seems quite different from the other valves labelled *estrellanum*. It lacks the interradiar riblet characteristic of *estrellanum*. Apparently it should be referred to *crassicardo*, and it is probably not from Conrad's type locality, since that species is not known to occur in the Estrella valley section.

Since the holotype of *Pallium estrellanum* Conrad has apparently been lost, I designate as neoholotype the valve figured by Arnold, U. S. Geol. Surv., Prof. Paper, **47** : pl. 20, fig. 1, 1907, U. S. National Museum, Cat. N° 13317, from Estrella valley, San Luis Obispo County, Calif.

Fischer, who followed Gabb's modification of the original orthography, listed *Lyropecten nodosus* Linné. According to Article 19, International Rules of Nomenclature, such a change in orthography is not possible.

Certainly Dall's is the first clear designation of genotype, and must be accepted. Conrad, in 1863, apparently intended *Pallium estrellanum* to be the genotype. In the later diagnosis he lists *L. crassicardo* as his first species, and included those forms which develop nodose ribs. There seems to be little reason for not including Dall's section *Nodipecten* under *Lyropecten*, s.s., since it is based upon distinctions which at best should be regarded as of no more than specific value. *Lyropecten estrellanus* shows contraction, or interruption of growth at different stages (Arnold, 1906, pl. 21, figs. 1, 1a, 1b), as does *Lyropecten crassicardo* (Arnold, op. cit., pl. 17, figs. 1, 1a, 1b; pl. 19, figs. 2, 2a). Dall's *Nodipecten condylomatus* develops similar, but somewhat more marked contractions.

This group is separated from *Chlamys*, s.s., by its fewer, heavier, non-dichotomous ribs which do not increase in number toward the ventral margin. The heavy cardinal crura, upon which Conrad based this subgenus, vary in their development within the group. It forms, however, a natural and well defined assemblage of species in the Atlantic and Pacific Coast faunas.

RANGE. — World wide (fossil). Living in the warmer seas.

HORIZON. — Atlantic Coast, Eocene to Recent; Pacific Coast, Lower Miocene to Recent.

Chlamys (Lyropecten) dysoni, sp. nov.

Pl. IV, fig. 3.

DESCRIPTION. — Shell equilateral, slightly convex, strongly sculptured. Nine strong, simple, keeled ribs which, on the central portion of the disk have a cord on their summits. Fine imbricating, concentric sculpture which is reflected toward the ventral margin on the summits of the ribs and passes directly across the wide, deep, somewhat flattened interspaces. Submargins narrow, steep, only concentric ornamentation. Auricles large, nearly equal; 2 or 3 very obscure radials on the left anterior auricle. Interior fluted.

REMARKS. — This species appears to be entirely distinct from any described east coast species. It seems to have more in common with *vaccamavensis* than with any other species. It lacks the radial sculpture in the interspaces and has fewer ribs than that species.

DIMENSIONS. — Holotype, height 54, width 45 mm.

LOCALITY. — Near Ocala, Fla. (type).

HORIZON. — Jackson (Eocene).

HOLOTYPE. — Collection H. I. Tucker-Rowland.

***Chlamys (Lyropecten) pulchricostata* (ALDRICH and MEYER).**

Pl. IV, fig. 11; pl. VI, fig. 2.

Pecten pulchricostata ALDRICH and MEYER, Cinn. Soc. Nat. Hist., Jour., **9** : 45, pl. 2, figs. 23, 23a, 1886; HARRIS, Bull. Am. Pal., **6** : 24, pl. 14, figs. 9, 10, 1919.

Pecten (Nodipecten) pulchricostata ALDRICH and MEYER, DALL, Wagner Free Inst. Sci., Trans., **3** : 730, 1898.

DESCRIPTION. — Aldrich and Meyer's original description :

« Convex, covered by eight broad, rounded, radiating ribs perceptible on the inside; those in the middle are largest. Near the ventral margin they dissolve into more numerous ribs. Wautubbee : only the figured valve is known. »

Ribs of the hypotypes show a tendency to divide on the beaks, as do those of the holotype. One has a sulcus on the summits of the ribs near the ventral margin; anteriorly and posteriorly 2 or 3 occur on each rib. Ribs are the shape of an inverted V; wider than the approximately V-shaped interspaces. Intercostals tend to disappear about 6 mm. from the beak, except occasionally on the anterior slope. Commonly well developed, closely spaced, concentric lines appear on the disc and extend across the small auricles. About 1 to 5 scabrous radial threads on each auricle. Internally strong ribs appear opposite the interspaces and extend to the beak.

Ribs of the holotype have deep sulci on their summits extending 3 mm. toward the ventral margin from the beak. Near the ventral margin the ribs are distinctly keeled; interspaces broadly V-shape. Valve concentrically sculptured with close-set, little elevated lamellae. Submargins plain, narrow, steep. Byssal auricle has 3 very obscure radials; narrow, rather deep fasciole. Ctenolium and provinculum present.

DIMENSIONS. — Holotype, height 13.8; width 11 mm. Hypotypes : Left, height 13, width 11 mm.; another left valve, height 16, width 11 mm.

LOCALITY. — Wautubbee, Miss. (type), Aldrich and Meyer, and Harris.

HORIZON. — Claiborne (Eocene).

HYPOTYPES. — Collection Cornell University.

HOLOTYPE. — Collection The Johns Hopkins University.

***Chlamys (Lyropecten) incertae*, sp. nov.**

Pl. V, fig. 3.

DESCRIPTION. — Shell small, equilateral, only slightly convex. Eleven broad, rounded, simple ribs, somewhat narrower than the flat, unornamented

interspaces. Submargins steep, plain. Auricles equal; 8 obscure radials on the posterior and 5 stronger ones on the byssal auricle. Fasciole shallow, conspicuous. Ctenolium? Interior ribbed.

REMARKS. — This species is separated from *alpha* by its simpler sculpture, flatter interspaces, fewer ribs, greater proportional height.

DIMENSIONS. — Holotype, height 26, width 20 mm.

LOCALITY. — Near Ocala, Fla.

HORIZON. — Jackson (Eocene).

HOLOTYPE. — Collection H. I. Tucker-Rowland.

Chlamys (Lyropecten) duncanensis (MANSFIELD).

Pl. V, fig. 22.

Pecten (Lyropecten) duncanensis MANSFIELD, Wash. Acad. Sci., Jour., **24**: (8): 332, figs. 1, 2, 3, 1934.

DESCRIPTION. — Mansfield's original description :

« Shell small, rather thin, inequilateral, weakly inflated, the left valve more convex than the right. Right anterior ear with a moderately deep notch and sculptured with five rather strong radials, the innermost of which lies close to the submargin, and with transverse closely-spaced imbrications; right posterior ear with six strong, imbricated radials. Disk of right valve sculptured with 23 to 25 (24 on holotype) squarish, scabrous and imbricated ribs, separated by intervals of about the same width as the ribs. The early portion of each rib is narrowly rounded and the later portion nearly square; the latter is undercut on the sides and is ornamented on the top with three scabrous threads, the medial one of which is the strongest. The interrarial spaces on the smaller specimens are either without a radial, or, if present, it is only faintly indicated. A fragment of a larger shell (fig. 1, U.S.N.M. N° 373056) shows one interrarial thread of moderate strength in each space. Ribs and interspaces crossed by imbrications whose edges are about one millimeter apart. Left valve sculptured similarly to the right, except that the interrarial thread appears to be more strongly developed. Submargins low and marked with faint radials. »

REMARKS. — *C. duncanensis* differs from *suwaneënsis* Dall in having a higher left valve and squarer ribs ornamented on the summits with tricarinate radial sculpture. This species is certainly very closely allied to *suwaneënsis* Dall.

DIMENSIONS. — Holotype, length 22.5, height 23, convexity 4 mm. Paratype, height 23, width 23 mm.

LOCALITY. — Duncan Church, Washington County, Fl. (type), Mansfield.

HORIZON. — Glendon (Oligocene).

PARATYPE. — U. S. National Museum, Cat. N° 373056.

HOLOTYPE. — U. S. National Museum, Cat. N° 373055.

***Chlamys (Lyropecten) alpha* (DALL).**

Pl. VI, figs. 4, 9.

Pecten (Lyropecten) sp. indet. a DALL, Wagner Free Inst. Sci., Trans., **3** : 725, 1896.

Pecten (Lyropecten) alpha DALL, U. S. Nat. Mus., Proc., **51** : 492, pl. 84, fig. 9, 1917.

DESCRIPTION. — Dall's original description :

« Shell small, thin, nearly equilateral, suborbicular, slightly convex, sculptured with 9 or 10 radial folds with subequal deep rounded interspaces, the disk and submargin also bearing fine radial threads; these appear to be smooth, but the condition of the specimens is such as to prevent a positive decision and they may have been slightly scaly; on the posterior ear of the left valve are five or six fine elevated radial threads with wider interspaces; the other ear is defective. »

DIMENSIONS. — Holotype, height 24, width 23 mm.

LOCALITIES. — East bank Flint River, about 10.5 mi. below Bainbridge, Ga. (type), Dall; just above Lambert Island, Ga., Dall; Sulphur Springs ferry, Suwannee County, Fla., Dall.

HORIZON. — Vicksburg (Oligocene).

HOLOTYPE. — U. S. National Museum, Cat. N° 166711.

***Chlamys (Lyropecten) skiptonensis* (MANSFIELD).**

Pl. V, fig. 23.

Pecten (Nodipecten) rogersi CONRAD, DALL, Wagner Free Inst. Sci., Trans., **3** : 730, 1898, *partim*.

Pecten (Chlamys) rogersi CONRAD, GLENN, Md. Geol. Surv., *Miocene* : pl. 99, fig. 4, 1904, not Conrad, 1834.

Pecten (Chlamys) skiptonensis MANSFIELD, Jour. Pal., **10** : (3) : 186, pl. 23, fig. 12, 1936.

Chlamys (Chlamys) rogersi (CONRAD), ROWLAND, Amer. Midl. Nat., **17** : (6) : pl. 7, fig. 9, 1936.

DESCRIPTION. — Mansfield's original description :

« Shell small, nearly equilateral, compressed but not flat. Right anterior auricle with a deep byssal sinus and sculptured with four fine radial threads over the surface between the dorsal margin and the byssal area. Byssal area crossed

with fine threads which surmount a rather strong thread parallel with and adjacent to the submargin. Posterior, ear marked with four weak radials. Disk sculptured with six ribs, the anterior and posterior weak, others much wider, equally and widely spaced. Faint growth lamellae ornament the ribs and interspaces. Obscure subradials visible only at the distal ends of the ribs, none observed between them. The ctenolium provided with fine short spines. »

REMARKS. — This species lacks the strong radial sculpture over the whole shell, which is characteristically developed on *rogersi*.

DIMENSIONS. — Holotype, width 8.5, height 10, convexity 1.6 mm.

LOCALITIES. — Skipton, Talbot County, Md. (type), Mansfield.

HORIZON. — Choptank (Miocene).

HOLOTYPE. — U. S. National Museum, Cat. N° 143658.

***Chlamys (Lyropecten) madisonius* (SAY).**

Pl. I, figs. 1, 2; pl. IV, fig. 8.

Pecten madisonius SAY, Acad. Nat. Sci. Phila., Jour., **4** : 134, 1824; CONRAD, Foss. Med. Tert. U. S. : 48-49, pl. 24, fig. 1, 1840; EMMONS, N. Car. Geol. Survey, Rept. : 282, fig. 200, 1858; MEEK, Smithsonian Misc. Coll., **7** : 4, 1864; HEILPRIN, Acad. Nat. Sci. Phila., Proc., **33** : 419, 1881; HEILPRIN, *op. cit.*, **40** : 398, 1888; WHITFIELD, U. S. Geol. Surv., Mon., **24** : 30, pl. 4, figs. 1-5, pl. 2, fig. 8, 1894; HARRIS, Bull. Am. Pal., **1** : 310, 1896, reprint of Say's publications.

Pecten fraternus CONRAD, Acad. Nat. Sci. Phila., Proc., **14** : 291, 1862.

Pecten tricarinatus CONRAD, Am. Jour. Conch., **3** : 189, 1867.

Pecten (Lyropecten) madisonius SAY, DALL, Wagner Free Inst. Sci., Trans., **3** : 724, 1898.

Pecten (Chlamys) madisonius SAY, GLENN, Md. Geol. Surv., *Miocene* : 377, pl. 99, fig. 6, 1904.

DESCRIPTION. — Say's original description :

« Much compressed, with about sixteen striated ribs. Shell rounded, much compressed; the whole surface covered with scaly striae : ribs elevated, rounded, with about three striae on the back of each; intervening grooves rather profound : ears equal, sinus of the ear of the superior valve profound, extending at least one third of the length of the ear. »

The valve figured, U. S. National Museum, Cat. N° 111606, may be the holotype. A young left valve, from the Miocene of Jericho, N. J. Sixteen flat-topped ribs; on the central portion of the disk the ribs have 3 scaly radials on their summits, toward the submargins, only 2. For about 5 mm. from the beak the ribs are narrow, almost sharply keeled. About 11 mm. from the beak 2 scaly threads appear on the summits of the ribs, later the third develops. One well developed row of scales in each flat interspace, frequently 2 minor rows. Submargins narrow, sculptured by fine radial threads.

Shell large, suborbicular, rather thin; left valve more or less convex in the umbonal region, the right valve usually flat, or nearly so. Fourteen to seventeen ribs. Occasional valves have only twelve ribs. In the umbonal area the ribs tend to be narrow, sharply elevated, about half the width of the deep interspaces. Near the ventral margin the ribs are broader at the base, nearly flat-topped; ribs about 5 mm. wide on the summits, interspaces 10 mm. at the ventral margin. Usually 3 scaly threads appear on the summits, the central one being the stronger, about 20 to 35 mm. from the beak. The sides of the ribs of adult individuals are usually threaded with fine, scaly radials. Interspaces flat, more shallow at the ventral margin, with a variable number of fine, scaly threads. Central thread commonly the better developed. Disk concentrically lamellated. Submargins rather wide, more or less flat, sculptured only with scaly radial threads and concentric lamellae. Auricles rather large; those of the left valve subequal, densely threaded with uniform, fine, extremely scaly radials. Auricles of the right valve more coarsely threaded, unequal; the anterior auricle corrugated at the dorsal margin; fasciole broad, conspicuous; byssal notch wide, deep. Ctenolium of 4 to 6 denticles. Provinculum present. Internally fluted to the umbones. Cardinal crura inconspicuous.

Young valves are ovate, translucent; auricles small; ribs rounded or occasionally keeled, well elevated, slightly narrower than the interspaces. Faint concentric lamellae appear, on valves 5 mm. in height, near the ventral margin. Valves about 12.5 mm. in height are more nearly suborbicular; ribs about the same width as the interspaces at the ventral margin. A single thread appears on the summits of the ribs about 6 mm. from the ventral margin. At the same time concentric lamellae develop, which are reflected toward the ventral margin in the interspaces, toward the beak on the sides of the ribs. No secondary radial sculpture in the interspaces. Occasional valves develop scaly, concentric lamellae when they are about 4 mm. in height. Auricles appear large in proportion to the size of the disk. Young valves are apt to be much more convex in the umbonal area than are adults.

Individuals vary widely in sculpture, degree of convexity, and size. A series of valves from the Choptank at Jones Wharf, Md., shows clearly a close relationship to *marylandicus* Wagner. Another series from the Calvert at Plum Point, Md., shows a close relationship to *coccymelus* Dall and to *acanikos* Gardner. Valves from this locality are quite thin, develop scaly lamellae and secondary radial sculpture very soon.

REMARKS. — *C. madisonius* can be separated from *jeffersonius* by the sculpture, auricles, differences in convexity, and number of primary ribs. The byssal auricle of *madisonius* is longer, the sinus deeper and wider; the fasciole broader and more conspicuous, and more coarsely threaded than that of *jeffersonius*. The ctenolium is retained in adult valves of *madisonius*; absent in *jeffersonius*. The ribs of *jeffersonius* are more nearly quadrangular and lack the coarse, scaly,

radial threads characteristic of *madisonius*. *C. jeffersonius* has fine, dense, scaly, uniform radial threads on the ribs and in the interspaces. *C. madisonius* is less orbicular in outline than *jeffersonius*. The valves of *jeffersonius* are equally convex; the left valve of *madisonius* is somewhat convex, the left usually flat.

DIMENSIONS. — Holotype ♀, height 46, width 41 mm. Hypotypes : Right, height 102, width 100 mm.; left, height 103, width 107 mm.

LOCALITIES. — Maryland (type), Say; Jericho, N. J. (type ?); Cove Point, St. Marys River, Jones Wharf, Chesapeake Beach, east of Friendship, Md.; Evergreen, Lanexa, Claremont Wharf, Standard Oil Bluff near Suffolk, Jacks Bluff near Suffolk, James River above Smithfield, Ruffins, and Yorktown, Va.; Petersburg, Va.; Natural Well, and Snow Hill, N. C., Dall.

HORIZON. — Calvert, Choptank, St. Marys, and Duplin (Miocene).

HYPOTYPES. — Collection Cornell University.

HOLOTYPE. — Possibly U. S. National Museum, Cat. N° 111606.

Chlamys (Lyropecten) madisonius acanikos (GARDNER).

Pl. IV, fig. 12; pl. V, figs. 2, 4.

Chlamys (Lyropecten) acanikos GARDNER, U. S. Geol. Surv., Prof. Paper, **142-A** : 46, pl. 11, figs. 1-2, 1926.

DESCRIPTION. — Gardner's original description :

« Shell rather thin and very easily broken, large and quite compressed. Umbonal angle acute and approximating 90°, the arc included between the dorsal margins slightly exceeding 180°. Radials narrow, abruptly elevated, rounded upon their summits, persistent to the outer margin, normally 17 in number, each of them, as a rule, cut by two linear sulci which divide the summit into three subequal lirae. Sides of ribs and intercostal areas also closely lirae, each thread bearing a series of small spinose processes, those upon the medial thread on the costal and upon the medial thread of the intercostal areas the most produced. Intercostal areas deep, concave, usually narrower than the costals. Inner margins sharply fluted. Auricles of moderate size, the anterior in the right valve angular, produced; cut off from the submargin by a deep byssal notch threaded with 6 or 7 scabrous lirations. Anterior submargin very narrow and free from ornamentation. Posterior auricle of right valve trigonal, cut off from the narrow unsculptured submargin by an acute angle; left auricles larger than the right, finely threaded, not sharply separated from the similarly sculptured submargins. Ctenolium including 4 or 5 rather prominent denticles. Ligament area very narrow. Resilial pit small, trigonal, the lateral margins well elevated. Cardinal margin of right valve bent over the left. Cardinal

crura obscure. Adductor scar large, subcircular, slightly posterior, placed well up toward the umbones. »

REMARKS. — This subspecies does not attain the dimensions of *madisonius*, s.s., to which it is closely related. It usually has 2 more ribs than *sayanus*. In *acanikos* the ribs are persistent to the margin of the disk, while in *sayanus* they become obsolete, or nearly so, in adult valves. The sculpture of *sayanus* is much less coarse than that of *acanikos*.

This subspecies is present in the Calvert of Maryland. At Plum Point it is rather common. Its close relationship to both *coccymelus* and to *madisonius* becomes evident when a large series of individuals, in various stages of development, is examined.

DIMENSIONS. — Holotype, height 36, width 35, semidiameter 7 mm. Hypotypes : Left, height 26, width 22 mm.; right, height 23, width 19 mm.

LOCALITIES. — Chesapeake Beach (hypotypes), Plum Point, Md.; Boynton Landing on the Choctawhatchee River, Washington County, Fl. (type), Gardner; White Springs on the Suwannee River, Columbia County, Fla., Gardner; Quincy, Gadsden County, Fla., Gardner.

HORIZON. — Calvert, and Chipola (Miocene).

HYPOTYPES. — Cornell University.

HOLOTYPE. — U. S. National Museum, Cat. N° 352450.

Chlamys (Lyropecten) condylomatus (DALL).

Pl. VI, fig. 3.

Pecten (Nodipecten) condylomatus DALL, Wagner Free Inst. Sci., Trans., 3 : 729, pl. 34, figs. 14, 15, 1898; GARDNER, U. S. Geol. Surv., Prof. Paper, 142-A : 46, pl. 12, figs. 3, 4, 1926.

DESCRIPTION. — Dall's original description :

« Shell small for the group, subequilateral, slightly inequivalve, the right valve more convex with nine to thirteen strong, undulated, rounded, more or less nodulous, finely radially striated ribs, the undulations affecting the whole of the disk, sudden and very pronounced, giving a side view of the valve somewhat the aspect of a clenched fist; interspaces narrower radially, finely threaded, the whole valve with fine concentric lamellation somewhat prickly or limose at the intersections; submargins rather wide, radially finely striate; ears small, subequal, the surface coarsely radially threaded, the byssal ear produced with a conspicuous sinus and fasciole; ctenolium well marked; inner basal margin fluted by the ribs; cardinal margin with two or three strong crural ridges. »

The holotype is young shell having 12 ribs. Auricles unequal; byssal auricle the longer; fasciole wide. Ctenolium and provinculum present.

REMARKS. — *C. condylomatus* has less elevated and less closely spaced lamination than *chipolanus*. That species is never nodose.

DIMENSIONS. — Holotype, height 25, width 24 mm. Hypotype, height 31, width 30 mm.

LOCALITIES. — Ten Mile Creek, 1 mi. west of Baileys Ferry, Fla. (type), Dall; Baileys Ferry, Fla.

HORIZON. — Chipola (Miocene).

HYPOTYPE. — Collection Cornell University.

HOLOTYPE. — U. S. National Museum, Cat. N° 114776.

***Chlamys (Lyropecten) sayanus* (DALL).**

Pl. II, fig. 6; pl. VI, fig. 1.

Pecten madisonius var. *sayanus* DALL, Wagner Free Inst. Sci., Trans., 3 : 725, pl. 26, fig. 6, 1898.

Chlamys (Lyropecten) sayanus DALL, GARDNER, U. S. Geol. Surv., Prof. Paper, 142-A : 45, pl. 12, fig. 7, 1926.

DESCRIPTION. — Dall's original description :

« This form is the precursor in the Upper Oligocene of the typical *madisonius* of the Miocene. It differs from the latter in its extreme compression, the ribs, except in the umbonal region, being almost obsolete. »

Holotype, a right valve, has 14 elevated, flat-topped, ribs, channeled in the umbonal region; about as wide as the interspaces. Ribs become more widely spaced, rounded, and at the ventral margin, are nearly obsolete. Submargins narrow, sculptured only by imbricated threads. Whole disk radially sculptured by fine scaly threads. Posterior auricle uniformly threaded with scaly radials; anterior auricle more coarsely sculptured. Fasciole wide, conspicuous. Ctenolium of 4 denticles. Interior fluted nearly to the beak.

DIMENSIONS. — Holotype, height 120, width 135, convexity 16 mm.

LOCALITIES. — Oak Grove, Santa Rosa County, Fla. (type), Dall; Old Chattahoochee Landing, Rock Bluff, and Chipola River, Fla., Dall.

HORIZON. — Chipola, and Oak Grove (Miocene).

HOLOTYPE. — U. S. National Museum, Cat. N° 135838.

***Chlamys (Lyropecten) madisonius bassleri*, subsp. nov.**

Pl. V, fig. 1.

DESCRIPTION. — Shell very thin, somewhat ovate; the left valve convex, right nearly flat, or only slightly convex. Sixteen narrow ribs, each carrying

a row of erect spines; about 20 mm. from the beak a secondary row of spines appears on either side of each rib. Ribs wider at the base. Interspaces rounded, with closely spaced, erect rows of spines which extend up the sides of the ribs. One or two of the rows of spines frequently more prominent. Submargins have radial sculpture of prickly radials. Auricles unequal; radially threaded with fine rows of small, erect spines. Ribbed internally to the umbones.

Individuals fairly close to this subspecies occur at Church View, Va. Left valve quite convex, right nearly flat; 15 ribs.

A left valve, in the collections of Cornell University, from Plum Point, Md., has a somewhat shorter byssal auricle than *madisonius*, s.s., is more ovate; ctenolium present; fasciole wide.

This subspecies is named in honor of Dr. R. S. Bassler, of the U. S. National Museum.

REMARKS. — *C. madisonius bassleri* is smaller, and the shell is thinner than that of *madisonius*, s.s. The development of scaly sculpture is more pronounced; ribs more numerous and narrower; left valves more convex; more nearly oval in outline. This subspecies tends to be larger than *coccymelus*, has fewer ribs; a single row of scales on the summits of the ribs; less conspicuous scaly sculpture; longer hinge line; more strongly convex. This subspecies appears to be quite characteristic of the Maryland Calvert.

DIMENSIONS. — Holotype, height 58, width 46, convexity 16, hinge 31.5 mm.

LOCALITIES. — Plum Point (type), and Chesapeake Beach, Md.

HORIZON. — Calvert (Miocene).

HYPOTYPES. — Collection Cornell University; collection H. I. Tucker-Rowland.

HOLOTYPE. — U. S. National Museum, Cat. N° 145919.

***Chlamys (Lyropecten) madisonius richardsi*, subsp. nov.**

Pl. III, figs. 4, 5.

Pecten madisonius SAY, variety, MANSFIELD, U. S. Nat. Mus., Proc., 74 : pl. 2, fig. 1, pl. 3, fig. 1, 1929.

DESCRIPTION. — Left valve quite convex; 15 somewhat elevated slightly rounded ribs, usually with 3 faint radial threads on the summits. In the umbonal area the ribs tend to be narrow, more or less flat-topped. One strong radial thread in each interspace, which extends to the umbones; usually 2 weaker radial threads. Surface of disk, and submargins strongly sculptured with wavy, elevated, concentric lamellae which tend to be more closely spaced at the ventral margin. Submargins indistinctly treaded radially. Auricles

unequal; concentric lamellae tend to form tiny linguiform processes on the summits of the radial threads.

Right valve has 14 ribs; sculpture similar to that of the left valve. Byssal auricle the more coarsely sculptured; 6 strong radials. Fasciole wide, conspicuous, not deep.

REMARKS. — This subspecies is apparently rather closely related to *urbannaënsis* Mansfield, which also occurs in Zone 2 of the St. Marys. Perhaps *eboreus*, s.s., was derived from such forms as *urbannaënsis* and *richardsi*. Typical *eboreus* appears in the Suffolk beds (Upper Yorktown) for the first time.

This subspecies has a less elongated byssal auricle than *madisonius*, s.s.; the interspaces are somewhat more shallow; the characteristic scaly sculpture of *madisonius* is not developed. It has the general appearance of *eboreus*, with the radial sculpture of *madisonius*.

DIMENSIONS. — Syntypes : Left, height 80, width 80, convexity 18 mm.; right, height 89.5, width 89.5, convexity 10 mm.

LOCALITY. — Grays Creek, Surry County, Va. (type).

HORIZON. — Zone 2, St. Marys (Miocene).

SYNTYPES. — Right and left valves of different individuals, U. S. National Museum, Cat. N° 370830.

***Chlamys (Lyropecten) jeffersonius edgecombensis* (CONRAD).**

Pl. II, fig. 5; pl. IV, fig. 6.

Pecten edgecombensis CONRAD, Acad. Nat. Sci. Phila., Proc., **14** : 291, 1862; HEILPRIN, *op. cit.*, **33** : 419, 1881.

Lyropecten carolinensis CONRAD, in Kerr, Geol. N. Car., App. : 48, 1875.

Pecten jeffersonius var. *edgecombensis* CONRAD, DALL, Wagner Free Inst. Sci., Trans., **3** : 722, 1898; GLENN, Geol. Surv. Md., *Miocene* : 379, pl. 100, fig. 3, 1904.

DESCRIPTION. — Conrad's original description :

« Suborbicular; height not quite equal to the length; lower valve-ribs 16 to 17, prominent, but not elevated, square or convex-depressed, not quite as wide as the intervening spaces, radiately lined with finely squamose striae, most conspicuous towards the margins, interstices of ribs carinated, in the middle squamose and finely striated; ears with fine close unequal squamose radiating lines, the larger ones most prominent on the posterior side; margins of ligament pit carinated. »

Fourteen to fifteen flat-topped ribs which are somewhat narrower than the interspaces. Usually five scaly, elevated threads on the summits of the ribs, the central one commonly the weakest. One strongly elevated, scaly cord in

the center of each interspace, with a variable number of scaly threads on either side. Sides of the ribs sculptured by weak, scaly threads. Submargins sculptured by close-set, scaly threads. Auricles subequal; scaly radial threads alternate in strength; sculpture of the byssal auricle slightly coarser. Small, inconspicuous fasciole.

Young individuals have quite narrow, sharply elevated ribs, with narrow, channeled interspaces. Concentric sculpture of little elevated lamellae. Three scaly threads on the summits of the ribs. Valves tend to be oval in outline. Ctenolium of about 4 denticles. Larger specimens from Coggins Point, Va., have seven scaly threads on the summits of the ribs.

The valve Conrad named *carolinensis* has 12 ribs; few traces of scaly threads in the interspaces; slightly convex; conspicuous byssal fasciole, slight sinus. The holotype is eroded almost beyond recognition. The label, Academy of Natural Sciences of Philadelphia, gives no locality. Height 77, width 51 mm.

DIMENSIONS. — Syntypes, both right valves : Height 87, width 77, convexity 17.5 mm.; height 90, width 78, convexity 16.5 mm. Hypotype, height 102.5, width 105 mm.

LOCALITIES. — Tarboro, Edgecombe County, N. C. (type), (Conrad); Suffolk, and Petersburg, Va., (Dall); Little Cove Point, and Grove Wharf, Md.; Langleys Bluff, Md., (Glenn); Kingsmill, Gloucester Point, and Bellefield, Va.

HORIZON. — St. Marys, and Yorktown (Miocene).

HYPOTYPES. — Collection Cornell University.

SYNTYPES. — Collection U. S. National Museum, Cat. N° 2495.

Chlamys (Lyropecten) santamaria TUCKER.

Pl. I, figs. 5, 6; pl. II, fig. 10.

Chlamys (Lyropecten) santamaria TUCKER, Amer. Midl. Nat., **15** : (5) : 615, pl. 26, fig. 2, 1934.

DESCRIPTION. — The original description :

« Shell equilateral, suborbicular, inequivalved. Radial sculpture of 12 to 16, most commonly 12 to 14, broad, well elevated ribs which are approximately 4 mm. narrower, at the ventral margins, than the interspaces. Right valves commonly have about 12 ribs which are about 2 mm. narrower than the interspaces. The right valves are flat, or nearly so, and resemble *C. madisonius* Say very closely in outline; left valve convex in the umbonal region; auricles subequal, radial sculpture of fine, scaly threads, the anterior the more coarsely threaded; fasciole broad. Auricles of the right valve subequal, uniformly sculptured with fine scaly threads. Summits and sides of the ribs threaded with numerous fine, scaly threads. Interspaces similarly ornamented; one or two of the threads are usually more strongly developed, especially on the right valve.

Submargins have a fine uniform sculpture of closely spaced, scaly threads. Interior ribbed to the umbones. Provinculum present. Ctenolium retained throughout the life of the individual. »

Left valves commonly have 13 ribs, about 6 mm. wide at the ventral margin; interspaces about 10 mm. wide; convex in the umbonal region. Right valves usually have 12 ribs, about 5 mm. wide at the ventral margin; interspaces about 7 mm. wide. Interspaces have scabrous threads, 1 or 2 of which in the right valve (syntype) are more strongly developed; nearly uniform on the left valve.

One left valve from Langleys Bluff, Md., has 16 ribs. Some individuals from St. Marys River, Md., have from 11 to 14 ribs.

REMARKS. — This species has the characteristic sculpture of *C. jeffersonius* Say and in outline closely resembles *C. madisonius* Say. It is separated from *jeffersonius* by the deep byssal notch, longer right anterior auricle, retention of the ctenolium in adult valves. It differs from *madisonius* in its finer, more uniform, scabrous sculpture; broader, flatter ribs, shorter byssal auricle.

It is possible that this species may be related to both *madisonius* and *jeffersonius*. *C. madisonius* occurs first in the Chipola (Miocene), while *C. jeffersonius*, s.s., appears in the lower Yorktown. The stronger development of some of the intercostals and the shortening of the byssal auricle suggest a possible relationship through *edgecombensis*.

DIMENSIONS. — Paratype, height 101, width 79 mm., an imperfect shell. Syntypes: Left valve, height 120, width 115 mm.; right, height 130, width 126 mm.

LOCALITIES. — St. Marys River, Md. (type), Tucker; Chancellor Pt., and Langleys Bluff, Md., Tucker.

HORIZON. — St. Marys (Miocene).

PARATYPE. — U. S. National Museum, Cat. N° 2498.

SYNTYPES. — Right valve, collection H. I. Tucker-Rowland. Left valve. U. S. National Museum, Cat. N° 2498.

***Chlamys (Lyropecten) santamaria middlesexensis* (MANSFIELD).**

Pl. II, fig. 12; pl. III, fig. 7 (1).

Pecten (Chlamys) santamaria middlesexensis MANSFIELD, Jour. Pal., **10** : (3) : 187, pl. 22, figs. 4, 5, 1936.

DESCRIPTION. — Mansfield's original description :

« *Pecten santamaria middlesexensis* is like *santamaria* Tucker, s.s., in its major features, but differs in the following minor features. Right valve slightly

(1) See Explanation of Plate III for correction of text of figs. 6 and 7 on Plate III.

more inflated, the ears relatively wider, the byssal notch shallower, the ribs less rounded distally; left valve with less rounded ribs distally and coarser subradials on the ribs. The new species is a descendant of *santamaria*. »

REMARKS. — This species differs from *C. santamaria* in having the right valve slightly the more convex, auricles longer, byssal notch shallower, ribs less rounded distally with coarser subradials. Left valve has similar sculpture.

DIMENSIONS. — Syntypes : Right, height 130, width 140, convexity 18 mm.; left, height 140, width 154, convexity 30 mm.

LOCALITIES. — Urbanna, Middlesex County, Va. (type), Mansfield.

HORIZON. — St. Marys (Miocene).

SYNTYPES. — U. S. National Museum, Cat. N° 373074.

Chlamys (Lyropecten) pontoni MANSFIELD.

Pl. I, fig. 7.

Pecten madisonius SAY?, MANSFIELD, U. S. Nat. Mus., Proc., **51** : 601, 1916, listed from Red Bay, Fla.

Chlamys (Lyropecten) pontoni MANSFIELD, Geol. Surv., Fla., Bull., **8** : 59, pl. 10, figs. 1, 2, 1932; TUCKER, Amer. Midl. Nat., **15** : (5) : 615, 1934.

DESCRIPTION. — Mansfield's original description :

« Shell large, rather strongly inflated, nearly equivalve and nearly equilateral, the posterior region being slightly more produced. Ornamented with 11 nearly flat to slightly rounded, widely spaced ribs, which are strong on the middle of the disk but weaker on the sides. Interradial spaces and surface of the ribs marked with moderately coarse radial threads which are more prominent between the ribs than on the surface of the ribs. Three to five weak radials lie on the extreme posterior and anterior areas of the disk. Ears partly broken away. Within, the surface distinctly reflects the strong external ribbing. »

If the Vaqueros formation of California is correctly assigned to the Lower Miocene, it is possible that *C. magnolia* Conrad may be related to the east coast *jeffersonius* through *pontoni*. *C. jeffersonius* does not appear in the Atlantic Tertiary before the Choctawhatchee (Lower Yorktown).

REMARKS. — *C. jeffersonius* has fewer, broader, more equal sized ribs than *pontoni*.

DIMENSIONS. — Holotype, height 130, 0, width 137, convexity 20 mm.

LOCALITY. — Red Bay, Walton County, Fla. (type), Mansfield.

HORIZON. — Choctawhatchee (Miocene).

HOLOTYPE. — U. S. National Museum, Cat. N° 371613.

***Chlamys (Lyropecten) jeffersonius* (SAY).**

Pl. I, figs. 3, 4; pl. V, figs. 19, 20.

Pecten jeffersonius SAY, Acad. Nat. Sci. Phila., Jour., **4** : 133, pl. 9, fig. 1, 1824; CONRAD, Foss. Med. Tert. U. S. : 46, pl. 22, fig. 1, 1840; EMMONS, N. Car. Geol. Surv., Rept. : 282, fig. 199, 1858; CONRAD, Acad. Nat. Sci., Proc., **14** : 581, 1862; MEEK, Smithsonian Misc. Coll., **7** : 4, 1864; CONRAD, Amer. Jour. Conch., **5** : 40, 1869; HEILPRIN, Acad. Nat. Sci. Phila., Proc., **33** : 419, 1881; HARRIS, Bull. Am. Pal., **1** : 309, pl. 9, fig. 1, 1896, reprint of Say's publication.

Pecten (Lyropecten) jeffersonius SAY, DALL, Wagner Free Inst. Sci., Trans., **3** : 722, 1898; GRANT and GALE, San Diego Soc. Nat. Hist., Mem., **1** : 176, pl. 9, fig. 3, 1931, *partim*.

Pecten (Chlamys) jeffersonius SAY, GLENN, Geol. Surv. Md., *Miocene* : 378, 1904, *partim*.

Chlamys (Lyropecten) jeffersonius SAY, MANSFIELD, Geol. Surv. Fla., Bull., **8** : 59, pl. 11, fig. 1, 1932.

DESCRIPTION. — Say's original description :

« Subequivalve, with from nine to eleven ribs. Shell rounded, convex, not quite equivalved, one of the valves being a little more convex than the other; the whole surface covered with approximate, scaly striae : ribs elevated, rounded, with six or seven striae on the back of each; intervening grooves profound ears equal; sinus of the ear of the superior valve not profound, being barely one height part of the length of the ear : within with broad rounded flattened ribs. »

Shell large, convex, rather heavy; subequilateral; nearly equivalve. Usually 7 to 10 broad, flat-topped ribs, which become broader at the base near the ventral margin. Ribs about 10 mm. wide, interspaces 15 mm. at the ventral margin. In the umbonal area ribs about twice the width of the interspaces, steep-sided. Entire surface of adult valves finely and evenly threaded with closely spaced, scaly threads. Usually smaller rib along border of each narrow, rather steep submargin. Auricles subequal; fine sculpture of uniform, fine, dense, scaly threads. Byssal auricle somewhat more coarsely threaded; fasciole narrow, inconspicuous; byssal sinus very small. Ctenolium absent in adult valves. Provinculum present. Ribbed internally. Cardinal crura more or less well developed.

Young valves translucent, nearly ovate. An occasional valve develops a single thread on the summits of the quadrangular, sharply elevated ribs. Concentric lamellae conspicuous, elevated. Interspaces deep, narrow, flat. Auricles unequal; byssal auricle the longer; sinus wide, conspicuous. Ctenolium présent; often persists until valves are 80 mm. in height. The characteristic sculpture of fine, scaly threads is usually well developed on valves 20 mm. in height.

REMARKS. — The valve figured by Glenn, pl. 100, fig. 2, 1904, is undoubtedly *C. santamaria* Tucker.

DIMENSIONS. — Holotype, height 131, width 140 mm. Hypotypes : Left valve, height 21, width 16.5 mm.; right, height 22, width 17 mm., young valves from Kingsmill, Va.; right, height 157, width 166 mm.; left 101, width 105 mm.

LOCALITIES. — Maryland (type), Say; Coggins Point, Kingsmill, James River, above Smithfield, Evergreen, Lanexa, Claremont Wharf, Jacks Bluff near Suffolk, Ruffins, Va.; Clarksville, Calhoun County, Fla., Mansfield; Greenville, and Chocowinity, N. C.; Bellefield, City Point, Grove Wharf, Nansemond River near Suffolk, Va.

HORIZON. — Yorktown (Miocene).

HYPOTYPES. — Collection Cornell University.

HOLOTYPE. — Collection Academy of Natural Sciences of Philadelphia.

***Chlamys (Lyropecten) jeffersonius palmyrensis* (MANSFIELD).**

Pl. II, fig. 11.

Pecten (Chlamys) jeffersonius palmyrensis MANSFIELD, Jour. Pal., **10** : (3) : 187, pl. 23, fig. 3, 1936.

DESCRIPTION. — Mansfield's original description :

« Shell large, ovate, equilateral, moderately inflated. Ribs four in number, high, very wide, nearly flat on the upper surface, and undercut over the umbonal area but rounded distally. Whole surface radially sculptured with many rounded, scabrous, coarse threads. »

REMARKS. — This species has fewer ribs than *C. jeffersonius septenarius*.

DIMENSIONS. — Holotype, height 146, width 155, convexity 30 mm.

LOCALITIES. — Palmyra Bluff, right bank of Roanoke River, Halifax County, N. C. (type), Mansfield.

HORIZON. — Yorktown (Miocene).

HOLOTYPE. — U. S. National Museum, Cat. N° 373075.

***Chlamys (Lyropecten) jeffersonius septenarius* (SAY).**

Pl. III, fig. 15.

Pecten septenarius SAY, Acad. Nat. Sci., Jour., **4** : 136, pl. 9, fig. 3, 1824; CONRAD, Foss. Med. Tert. U. S. : 47, pl. 22, fig. 2, 1840; TUOMEY and HOLMES, Pleioc. Foss. S. Car. : 131, pl. 13, figs. 1-4, 1857; CONRAD, Acad. Nat. Sci. Phila., Proc., **14** : 581, 1863; HEILPRIN, *op. cit.*, **33** : 420, 1881; HARRIS, Bull. Am. Pal., **1** : 312, pl. 9, fig. 3, 1896, reprint of Say's publications.

Pecten jeffersonius var. *septenarius* SAY, DALL, Wagner Free Inst. Sci., Trans., **3** : 722, 1898; GLENN, Md. Geol. Surv., *Miocene* : 379, pl. 100, fig. 4, 1904; GRANT and GALE, San Diego Soc. Nat. Hist., Mem., **1** : 178, 1931, *partim*.

DESCRIPTION. — Say's original description :

« Shell convex, suborbicular; auricles subequal; surface with numerous slightly scaly striae, and about seven remote ribs, of which the three intermediate ones are much elevated, rounded, or slightly flattened on the top. »

The hypotype is the valve figured by Glenn, Md. Geol. Surv., *Miocene* : pl. 100, fig. 4, 1904. Outline similar to that of *jeffersonius*, s.s. Six to eight flat-topped ribs which are somewhat narrower than the steep-sided, flat interspaces. Disk sculptured by fine, even radial threads. Elevated, concentric lamellae form closely spaced, erect, linguiform processes on the summits of the radial threads. Submargins and auricles have radial sculpture of fine scaly threads. Inconspicuous byssal fasciole.

Probably *septenarius* does not occur in the St. Marys Miocene. There are no specimens in either the collections of the U. S. National Museum or in the Cornell University collections from that horizon.

The holotype has 8 ribs; rather small auricles; ctenolium; internally ribbed. Resembles very closely the figured hypotype. U. S. Nat. Mus., Cat. N° 143779.

REMARKS. — This subspecies is differentiated from *jeffersonius*, s.s., by its less numerous, broad, angular ribs. It has more uniform, radial threads than *edgecombensis*.

DIMENSIONS. — Holotype, height 65, width 66 mm. Hypotype, height 91, width 73 mm.

LOCALITIES. — City Point, Va., Conrad; Petersburg, Va., Dall; near Gile's Bluff, Pee Dee River, S. C., Tuomey and Holmes; St. Marys River, Md. (type?), Say; Duplin County, N. C., Dall.

HORIZON. — Yorktown, and Duplin (Miocene).

HYPOTYPE. — U. S. National Museum, Cat. N° 143779.

HOLOTYPE. — Academy of Natural Sciences of Philadelphia.

Chlamys (Lyropecten) tamiamiensis (MANSFIELD).

Pl. IV, fig. 4.

Pecten (Lyropecten) tamiamiensis MANSFIELD, U. S. Geol. Surv., Prof. Paper, **170-D** : 47, pl. 16, figs. 4, 6, March, 1932.

DESCRIPTION. — Mansfield's original description :

« Shell rather small, ovate, moderately ventricose, equivalve, and nearly, equilateral. Both valves similarly sculptured. Right valve sculptured with

23 major ribs, which are stronger over the middle of the disk and weaker on the lateral areas. The two marginal posterior ribs are paired and much weaker than the others. Interspaces occupied by a single strong, rounded riblet. Surface of the shell ornamented with fine concentric, beakward-reflected imbrications. Anterior ear with a rather deep byssal notch and externally marked with six rather coarse radials; posterior ear with finer radials than the anterior. »

Submargins without ornamentation. Ctenolium present.

REMARKS. — The nearest related fossil is *mediacostatus* Hanna, from which this species is separated by its narrower shell and smaller auricles. *C. tamiamiensis* has less well developed concentric sculpture than *interlineatus* Gabb. *C. interlineatus* has a radial cord in each interspace while the rounded riblets of *tamiamiensis* fill the interspaces.

DIMENSIONS. — Holotype, height 74, width 69 mm.

LOCALITY. — Tamiami Trail 6 mi. west of crossroads leading to Everglades, Collier County, Fl. (type), Mansfield.

HORIZON. — Pliocene.

HOLOTYPE. — U. S. National Museum, Cat. N° 371325.

***Chlamys (Lyropecten) pittieri collierensis* (MANSFIELD).**

Pl. III, fig. 14; pl. IV, figs. 2, 3; pl. V, fig. 21.

Pecten (Nodipecten) pittieri collierensis MANSFIELD, U. S. Geol. Surv., Prof. Paper, **170-D** : 47, pl. 16, figs. 3, 5, 1931.

Pecten (Lyropecten) pittieri floridensis TUCKER and WILSON, Bull. Am. Pal., **18** : (65) : 5, pl. 4, fig. 6, 1932.

DESCRIPTION. — Mansfield's original description :

« Shell large, orbicular, moderately ventricose, equivalve, and nearly equilateral, the posterior region being slightly more produced. Sculptured with broad, nearly flat, weakly undulating ribs (seven on the left valve and eight on the right) separated by little wider interspaces. The ribs are broader over the middle of the disk and narrower on each side. Top of ribs sculptured with five to eight coarse, raised threads separated by narrower interspaces. Spaces between major ribs marked with three or five coarse, weakly undulating threads and occasionally with a finer thread. Submargins sculptured with six to eight radial threads, which are equal in strength to the intercostal threads. Ears ornamented with rather coarse radiating riblets. »

— Ribs arranged in pairs, with wider interspaces; 8 ribs, with 2 smaller ones along each submargin. Some left valves have a slight tendency to become nodose in the umbonal region. Only one left valve developed scales typical of *pittieri*. Ctenolium present at all stages of growth. Strong crura.

The poorly preserved holotype is not figured. Dr. Herman Gunter very kindly gave permission to use specimens belonging to the Geological Survey of Florida for purposes of illustration.

REMARKS. — This subspecies is separated from *pittieri* Dall by its lack of vaulted scales, fewer ribs, and its less marked convexity. This subspecies appears to be intermediate between *pittieri* and *nodosus*.

DIMENSIONS. — Holotype, left valve, height 125, width 142 mm. Hypotypes: Left valve, Fla. Geol. Surv., Cat. N° I-3149, height 85, width 85 mm.; right, same number, height 104, width 100 mm.; left valve, U. S. Nat. Mus., Sta. N° 1/1176, height 40, width 38 mm.

LOCALITIES. — Tamiami Trail, about 11 mi. east by north of Marco, Collier County, Fla. (type), Mansfield; Tamiami Trail, about 6 mi. west of crossroads leading to Everglades, Collier County, Fla., Mansfield; Tamiami Trail at Carnestown, 4 mi. north of Everglades, Collier County, Fla., Mansfield; 18 mi. south of Immokalee, Collier County, Fla., (hypotypes from Fla. Geol. Surv., Cat. N° I-3149).

HORIZON. — Pliocene.

HYPOTYPE. — Florida Geological Survey, Cat. N° I-3149.

HOLOTYPE. — U. S. National Museum, Cat. N° 371326.

***Chlamys (Lyropecten) peedeensis* (TUOMEY and HOLMES).**

Pl. I, fig. 8.

Pecten peedeensis TUOMEY and HOLMES, Pleioc. Foss. S. Car. : 30, pl. 12, figs. 1-5, 1857; EMMONS, N. Car. Geol. Surv., Rept. : 281, 1858; CONRAD, Acad. Nat. Sci. Phila., Proc., **14** : 581, 1862; HEILPRIN, *op. cit.*, **33** : 420, 1881.

Pecten (Nodipecten) peedeensis TUOMEY and HOLMES, DALL, Wagner Free Inst. Sci., Trans., **3** : 729, 1898.

DESCRIPTION. — Tuomey and Holmes' original description :

« *P. testa trigono-ovata, crassa, aequilaterali; costis 8, ampliter nodosis, concentric striatis, sub-squamosis.*

« Shell triangularly ovate, somewhat flatly convex, equivalve, equilateral; with eight large knobbed ribs, the whole concentrically covered with squamose striae. Lower valve with the ribs generally dislocated vertically, and rather abruptly on the umbones. The interstices between the ribs become very wide toward the pallial margin. The upper valve with ribs strongly keeled. »

Shell very thick, heavy, greatest convexity in the umbonal region; after reaching a height of 5 mm. the valve becomes nodose. Nodulations disappear after the individual attains a height of 60 or 70 mm. Three strong, primary

ribs on the central portion of the valve, with 2 weaker ones on either side; tend to be flat-topped or broadly rounded, and to develop a single strong radial thread on the summits of each rib. Interspaces in young individuals about the same width, or slightly narrower than the ribs; in adults, slightly broader than the ribs. Disk sculptured with fine radial threads and strong, widely spaced, concentric lamellae. Submargins wide, sculptured only by concentric lamellae. Auricles ? Disk fluted at the margins.

Whitfield, Am. Mus. Nat. Hist., Bull., 11 : (4) : 448, 1901, includes *peedeensis* in the list of type specimens in the collections of the American Museum of Natural History. The Museum records do not indicate that the holotype was ever catalogued. Since the holotype has apparently been lost, it seems best to designate as the neoholotype the valve figured in this paper, U. S. National Museum, Cat. N° 9526.

REMARKS. — *C. peedeensis* differs from *nodosus* in having the disk covered with fine radial and concentric sculpture. The shell of *peedeensis* is heavier, and it loses the tendency to develop nodes on the summits of the ribs sooner than *nodosus*.

DIMENSIONS. — Neoholotype, height 115, width 115, convexity 37 mm.

LOCALITIES. — Peedee River, Darlington District, S. C. (type), Tuomey and Holmes; Virginia, Dall.

HORIZON. — Waccamaw (Pliocene).

NEOHOLOTYPE. — U. S. National Museum, Cat. N° 9526.

***Chlamys (Lyropecten) vaccamavensis* (OLSSON).**

Pl. IV, fig. 10.

Pecten (Nodipecten) vaccamavensis OLSSON, Bull. Am. Pal., 5 : (24) : 49, pl. 1, fig. 1, 1914.

DESCRIPTION. — Olsson's original description :

« Shell rather large; valves of moderate but equal convexity; left valve with about seven narrow, elevated ribs which are slightly nodose at more or less equal radial distances from the beak; interspaces very wide and with about 4 or 5 longitudinal lines which are made slightly setose by the equidistant, elevated, concentric lines; anterior and posterior marginal slopes, abrupt; ears flat, with narrow riblets, slightly imbricated by the concentric lines which are here rather closely crowded. Left valve (not well preserved in type specimen) with seven or eight very wide ribs, separated by narrow and deep interspaces. »

Three of the ribs are much more prominent, but apparently all were introduced at the same time. The pronounced development of these ribs, and the angular submargins tend to give the shell a quinquecostate appearance..

DIMENSIONS. — Holotype, height 70, width 68, convexity 18 mm.

LOCALITY. — Lake Waccamaw, N. C. (type), Olsson

HORIZON. — Waccamaw (Pliocene).

HOLOTYPE. — Paleontological Research Institution ⁽¹⁾.

Chlamys (Lyropecten) nodosa (LINNÉ).

Pl. II, figs. 8, 9.

Ostrea nodosa LINNÉ, Syst. Nat., ed. X : (164) : 698, 1758; LINNÉ, *op. cit.*, ed. XIII : 1145, 1767; HANLEY, *Ipsa Linnaei Conchylia* : 106, 1855.

Pecten nodosus LINNÉ, LAMARCK, An. sans Vert., 6 : 170, 1819; d'ORBIGNY, Moll. Cuba, 2 : 353, 1845; REEVE, Conch. Icon., *Pecten* : pl. 3, fig. 15, 1853; HEILPRIN, Wagner Free Inst. Sci., Trans., 1 : 100, 1899.

Lyropecten nodosus LINNÉ, VERRILL, Conn. Acad. Sci., Trans., 10 : 63, 91, 1897.

Pecten pernodosus HEILPRIN, Wagner Free Inst., Sci. Trans., 1 : 131, pl. 16b, figs. 69, 69a, 1889.

Pecten (Nodipecten) nodosus LINNÉ, DALL, Wagner Free Inst. Sci., Trans., 3 : 728, 1898.

DESCRIPTION. — Linné's original description :

« O testa radiis 9 nodoso-vesicularibus.

» Habitat in O. Africano E. Indico. »

Shell large, strong; suborbicular; nearly equivalve, equilateral; somewhat convex. Seven to ten large, fluted, nodose ribs; those of the right valve tend to be flatter, broader, and less nodose than the ribs of the left valve. Summits of the ribs sculptured by numerous coarse threads. Interspaces narrower than the ribs; sculptured by from 1 to 3 major intercostal cords and occasional threads. The whole surface of the disk concentrically sculptured by somewhat coarse lamellae which form erect, pointed, marginward reflected scales on the summits of the secondary radials. Submargins rather wide; radial sculpture of fine radial thread and concentric sculpture of scaly lamellae. Auricles medium size; unequal; sculpture of coarse radial threads and concentric lamellae. Fasciole broad; byssal notch conspicuous; ctenolium present. Margins coarsely scalloped. Interior broadly ribbed nearly to the umbonal region. Provinculum and cardinal crura rather well developed.

Individuals vary considerably in the degree of nodulation. Some have only the turgid undulations of the ribs which are characteristic of *subnodosus* of the Pacific Coast. Others have subglobular bullae at short intervals. Occasional specimens suddenly become nodulous after about half of their growth is completed. Caloosahatchie shells tend to develop the nodulations very early in the

⁽¹⁾ A small, incorporated, private museum at Ithaca, New York, U. S. A., having no connection with Cornell University.

life of the individual. If Dall is correct in his assumption that deep water specimens are thinner and more nodose we must conclude that these individuals lived under such conditions.

REMARKS. — This species is separated from *condylomatus* by its fewer ribs and by the development of bullae on the ribs. *C. nodosus* is a larger individual than *condylomatus*. It is separated from *ernestsmithi* by its more pronounced development of nodules and by the marked differences in sculpture.

DIMENSIONS. — Holotype, height 96.5, width 90 mm. Hypotype, height 78, width 75 mm.

LOCALITIES. — Pleistocene of the Antilles and the north coast of South America, Dall; Living in the Antilles and the Gulf of Mexico, Dall; Teneriffe Island; Sanibel Island, Fla.; Ft. Denaud (hypotype), and La Belle, Fla.

HORIZON. — Pliocene to Recent.

HYPOTYPE. — Collection H. I. Tucker-Rowland.

HOLOTYPE. — Museum of the Linnean Society of London.

***Chlamys (Lyropecten) interlineatus* (GABB).**

Pl. V, figs. 5, 18.

Pecten interlineatus GABB, Am. Phil. Soc. Phila., Trans., N. S., **15** : 256, 1873; PILSBRY, Acad. Nat. Sci. Phila., Proc., **73** : 441, pl. 45, fig. 3, 1921.

Pecten (Chlamys) interlineatus GABB, DALL, Wagner Free Inst. Sci., Trans., **3** : 716, 1898; TUCKER and WILSON, Bull. Am. Pal., **18** : (65) : 5, pl. 4, fig. 7, 1932.

DESCRIPTION. — Gabb's original description.

« Shell slightly convex, nearly equilateral, base and sides evenly rounded, ears large, radiately ribbed; surface marked by about eighteen round or sub-angulated ribs, with a single line in each interspace. »

Holotype, right and left valves of the same individual. Slightly ovoid, fairly thick, nearly equilateral; uniformly ribbed and obscurely lamellated concentrically. Sixteen ribs, which toward the submargins tend to become smaller, less rounded, or even keeled, and finally to disappear. Interspaces shallow, narrower than the ribs. The left valve has a single strong thread in each interspace 10 to 20 mm. from the beak, and on the right valve about 10 mm. from the ventral margin; commonly 1 or 2 secondary threads. Concentric lamellae slightly elevated, closely spaced, reflected beakward on the summits of the ribs. Auricles imperfect; right posterior auricle finely and obscurely threaded with scaly radial threads; byssal auricle more coarsely threaded. Auricles of the left valve uniformly and less finely threaded with closely spaced, scaly radials. Fasciole broad; deep byssal sinus; ctenolium.

Florida shells are large, rather thin; with 16 to 20 low, rounded ribs, crossed by concentric, wavy lamellae which are better developed in the interspaces. Interspaces shallow, narrower than the ribs. Submargins narrow, the anterior smooth. Auricles unequal, radially sculptured with corrugated threads; byccal sinus deep, marked fasciole. Ctenolium consists of 4 or 5 denticles. Interior fluted.

DIMENSIONS. — Holotype, height 24.7, width 23, convexity 7.2 mm. Hypotype, height 53, width 47 mm.

LOCALITIES. — Santo Domingo (type), Gabb; Buckingham, and Naples, Fla., Tucker and Wilson.

HORIZON. — Oligocene, fide Gabb; Caloosahatchie (Pliocene).

HYPOTYPES. — Collection H. I. Tucker-Rowland.

HOLOTYPE. — Academy of Natural Sciences of Philadelphia, Cat. N° 2856.

Chlamys (Lyropecten) ernestsmithi (TUCKER).

Pl. II, fig. 7.

Pecten ernestsmithi TUCKER, Ind. Acad. Sci., Proc., **40** : 244, pl. 1, figs. 2, 3, 1931; TUCKER and WILSON, Bull. Am. Pal., **18** : (66) : 4, pl. 2, fig. 13, 1933.

DESCRIPTION. — The original description :

« Shell ovate, rather large, heavy, with five ribs, three of which are better developed. The ribs are broad and rounded on their summits and show a marked tendency to become nodose from the umbonal region to the periphery. Interspaces wider than the ribs and deeply channeled. Both ribs and interspaces strongly, radially threaded. A fragment of a right valve shows a strongly developed concentric sculpture of scaly lamellae over both ribs and the interspaces. Beak narrow and quite pointed. Submargins narrow, the outer margins nearly smooth, the inner radially threaded like the rest of the disk. Ears large, unequal, and radially threaded. Anterior byssal ear quite pointed and somewhat corrugated along the cardinal margin. Posterior ear somewhat less strongly threaded. Byssal sinus deep, narrow, inconspicuous. Fasciole broad. Interior fluted to the umbones. Margins crenulated. Ctenolium consists of six prominent denticles. Resilial pit narrow, trigonal, lateral margins elevated. Cardinal margins of the right valve bent over the left. Provinculum strongly developed. Valve retains traces of a blotchy color pattern. »

REMARKS. — *C. ernestsmithi* differs from *caloosaensis* Dall in the shape of the auricles, width of interspaces and in sculpture. This species shows a well developed sculpture of radial threads while in *caloosaensis* the interspaces are sculptured only with feeble concentric lines. The anterior byssal auricle of *ernestsmithi* is much more pointed than that of this species.

DIMENSIONS. — Holotype, height 85, width 82.5, hinge 60, convexity 20 mm.

LOCALITIES. — Acme, N. C. (type), Tucker; Moore Haven, Fla., Tucker and Wilson.

HORIZON. — Waccamaw, and Caloosahatchie (Pliocene).

HOLOTYPE. — Collection H. I. Tucker-Rowland.

Chlamys (Lyropecten) caloosaensis (DALL).

Pl. IV, fig. 7; pl. V, fig. 9.

Pecten (Nodipecten) caloosaensis DALL, Wagner Free Inst. Sci., Trans., **3** : 781, pl. 29, fig. 12, 1898.

DESCRIPTION. — Dall's original description :

« Shell moderately large, with four principal ribs and sometimes a subsidiary, much smaller rib at the inner edge of the sub-margins, backs of the ribs strongly, radiately striated or even threaded, the interspaces smooth or with only obsolete traces of striation, equal to or wider than the ribs; concentric sculpture usually feak, of close-set concentric elevated or incremental lines; submargins wide, the outer margins smooth, the inner threaded like the backs of the ribs; ears large, triangular, widest at the cardinal margin and pointed at the distal cardinal angle, their sculpture radial, not crowded; feeble except upon the byssal ear, where the threads are strong and concentrically scabrous; byssal notch wide, shallow, the fasciole conspicuous; ctenolium distinct; interior reflecting the external ribs; hinge with crura present but feeble in the young; the old specimens have them obsolete, but on the cardinal margin a relatively broad ligamentary area is formed. »

DIMENSIONS. — Holotype, height 65, width 59, hinge 42 mm.

LOCALITIES. — Shell Creek, Fla. (type), Dall; Caloosahatchie River, Fla., Dall; Moore Haven, Ft. Denaud, Prairie Creek, and near Clewiston, Fla.

HORIZON. — Caloosahatchie (Pliocene).

HYPOTYPES. — Collection H. I. Tucker-Rowland.

HOLOTYPE. — U. S. National Museum, Cat. N° 107756.

SUBGENUS *AEQUIPECTEN* FISCHER, 1886.

Aequipecten FISCHER, Man. de Conch. : 944, 1886, type *C. opercularis* LINNÉ, by monotypy; DOLLFUS, Moll. Mar. Rousillon, **2** : 72, 1889; DOUVILLÉ, Soc. Geol. de France, sér. **3** : **25** : 204, 1897; SACCO, I Moll. dei Terr. Terz. del Piemonte, pt. **24** : 13, 1897; VERRILL, Conn. Acad. Sci., Trans., **10** : 67, 68, 1897; DALL, Wagner Free Inst. Sci., Trans., **3** : 695, 1898; VERRILL and BUSH, U. S. Nat. Mus., Proc., **20** : 830, 1898;

ARNOLD, U. S. Geol. Surv., Prof. Paper, **47** : 49, 1906; UGOLINI, Paleont. Italica, **13** : 162, 1906; COSSMAN and PEYROT, Actes de la Soc. Linn. de Bordeaux, **66** : 311, 1914; DAUTZENBERG et FISCHER, Trav. de la Sta. Roscoff, fasc. **3** : 111, 30 août 1925; Cox, Rept. Zanzibar Protectorate : 47, Sept. 1927; GRANT and GALE, San Diego Soc. Nat. Hist., Mem., **1** : 198, 1931; JOHNSON, Boston Soc. Nat. Hist., Proc., **40** : (1) : 24, 1934.

GENOTYPE. — « *Ostrea* » *opercularis* Linné, by monotypy, Fischer, 1886. Living, Norway to the Mediterranean.

DIAGNOSIS. — Fischer's original diagnosis :

« Forme circulaire; côtes rayonnantes bien marquées (*C. opercularis* Linné). »

Shell of moderate size and thickness; length and height approximately equal; subequivalve, or with either valve slightly the more convex. Radial sculpture of uniform, simple, primary, rounded or flat-topped ribs more or less well developed on both valves, or nearly obsolete on the right valve. Valves sometimes striated radially and concentrically lamellated. Interspaces often narrower than the ribs. Auricles usually subequal, subangular; ctenolium commonly present. Hinge-plate with 1 or 2 slightly divergent crura at each end, often crossed by transverse incisions. Internal bicarinate ribs, if present, correspond to external interspaces.

REMARKS. — This subgenus is closely related to *Chlamys*, s.s. It has fewer, more distinct ribs, characteristically without striations; more circular in outline. Auricles more nearly equal; byssal sinus smaller.

Ctenolium abortive in genotype. In *C. opercularis* Linné the left valve is the more convex, but usually in this subgenus the reverse is the case.

LOCALITY. — Living in warm and temperate waters of all oceans. World wide (fossil).

HORIZON. — Jurassic to Recent.

SECTION *Aequipecten* s.s.

DIAGNOSIS. — Valves only slightly convex, the right sometimes nearly flat. Radial sculpture of low, rounded, simple, distant ribs; radial striations usually not conspicuous.

Chlamys (*Aequipecten*) *perplanus* (MORTON).

Pl. VI, fig. 12.

Pecten sp. LE SEUR, Walnut Hills Fossils : pl. 5, fig. 2, 1829.

Pecten perplanus MORTON, Am. Jour. Sci., **23** : 293, pl. 5, fig. 5, 1833; MORTON, Syn. Org. Rem. : 58, pl. 5, fig. 5, 1834; COOKE, in Ala. Geol. Surv., Rept., **14** : pl. 96, fig. 5, 1926.

Pecten spillmani GABB, Acad. Nat. Sci. Phila., Jour., 2nd ser., **4** : 402, pl. 68, fig. 3, 1860; CONRAD, Am. Jour. Conch., **1** : 14, 1865; HEILPRIN, Acad. Nat. Sci. Phila., Proc., **33** : 417, 1881; DE GREGORIO, Ann. de Geol. et de Pal., **7** et **8** liv. : 182, 1890.

Pecten (Aequipecten) perplanus MORTON, DALL, Wagner Free Inst. Sci., Trans., **3** : 732, 1898.

DESCRIPTION. — Morton's original description :

« Depressed with about twenty simple costae, transversely striated. Diameter less than an inch. Found with the preceding species » (*anatipes*).

Shell thinner than that of *poulsoni*, suborbicular, usually equilateral; valves about equally convex. In some individuals the right valve tends to be slightly the more convex. Usually 20 to 25 narrow, keeled ribs, which develop 2 parallel sulci on their summits about 10 mm. from the ventral margin on adult valves. Ribs reduced to scaly threads on the submargins. Concentric sculpture of small, linguiform, erect, slightly overlapping scales which continue across the V-shaped interspaces as only slightly elevated lamellae. An occasional specimen from the type locality has a single scaly intercostal thread near the ventral margin. Auricles have scabrous radial threads, which are markedly coarser on the right anterior auricle. Byssal notch wide; ctenolium present. Auricular and cardinal crura.

REMARKS. — *C. perplanus* is much less convex than *poulsoni*. The ribs are more angular, scaly sculpture well developed, ctenolium present in *adults*, and the valves are more equally convex than in *poulsoni*.

None of the valves of *perplanus* from the type locality could possibly be mistaken for *poulsoni*, although the original label in the Academy of Natural Sciences of Philadelphia reads « *Pecten perplanus* Morton and opercular valves of *P. poulsoni*. »

In the event it were established that the type of *perplanus* is the left valve of *poulsoni*, as has been suggested, *spillmani* would then become type. The holotype of *spillmani* is a complete individual, height 27, width 28 mm. If it were to become established as the type, it would be the exact equivalent of *perplanus* Morton.

DIMENSIONS. — Hypotype, height 29, width 26 mm.

LOCALITIES. — St. Stephens, Ala. (type), Morton; Tullis, La.; Cocoa Post-Office, Choctaw County, and Fair Post-Office near Claiborne, Ala., Dall; Pachula Creek, and Shubuta, Clarke County, Miss.; Gainesville, Fla., Dall; Ocala, Fla.; Grant Parish, La., Johnson; Jackson, Miss.

HORIZON. — Jackson (Eocene), Vicksburg (Oligocene).

HYPOTYPES. — Collection Cornell University.

HOLOTYPE. — Academy of Natural Sciences of Philadelphia, Cat. N° 275.

***Chlamys (Aequipecten) perplanus centrotus* (DALL).**

Pl. VI, fig. 6.

Pecten (perplanus?) centrotus DALL, Wagner Free Inst. Sci., **3** : 733, pl. 34, fig. 21, 1898.

DESCRIPTION. — Dall's original description :

« Shell like the preceding, with twenty-three flattopped smooth ribs with lateral fringes which wholly fill the interspaces but do not unite in the middle of the channel. Two or three of the ribs near the middle of the disk show six to eight distant, regularly spaced short spines projecting from their tops; the other ribs are destitute of spines. Interior sharply and deeply grooved to correspond with the external ribs. »

REMARKS. — Since the holotype has apparently been lost, it seems best to include Dall's description and to refigure the holotype.

DIMENSIONS. — Holotype, height 20, width 18.5 mm.

LOCALITY. — Ponce de Leon artesian well, St. Augustine, Fla., at a depth of 225 ft. (type).

HORIZON. — « Eocene (Vicksburgian ?) », fide Dall.

HOLOTYPE. — U. S. National Museum ?

***Chlamys (Aequipecten) suwanneensis* (DALL).**

Pl. VI, fig. 10.

Pecten (Aequipecten) suwanneensis DALL, Wagner Free Inst. Sci., Trans., **3** : 734, 1898;
DALL, U. S. Nat. Mus., Proc., **51** : 492, pl. 83, figs. 2, 3, 4, 1916.

DESCRIPTION. — Dall's original description :

« Shell with 22 entire, rounded ribs, with narrower, rather shallow interspaces crossed by little raised, concentric, not crowded, more or less fluctuated laminae continuous over ribs and spaces, fifth lateral grooves on the ribs near the basal margin; submargins narrow, smooth; ears subequal, moderate, with fine, close, concentric sculpture and four or five distant fine imbricated radii; notch distinct, rather deep. »

REMARKS. — This species is separated from *kneiskerni* by its unchanneled interspaces, continuous concentric lamellae and by its subequal auricles. *C. chilopalanus* has fewer ribs, smaller auricles, and more conspicuous sculpture than this species. *C. suwanneensis* is flatter, thinner, and smaller than *perplanus*. *C. nuperus* differs from *suwanneensis* in the sculpture of the auricles, and in having more sharply keeled ribs.

DIMENSIONS. — Syntypes : Right, height 22, width 22 mm.; left, height 20, width 20 mm.

LOCALITIES. — East bank of Flint River, just above Lambert Island, about 10.5 mi. below Bainbridge, Decatur County, Georgia, Dall; Mascot Point, below the mouth of Blue Springs branch, Georgia, Dall; Suwannee River, Florida (type), Dall.

HORIZON. — Jackson (Eocene) and Vicksburg (Oligocene).

SYNTYPES. — U. S. National Museum, Cat. N° 115777.

***Chlamys (Aequipecten) burnetti* TUCKER.**

Pl. V, fig. 6.

Chlamys (Aequipecten) burnetti TUCKER, Amer. Midl. Nat., **15** : (5) : 616, pl. 25, fig. 2, 1934.

DESCRIPTION. — The original description :

« Shell equilateral; radial sculpture well developed; the valves somewhat flat, the left the more convex. The right valve has sixteen rounded ribs; the left, fifteen somewhat sharper ribs. A sulcus appears on the summits of the ribs 10 to 15 mm. from the ventral margin. A single intercostal appears on the right valve 3 or 4 mm. before the groove on the primary ribs. On the left valve there is one, rarely two, smaller intercostal. Interspaces on the left valve much the wider. Concentric lamellae stronger on the left valve. Submargins plain. Auricles of left valve lamellated; 4 to 5 radial threads; right anterior auricle has 3 radial threads; posterior, 5. Very wide byssal fasciole. Ctenolium present. Interior ribbed. »

REMARKS. — This species differs from *C. perplanus* Morton in having fewer ribs, smaller auricles, less marked scaly sculpture, and in the absence of a pro-vinculum. This species has 15 to 16 ribs while *perplanus* has from 23 to 25 ribs.

DIMENSIONS. — Holotype, height 33, width 27 mm.

LOCALITIES. — Six Mile Creek (type), and Black Water Creek, Fla.

HORIZON. — Tampa (Miocene).

HYPOTYPES. — Collection H. I. Tucker-Rowland.

HOLOTYPE. — Collection H. I. Tucker-Rowland.

SECTION *Plagioctenium* DALL, 1898.

Plagioctenium DALL, Wagner Free Inst. Sci., Trans., **3** : 696, 1898, type « *Pecten* » *ventricosus* SWBY, by original designation; ARNOLD, U. S. Geol. Surv., Prof. Paper, **47** : 50, 1906; WOODRING, Carnegie Inst. Wash., **366** : 68, 1925; GARDNER, U. S. Geol. Surv., Prof. Paper, **142-A** : 48, 1926; GRANT and GALE, San Diego Soc. Nat. Hist., Mem., **1** : 206, 1931; JOHNSON, Boston Soc. Nat. Hist., Proc., **40** : (1) : 24, 1934.

TYPE. — « *Pecten* » *ventricosus* Sowerby = *C. gibbus circularis* Sowerby, by original designation, Dall, 1898.

DIAGNOSIS. — Dall's original diagnosis :

« Resembling *Aequiptecten* but without radial striation; the concentric sculpture in looped lamellae; the ribs strong, frequently smooth above; the sub-margins impressed below the subequal auricles; the valves well inflated with a tendency to oblique growth in the adult. »

Shell rather large; somewhat inequilateral; strongly convex, the right valve more inflated than the left. Radial sculpture of flat-topped ribs, less commonly rounded, with somewhat narrower, squarely channeled interspaces. Concentric lamellae concave upward. Auricles subequal; anterior auricles the more strongly ribbed. Crura less strong than in *Aequiptecten*, s.s.

REMARKS. — Shell resembles that of *Aequiptecten*, s.s., but has stronger, squarer ribs, with faint, or obsolete striations. Valves frequently more convex and less equilateral than in *Aequiptecten*, s.s. Auricles longer.

The species of *Aequiptecten*, s.s., and especially of *Plagiectenium*, are among the most variable known. Species of *Plagiectenium* are very abundant in North American Tertiary and living faunas.

LOCALITY. — Living in warm and temperate waters. World wide (fossil).

HORIZON. — Oligocene to Recent.

***Chlamys (Plagiectenium) eboreus watsonensis* (MANSFIELD).**

Pl. III, fig. 8; pl. IV, fig. 5.

Pecten eboreus CONRAD, DALL, Wagner Free Inst. Sci., Trans., **3** : 1597, 1903, not Conrad, 1833.

Chlamys (Plagiectenium) eboreus eboreus CONRAD, MANSFIELD, Fla. Geol. Surv., Bull., **8** : 60, pl. 12, fig. 11, 1932.

Pecten (Chlamys) eboreus watsonensis MANSFIELD, Jour. Pal., **10** : (3) : 188, pl. 23, figs. 1, 2, 1936.

DESCRIPTION. — Mansfield's original description :

« Shell rather large, ovate, slightly inequilateral, the posterior region being more produced and moderately inflated, the left valve slightly more so than the right. Ears rather large; right anterior with a shallow byssal notch and ornamented with 4 weak radials and fine concentric lamellae; left posterior ear with about 6 radials. Both valves sculptured with 18 nearly flat, nearly smooth, moderately narrow ribs, separated by spaces about as wide as ribs. Both ribs and interspaces sculptured with coarse concentric imbricated lamellae. »

REMARKS. — This species differs from *eboreus*, s.s., in having from 5 to 8 fewer, more widely spaced ribs.

DIMENSIONS. — Holotype, width 80, height 74, convexity 17 mm. Paratype, width 100, height 94, convexity 22 mm.

LOCALITIES. — 2 mi. north of Alum Bluff, on old road to Watsons Landing, Liberty County, Fla. (type), Mansfield; Schmidts Bluff, right bank James River, Surry County; 1/3 mi. below Lanexa, New Kent County; College Park, 1 mi. southwest of Williamsburg, on road to James town, Va., Mansfield.

HORIZON. — Choctawhatchee, and Yorktown (Miocene).

PARATYPE. — U. S. National Museum, Cat. N° 373076.

HOLOTYPE. — U. S. National Museum, Cat. N° 371139.

Chlamys (Plagioctenium) gladensis (MANSFIELD).

Pl. II, fig. 4.

Pecten (Chlamys) gladensis MANSFIELD, Jour. Pal., **10** : (3) : 188, pl. 23, fig. 4, 1936.

DESCRIPTION. — Mansfield's original description :

« Shell large, rather thick, nearly equilateral, longer than high. Ears subequal, slightly concave, sculptured mainly with rather closely spaced concentric lamellae. Middle of disk the highest part of the valve; away from the middle the surface gradually declines to the margins. Ribs 17 in number, rounded in outline, separated by spaces about as wide as the ribs, interspaces and sub-margins without any visible subradials. The concentric lamellae over the whole shell are widely spaced. »

REMARKS. — In outline this species agrees closely with a left valve from the Pleistocene of North Creek at Osprey, Fla. referred by Dall to *C. gibbus irradians*. *C. gladensis* has a lower umbonal area, and is larger than that shell.

DIMENSIONS. — Holotype, width 120, height 101, convexity 23 mm.

LOCALITIES. — 18 mi. south of Immokalee, Collier County, Fla. (type), Mansfield.

HORIZON. — Pliocene.

HOLOTYPE. — U. S. National Museum, Cat. N° 373077.

Chlamys (Plagioctenium) gibbus anteamplicostatus (MANSFIELD).

Pl. II, figs. 3a, b; pl. III, fig. 3.

Pecten gibbus amplicostatus DALL, Wagner Free Inst. Sci., Trans., **3** : 747, 1898, *partim*.

Pecten (Chlamys) gibbus anteamplicostatus MANSFIELD, Jour. Pal., **10** : (3) : 189, pl. 23, figs. 5-7, 1936.

DESCRIPTION. — Mansfield's original description :

« The holotype of *P. gibbus amplicostatus* Dall, a Recent specimen from Texas (U. S. Nat. Mus., 106990), is figured in the Proceedings of the United

States Museum, vol. 24, pl. 32, fig. 9, 1902. Dall's type specimen, as well as other Recent specimens referred to his subspecies, have radially striated submargins. The specimens from the Pliocene Caloosahatchie marl that Dall included under his subspecies have smooth submargins and 3 to 4 more ribs. In other features it is similar to the Recent. »

DIMENSIONS. — Syntypes : Right valve, width 39, height 37, convexity 19 mm.; left valve, width 39, height 37, convexity 19 mm.

LOCALITIES. — Caloosahatchie River, Fla. (type), Mansfield; one mile below highway bridge at Labelle, Hendry County, Fla., Cooke; Shell Creek, Fla., Mansfield.

HORIZON. — Caloosahatchie (Pliocene).

SYNTYPES. — U. S. National Museum, Cat. N° 373078.

***Chlamys (Plagiectenium) evergladensis charlottensis* (MANSFIELD).**

Pl. IV, fig. 25.

Pecten (Chlamys) evergladensis charlottensis MANSFIELD, Jour. Pal., 10 : (3) : 189, pl. 23, figs. 8, 9, 1936.

DESCRIPTION. — Mansfield's original description :

« Shell of medium size; left valve more strongly convex than right, both valves inequilateral, the posterior region being more produced. Anterior ears slightly larger than the posterior; right anterior ear weakly sinuate, sculptured with 8 radials crossed by closely spaces lamellae. Submargins steep, sculptured only with fine, crowded lamellae. Ribs 21 in number, rather high, nearly flat topped, weakly undercut on the sides. Interspaces on the right valve slightly narrower than the ribs; on the left valve about equal in width. »

REMARKS. — This species has squarer ribs, more closely spaced, concentric lamellae, and a relatively narrower shell than *evergladensis*. It is more inequilateral; submargins smooth; a lower right valve, and slightly higher left valve than *gibbus irradians*.

DIMENSIONS. — Syntypes : Right valve, width 70, height 63, convexity 16.5 mm.; left valve, width 72.5, height 64, convexity 19.5 mm.

LOCALITIES. — Shell Creek, Charlotte County, Fla. (type), Mansfield; Caloosahatchie River, Alligator Creek, Fla., Mansfield.

HORIZONS. — Caloosahatchie (Pliocene).

SYNTYPES. — U. S. National Museum, Cat. N° 154183.

***Chlamys (Plagioctenium) charltonius* (MANSFIELD).**

Pl. VI, fig. 5.

Pecten (Chlamys) charltonius MANSFIELD, Jour. Pal., **10** : (3) : 190, pl. 23, figs. 10, 11, 1936.

DESCRIPTION. — Mansfield's original description.

« Shell rather small, solid; valves inflated, the left slightly more so than the right, inequilateral, the posterior region being more produced. Right anterior ear with a moderately deep notch, sculptured with about 4 rather strong radials. Right posterior ear sculptured with 3 or 4 weak radials on figured cotype but on some other cotypes with 7 or 8 radials. Ribs low, rather wide, nearly smooth, flat, 17 on each valve; interspaces shallow, round bottomed, a little narrower than ribs. Submargins without radials. Concentric lamellae more strongly developed between the ribs than on them. »

REMARKS. — This species has fewer, wider, less squarely cut ribs, and a smaller shell than *evergladensis charlottensis*.

DIMENSIONS. — Syntypes : Right valve, width 40, height 37, convexity 11 mm.; left valve, width 40, height 37, convexity 12 mm.

LOCALITIES. — South abutment of Atlantic Coast Line R.R. bridge, St. Marys River, Nassau County, Fla. (type), Mansfield.

HORIZON. — Charlton (Pliocene ?).

SYNTYPES. — U. S. National Museum, Cat. N° 373080.

***Chlamys (Plagioctenium) nicholsi* GARDNER.**

Pl. V, figs. 7, 8.

Chlamys (Plagioctenium) nicholsi GARDNER, U. S. Geol. Surv., Prof. Paper, **142-A** : 48, pl. 12, figs. 5, 6, 1926.

DESCRIPTION. — Gardner's original description :

« Shell rather small, thin, but tough, slightly inequivalve, the left valve quite compressed, the right feebly inflated. Umbonal angle a little more than 90°. Dorsal margins rather short, the posterior slightly more produced than the anterior. Ventral arc including more than 180°. Radials 17 in number in each valve of the type, though commonly not exceeding 15, beginning almost at the very tips of the umbones and gradually increasing in width and elevation; adult ribbing strong and even, the summits of the costals broadly rounded or somewhat flattened and forming obtuse angles with the sides, the intercostals broadly concave and of approximately the same width as the costals; secondary threading ordinarily not developed, but both costal and intercostal

areas exhibiting a close and microscopically fine radial lineation. Incremental sculpture very obscure in the right valve and on the costals of the left, the intercostal areas of the left valve evenly but not very closely laminated. Ventral margin scalloped in harmony with the radial sculpture. Interior fluted almost to the umbones. Submargins narrow, steeply sloping, free from ornamentation. Auricles of the left valve and the posterior auricle of the right subequal, well differentiated from the submargins, and threaded with six or seven lirae, which become increasingly coarse toward the hinge line and which are rendered more or less scabrous by the over-riding concentric lamellae; byssal ear narrower than the others and more coarsely sculptured both radially and concentrically. Byssal notch quite deep. Ctenolium including four or five denticles of moderate prominence; length of hinge line more than half the maximum width of the shell. Right valve flexed sharply over the left. Ligament area very narrow, persisting almost to the extremities of the hinge. Resilial pit very small, trigonal, subumbonal. Cardinal crura quite well developed, the surface shagreened in order that they may hold more firmly. Monomyarian, the single adductor scar rather small, slightly posterior, and placed a little above the median horizontal. Pallial line simple, commonly obscure, distant from the base.

» A larger valve from the type locality shows a rather fine threading toward the ventral margin most distinct in the intercostal areas. There is a moderate range of variation in relative dimensions, but the costals may be as few as 15 and as many as 19. In *Chlamys sayanus* the secondary sculpture is introduced very early in the life of the shell. *Chlamys chipolanus* is relatively larger as a rule, and the concentric laminae are more crowded and more elevated and equally prominent upon the costal and intercostal areas. *Chlamys nicholsi* Gardner n. sp., is probably an ancestral type of the *gibbus* group, so abundant and diversified in the later Tertiary and Recent forms. »

DIMENSIONS. — Cotypes : Right, height 20.6, width 21.2 mm.; left, height 25, width 25.5 mm.

LOCALITY. — Mossyhead, Fla. (type), Gardner.

HORIZON. — Shoal River (Miocene).

COTYPES. — U. S. National Museum, Cat. N° 352453.

***Chlamys (Plagioctenium) eboreus urbannaensis* (MANSFIELD).**

Pl. III, figs. 1, 2.

Pecten eboreus urbannaensis MANSFIELD, U. S. Mus., Proc., 14 : (2759) : 6, pl. 12, fig. 2, pl. 3, fig. 2, 1929.

DESCRIPTION. — Mansfield's original description :

« The type locality of *Pecten eboreus* Conrad is Suffolk, Va. Dall classified different mutations of the species and designated each by a varietal name. The form occurring at Suffolk he designated *Pecten eboreus eboreus*.

« The new subspecies differs from the Suffolk form as follows. The ribs are lower and are separated by a shallower and less distinct interspace. Two to three fine radials lie within these interspaces. The ears are larger, the byssal notch deeper, and the radials on the ears are finer and less distinct. The new subspecies is an intermediate form between *P. madisonius* Say and *P. eboreus eboreus* Conrad. »

REMARKS. — The cotypes appear to be badly worn. Right valve has 21 ribs; left, 25 ribs. Ribs low, rounded; concentric sculpture of elevated, closely spaced lamellae. Inter radial threads fairly distinct in central portion of left valve. Auricles larger in proportion to disk than in *eboreus*, s.s. Auricles of left valve have 4 or 5 faint radials which disappear about 10 mm. from the beak. Byssal auricle has 5 obsolete radials.

Other specimens from the type locality appear to have more strongly elevated ribs. Young shells have more distinct radial threads on the auricles.

DIMENSIONS. — Cotypes : Right valve, height 97, width 107, diameter 17 mm.; left valve, height 98, width 104, diameter 20 mm.

LOCALITIES. — Urbanna (type), Lanexa, Scotland Wharf, Schmidts Bluff, and Mount Folly, Va., Mansfield.

HORIZON. — St. Marys (Miocene).

COTYPES. — U. S. National Museum, Cat. N° 370829.

Chlamys (Plagioctenium) eboreus yorkensis (CONRAD).

Pl. V, fig. 10.

Pecten yorkensis CONRAD, Am. Jour. Conch., 3 : 189, 1867.

Pecten eboreus var. *yorkensis* CONRAD, DALL, Wagner Free Inst. Sci., Trans., 3 : (4) : 750, 1898.

DESCRIPTION. — Conrad's original description :

« Orbicular, thin, depressed; umbonal region convex; ribs 21 subquadrate, little prominent; interstices about as wide as the ribs, with transverse wrinkles, which are obsolete on the ribs. Height 1 3/4 inches; length 1 7/8 inches.

» Locality : Yorktown, Virginia. Miocene.

» Closely resembles *P. irradians*, Lam., but has much less prominent ribs and is not ventricose. »

REMARKS. — The holotype carries this label : « *Pecten comparalis* T. and H. (marked *P. yorkensis* Conr.). » The holotype, an incomplete left valve, has 22 low, slightly rounded ribs which are about one-half the width of the narrow, steep, flat-bottomed interspaces. Concentric sculpture of wavy lamellae which on the summits of the ribs are reflected toward the beak and which pass

directly across the interspaces. Auricles rather large, radially threaded, and concentrically sculptured by dense, slightly elevated, wavy lamellae. Ribbed internally. Auricular and cardinal crura present. Height 45, width 43 mm.

This subspecies is separated from *eboreus*, s.s. by its less numerous and more quadrangular ribs, and by the development of concentric sculpture in the interspaces.

DIMENSIONS. — Hypotype, height 20, width 20 mm.

LOCALITY. — York River, Va. (type), Conrad.

HORIZON. — Yorktown (Miocene).

HYPOTYPE. — U. S. National Museum, Cat. N° 144677.

HOLOTYPE. — Academy of Natural Sciences of Philadelphia.

***Chlamys (Plagioctenium) eboreus solarioides* (HEILPRIN).**

Pl. I. figs. 9, 10.

Pecten solarioides HEILPRIN, Wagner Free Inst. Sci., Trans., 1 : 99, fig. 34, 1887; TUCKER and WILSON, Ind. Acad. Sci., Proc., 41 : 355, 1932, faunal list.

Pecten eboreus var. *solarioides* HEILPRIN, DALL, Wagner Free Inst. Sci., Trans., 3 : (4) : 750, 1898.

DESCRIPTION. — Heilprin's original description :

« Shell suborbicular depressed, of about equal height and width; ribs about 20 (?), quadrangular or flattened, broader than the interspaces, crossed by fine rugose lines of growth; a faint median longitudinal line of carination can be detected on some of the ribs, probably eroded on the others; the interspaces with two or more elevated longitudinal lines; left ear of the right valve with about five very oblique, narrow ribs, rugose with the lines of growth; right wing ? Interior of shell prominently ribbed.

» Height, 5.7. inches.

» The half of a single right valve, and a fragment of probably the other valve, from the banks below Ft. Thompson.

» This shell can be readily distinguished from the only species that at all resembles it, *Pecten comparilis*, by its more elevated form, the height of its wings, and the structure and disposition of its ribs, which are more distinctly quadrangular and elevated. In the fragment which possibly represents the left valve the ribs are broader than in the opposite valve, of about twice the width of the interspaces, which, at least in the upper portion of the shell, are deep and nearly parallel-sided. They show a single median elevated line. »

REMARKS. — Valves equilateral; slightly inequivalved. Valves strongly and discrepantly sculptured. The left valve usually has 19 elevated, rounded ribs which, at the ventral margin, are about half as wide as the interspaces. Com-

monly 1 to 3 radial threads on the summit of each rib. From 1 to 3 cords appear in the flat interspaces in the umbonal region and continue to the ventral margin. In the central portion of the disk there are 2 or 3 fine radial threads on the sides of the primary ribs. Anteriorly and posteriorly the ribs become narrower. Submargins somewhat narrow, sculptured with fine radial threads. Valve has conspicuous sculpture of concentric imbricated lamellae which are reflected toward the beak on the ribs and which pass directly across the interspaces. Auricles nearly equal; from 9 to 12 fine radial threads crossed by closely spaced concentric lamellae. Right valve has from 17 to 20 broad, flat-topped ribs about twice as wide as the interspaces at the ventral margin. Anteriorly and posteriorly the ribs become narrower. Sometimes 1, more rarely 2 or 3, intercostal cords present. Concentric lamellae frequently eroded from summits of ribs; strongly developed in interspaces. Sculpture of submargins and auricles similar to that of left valve. Byssal auricle the more strongly sculptured.

Interior of both valves ribbed. Provinculum present. No ctenolium. Auricular crura feeble.

Young shells quite orbicular; byssal fasciole wide; notch conspicuous; ctenolium of about 3 denticles. Provinculum present.

DIMENSIONS. — Hypotype, right and left valves of same individual, height 115 mm., width 115 mm.

LOCALITIES. — Shell Creek, and Caloosahatchie River, Fla., Dall; Ft. Thompson, Fla. (type), Heilprin; Waccamaw River, S.C., Johnson; near Woods, Liberty County, Fla., Mansfield; one half mile east of Evans, Liberty County, Fla., Mansfield; Harveys Creek, one half mile above abandoned mill, Leon County, Fla., Mansfield; Moore Haven, Ft. Denaud, and Prairie Creek, Fla., Tucker and Wilson; Acline, Okeechobee City, and La Belle, Fla.

HORIZON. — Pliocene.

HYPOTYPES. — Collection H. I. Tucker-Rowland.

HOLOTYPE. — Fragment of a right valve, Academy of Natural Sciences of Philadelphia.

Chlamys (Plagioctenium) eboreus (CONRAD).

Pl. III, fig. 12.

Pecten eboreus CONRAD, Am. Jour. Sci., **23** : 341, 1833; CONRAD, Foss. Med. Tert. U. S. : 48, pl. 23, fig. 2, pl. 24, fig. 3, 1840, *partim*; CONRAD, Acad. Nat. Sci. Phila., Proc., **14** : 581, 1862; HEILPRIN, *op. cit.*, **33** : 419, 1881; TUCKER and WILSON, Ind. Acad. Sci., Proc., **41** : 355, 1932, faunal list.

Pecten vicenarius CONRAD, Acad. Nat. Sci. Phila., Proc., **1** : 306, 1843.

Pecten holbrooki RAVENEL, *op. cit.*, **2** : 96, 1844.

Pecten micropleura LEA, Am. Phil. Soc., Trans., **9** : 245, pl. 35, fig. 32, 1845.

Pecten (Plagiectenium) eboreus CONRAD, DALL, Wagner Free Inst. Sic., Trans., 3 : (4) : 749, 1898, *partim*.

Chlamys (Plagiectenium) eboreus eboreus CONRAD, MANSFIELD, Fla. Geol. Surv., Bull., 8 : 60, pl. 12, fig. 11, 1932.

DESCRIPTION. — Conrad's original description :

« Shell suborbicular, compressed, thin, a little oblique; ribs about twenty two, rounded, a little elevated and smooth; inferior valve nearly flat. Length, two inches. »

REMARKS. — Shell suborbicular; large; thin. Left valve somewhat convex. Right valve slightly flattened. Twenty-three to twenty-seven, low, rounded ribs with shallow, somewhat narrower interspaces. Feeble, distant, concentric, wavy sculpture stronger in the interspaces. Submargins narrow, ornamented with fine, concentric lines. Auricles subequal, rather large, well differentiated from the submargins, radially threaded and concentrically lamellated. Auricles of right valve a little elevated. Byssal auricle the more coarsely sculptured radially and concentrically. Fasciculated. Ventral margin scalloped. Interior fluted nearly to the umbones. Cardinal margin of right valve bent back over the left. Resilial pit shallow.

Specimens from Standard Oil Bluff, Va. have 22 to 26 ribs, are equilateral, and have fairly strong concentric sculpture.

Some of the shells from Jennys Bluff, Va. are quite inequilateral. They rarely approach specimens from Chocowinity, N. C. in degree of development of concentric lamellae. Valves from the latter locality have from 17 to 20 ribs, commonly 18; quite equilateral and rather apt to be convex.

Valves from Nixons Landing, N. C. usually have 20 ribs; quite inequilateral; strong concentric lamellae.

Shells from Walker's Bluff, N. C. agree very closely with those from Nixons Landing in development of concentric sculpture, number of ribs and degree of inequilaterality.

The specimens from Edenhouse Point, N. C. sometimes resemble shells from Suffolk, Va. quite closely. Occasional valves from this locality approach *gibbus* in degree of convexity, and usually have 21, rarely 22 ribs.

Natural Well, N. C. specimens have 23 to 26 ribs. An occasional valve is extremely convex.

Young shells from Chocowinity, N. C. are very thin; equi-convex; equilateral; auricles conspicuously large in proportion to size of shell. Byssal auricle long, notch rather wide, deep. Ctenolium and provinculum present.

Some of the valves from Suffolk, Va. tend to be more or less inequilateral. Commonly have 23 ribs.

DIMENSIONS. — Hypotype, height 81, width 81 mm.

LOCALITIES. — Suffolk, Va. (type), Conrad; Natural Well, N. C.; Edenhouse Point, N. C.; Jennys Bluff, Va.; City Point, Va.; Claremont Wharf, Va.; James River above Smithfield, Va.; Standard Oil Bluff, Va.; Chocowinity, N. C.; Nixons Landing, N. C.; Walker's Bluff, N. C.; Waccamaw River, S. C.; Watsons Landing, Liberty County, Fla., Mansfield; Darlings Slide, Chipola River, Calhoun County, Fla., Mansfield; half a mile northeast of Clarksville, Calhoun County, Fla., Mansfield; Jackson Bluff, Leon County, Fla.; Ft. Denaud, Fla., Tucker and Wilson; Moore Haven, Fla., Tucker and Wilson; Prairie Creek, Fla., Tucker and Wilson.

HORIZON. — Choctawhatchee (Miocene), Yorktown (Miocene), Duplin (Miocene), Pliocene.

HYPOTYPES. — Collection H. I. Tucker-Rowland, and Cornell University.

HOLOTYPE. — Academy of Natural Sciences of Philadelphia.

***Chlamys (Plagiostenium) eboreus darlingtonensis* (DALL).**

Pl. III, figs. 9, 10.

Pecten eboreus darlingtonensis DALL, Wagner Free Inst. Sci., Trans., **3** : 750, 1898.

Chlamys (Plagiostenium) eboreus darlingtonensis DALL, MANSFIELD, Fla. Geol. Surv., Bull., **8** : 60, pl. 12, fig. 11, 1932.

DESCRIPTION. — Dall's original description :

« Shell large, radially striate on the disk near the margin; the ribs angular, well marked, twenty-one to twenty-four; the concentric sculpture fine. »

REMARKS. — Valves about equally convex, slightly inequilateral. From 1 to 3 inter radial threads, usually extending not more than 45 mm. from margin of valve toward the beak. Faint radial threads more apt to develop on summits of ribs of left valves. Concentric sculpture of wavy, distant elevated lamellae which sometimes become crowded near the periphery.

Since Dall failed to select types, the valves figured have been chosen from his type material. I designate as cotypes the figured right and left valves, U. S. National Museum, Cat. N° 145432, from Darlington, S. C.

DIMENSIONS. — Cotypes : Right, height 84, width 84, hinge 49 mm.; left height 92, hinge 63 mm.

LOCALITIES. — Darlington, S. C. (type), Dall; Harveys Creek, half a mile above abandoned mill, Leon County, Fla., Mansfield; borrow pit near Jackson Bluff, Leon County, Fla., Mansfield; 2 miles north of Hosford, Liberty County, Fla., Mansfield; one half mile east of Evans, Liberty County, Fla., Mansfield; Near Woods, Liberty County, Fla., Mansfield.

HORIZON. — Choctawhatchee, and Duplin (Miocene).

COTYPES. — U. S. National Museum, Cat. N° 145432.

Chlamys (Plagioctenium) comparalis (TUOMEY and HOLMES).

Pl. III, fig. 11; pl. IV, fig. 14.

Pecten comparalis TUOMEY and HOLMES, Pleioc. Foss. S. C. : 29, pl. 11, figs. 6-10, 1857;
EMMONS, Geol. Surv. N. C., Rept. : 279, 1858; CONRAD, Acad. Nat. Sci. Phila., Proc.,
14 : 581, 1862; HEILPRIN, *op. cit.*, 33 : 418, 1881.

Pecten eboreus var. *comparalis* TUOMEY and HOLMES, DALL, Wagner Free Inst. Sci.,
Trans., 3 : (4) : 750, 1898.

Chlamys (Plagioctenium) comparalis TUOMEY and HOLMES, MANSFIELD, Fla. Geol. Surv.,
Bull., 8 : 61, pl. 11, figs. 5, 6, 1932.

DESCRIPTION. — Tuomey and Holmes' original description :

« *P. testa orbiculata, aequivalvi; aequilaterali vel inaequilaterali; 23 costis convexis, concentric striatis; auriculis subaequalibus.*

» Shell orbicular, convex, somewhat thick, equivalve, with concentric lines of growth, ears nearly equal; lower valve, buccal ear notched radiately and coarsely ribbed, fifth 5 to 6 ribs; anal ear ribs smaller and more numerous; upper valve, ears with the radiating lines equal; ribs and interstices nearly equal.

» This fossil is distinguished from *P. eboreus* by having the ribs more raised and convex, both valves more convex, and by the coarse ribs of the buccal ear of the lower valve. Like *P. eboreus* it is also a variable shell, some specimens nearly equilateral, and others very inequilateral. It also bears a strong resemblance to a recent shell from the coast of Florida. »

REMARKS. — The Florida shells become conspicuously more inequilateral and heavier with age. Valves of adult specimens usually equally convex. Margins scalloped, resembling *eboreus*, s.s. auricles subequal; the right anterior with sculpture of coarse radial threads. Fasciole wide; notch small. Auricles of left valve, and right posterior auricle have from 5 to 8 fine radials. Adult valves, have no ctenolium. Provinculum present; auricular crura not conspicuous. Interior has broad ribs extending toward beak approximately one-third the height of the shell.

Valves of young individuals more convex than adults; radial and concentric sculpture similar. Young valves have larger auricles in proportion to size of shell than adult specimens. Ctenolium of 4 or 5 denticles present. Provinculum present, but more conspicuous in older shells.

Since the types are evidently lost, I designate as neoholotype the figured right valve from Buckingham, Fla.

DIMENSIONS. — Neoholotype, height 75, width 67 mm.; hypotype, height 47.5, width 41 mm.

LOCALITIES. — Buckingham (left valve hypotype), Acline, Ft. Denaud (neoholotype), and Prairie Creek, Fla.; Walkers, N. C.; Harveys Creek, one-half mile

above abandoned mill, Leon County, Fla., Mansfield; borrow pit near Jackson Bluff, Leon County, Fla., Mansfield; well 1 mile west of Holland post-office, Leon County, Fla., Mansfield; 2 miles north of Hosford, Liberty County, Fla., Mansfield; Gully Pond, and Hamlin Pond, Washington County, Fla., Mansfield; one-half mile east of Evans, Liberty County, Fla., Mansfield; one-half mile south of Knox Still Landing, Franklin County, Fla., Mansfield; Petersburg and Nansemond River 16 miles below Suffolk, Va., Burns; Porters Landing, Savannah River, Georgia, Mansfield; Darlington, and Smiths on Goose Creek (type), S. C., Tuomey and Holmes.

HORIZON. — Yorktown, and Choctawhatchee (Miocene); Pliocene.

HYPOTYPE. — Collection H. I. Tucker-Rowland.

NEOHOLOTYPE. — Collection H. I. Tucker-Rowland.

Chlamys (Plagioctenium) gibbus (LINNÉ).

Pl. IV, fig. 21.

Ostrea gibba LINNÉ, Syst. Nat., Ed. 10 : 698, 1758; BORN, Test. Mus. Vind. : 107, 1780.

Pecten dislocatus SAY, Acad. Nat. Sci. Phila., 2 : 260, 1822; SAY, Am. Conch. : pl. 56, figs. 2, 2a, 1834; HOLMES, Post-Plioc. Foss. S. C. : 13, pl. 2, fig. 12, 1860.

Pecten irradians var. *dislocatus* SAY, DALL, U. S. Nat. Mus., Bull., 37 : 34, 1889.

Pecten gibbus LINNÉ, SOWERBY, Thes. Conch., 1 : fig. 17, 1843; D'ORBIGNY, Moll. Cuba, 2 : 352, 1845; REEVE, Conch., Icon., *Pecten* : pl. 9, figs. 37b, 37c, 1852; KREBS, West Indies Mar. Shells : 134, 1864; ARANGO, Fauna Mal. Cubana, 2 : 270, 1878; DAVENPORT, Mark Anniversary Volume : 123, pl. 9, 1903; TUCKER and WILSON, Ind. Acad. Sci., Proc., 41 : 355, 1932.

Pecten circularis SOWERBY, GUPPY, Paria Fauna : 155, 1877.

Pecten nucleus BORN, HEILPRIN, Wagner Free Inst. Sci., Trans., 1 : 102, 1886.

Pecten (Plagioctenium) gibbus LINNÉ, DALL, Wagner Free Inst. Sci., Trans., 3 : (4) : 745, 1898; MAURY, Bull. Am. Pal., 8 : (34) : 27, 1920; MAURY, *op. cit.*, 10 : (42) : 86, pl. 14, fig. 2, pl. 16, fig. 1, 1925.

Pecten (Plagioctenium) gibbus var. *dislocatus* SAY, DALL, Wagner Free Inst. Sci., Trans., 3 : (4) : 746, 1898.

Pecten (Aequipecten) gibbus (Linnaeus) GRANT and GALE, San Diego Soc. Nat. Hist. Mem., 1 : 215, 1931.

DESCRIPTION. — Linné's original description :

- « O testa radiis 20 glabris, gibba
- » Brown. jam. t. 40. f. 10
- » Habitat in M. Americano.
- » Valvula utraque convexa et sanguinea.
- » Pectines valvulis altera latere magis gibbis. »

REMARKS. — Shell equilateral, nearly orbicular in outline; rather thin, convex; hinge more than half as long as width of disk. Usually 19 to 22

rounded, elevated ribs. Concentric sculpture of wavy, imbricating lines. Sub-margins have fine riblets, or radial cords. Auricles rather small, sub-equal, sculptured by radiating threads of varying strength; 4 to 6 fairly strong threads on right anterior auricle. Byssal notch shallow. Interior fluted; provinculum present.

Typical *gibbus* is characterized by having the right valve much more convex than the left valve.

Dall, 1898, says in speaking of *gibbus*, sensu lato, « The variations in the fossils parallel those of the living forms; the concentric sculpture may be weaker or stronger, may be visible on the backs of the ribs or only in the interspaces. The ribs may be more or less emphatic, rounded or flattopped with lateral angles. In the latter case the concentric sculpture sometimes stops short at the angle, leaving the unworn back of the rib smooth, as if the concentric lamellae had been worn off. In this case, which is the most conspicuous of the various mutations, the ribs appear laterally fringed. All the species of this group, recent or fossil, show this mutation occasionally, though it is rarer among the recent shells than among the fossils. »

Of the Florida fossil specimens examined one had eleven ribs; three, twelve ribs; forty-three, fourteen ribs; sixty-two, fifteen ribs; seventy-seven, sixteen ribs; one hundred forty-eight, seventeen ribs; one hundred forty-three, eighteen ribs; one hundred forty-two, nineteen ribs; forty, twenty ribs; seven, twenty-one ribs; two, twenty-two ribs. Twenty-nine valves from Buckingham, Fla. had seventeen ribs; seventy-five, eighteen ribs; twenty-one, twenty ribs. Specimens from Buckingham, Fla. showed a greater degree of obliquity than those from any other Florida Tertiary locality.

Davenport, 1903, collected and studied a large series of specimens from the Atlantic and Pacific coasts of the United States. He found that the Tampa shells averaged about one rib more per shell, but noted that the Tampa average is higher than that of any other Atlantic Coast locality. He also found that the Tampa specimens have an obliquity of about six per cent while those from San Diego have about fifteen per cent. Davenport considered that this greater obliquity is attributable to the influence of local environment. He points out that it is sometimes easier to separate specimens from different Atlantic Coast localities than it is to distinguish Pacific forms from the Atlantic. Apparently neither branch of the original race has changed sufficiently to become a distinct species.

C. gibbus is a highly variable species which at the present time has a wide distribution. A number of ecologic forms have been described. There is a complete and gradual intergradation between the extreme northern varieties, *irradians* and *borealis*, which would otherwise be specifically separated from *gibbus*, s.s. Davenport (Am. Nat., 34 : 863-877, 1900) has pointed out that spe-

cies tend to become less convex and to have rounder, more widely spaced ribs in colder climates.

Typical *gibbus* occurs in the Miocene of Virginia, the Pliocene (Caloosahatchie) of Florida and the Pliocene of Trinidad (Maury). *C. gibbus*, s.s. and *borealis* Say occur in the Pleistocene of North Creek, Fla. Probably *amplicostatus* is as common in the Caloosahatchie of Florida and the Pliocene of Trinidad (Maury). *C. gibbus*, s.s. and *borealis* Say occur in the Pleistocene of North Creek, Fla. Probably *amplicostatus* is as common in the Caloosahatchie as is the typical form of *gibbus*. The subspecies *borealis* lives along the New England Coast; *irradians* occurs as far south as Cape Hatteras and typical *gibbus* southward from that point to Brazil.

Chlamys gibbus s.s. has from 19 to 22 ribs; obliquity about 6%; wide range of bright colors. Subspecies *amplicostatus* has about 15 to 16 broader, more solid ribs; right valve usually white, left mottled grey; living from Texas to Cartagena. Subspecies *irradians* has from 17 to 22 ribs which vary from angulated to rounded, sometimes striated, less inflated than typical *gibbus*; thinner shell and more darkly colored. Subspecies *borealis* has from 16 to 18 rounded, distant ribs; thin shell; valves about equally convex; very dark colored.

Grant and Gale say, in discussing the possible ancestry of *gibbus* « that *Pecten eboreus* Conrad and its varieties, including perhaps the forms here described as *P. deserti*, may be the ancestors of *Pecten gibbus*. They appear to have radiated from the common center so as to arrive in most regions just ahead of the varieties of *gibbus*, though some of them managed to live on for some time after the arrival of the latter species. In some cases it is difficult to distinguish the two. »

DIMENSIONS. — Hypotype, height 46, width 42 mm.

LOCALITIES. — Suffolk, Va., Burns; Shell Creek, Myakka River, and Alligator Creek, Fla., Dall and Willcox; Living from Cape Hatteras to Brazil; Northwest coast of Africa, Dall; La Belle, Port Mayaca, Prairie Creek, Moore Haven, Acline, Buckingham, and Okeechobee City, Fla.; Living along the Gulf Coast of Florida; Gulf of Mexico; Simmons Bluff, S. C., Burns.

HORIZON. — Yorktown (Miocene) to Recent.

HYPOTYPE. — Collection H. I. Tucker-Rowland.

HOLOTYPE. — Collection Linnean Society of London.

***Chlamys (Plagiostenium) choctawhatcheensis* MANSFIELD.**

Pl. IV, fig. 20; pl. V, fig. 25.

Pecten gibbus Linnaeus MANSFIELD, U. S. Nat. Mus., Proc., 51 : 604, 1917, list.

Chlamys (Plagiostenium) choctawhatcheensis MANSFIELD, Fla. Geol. Surv., Bull., 8 : 63, pl. 9, figs. 4, 8, 1932.

DESCRIPTION. — Mansfield's original description :

« Shell rather small, suborbicular, left valve more convex than right, inequilateral — the anterior region more produced than the posterior. Right valve sculptured with 21 to 22 broadly rounded to nearly flat ribs, separated by interspaces that are about half the width of ribs. Left valve strongly inflated over middle of the disk, sculptured with about 21 ribs similar to those on right valve. Submargins without radials. Right ear longer than the left, deeply sinuate, and ornamented with four rather strong, crenulated radials. Left ear ornamented with about two more radials than right.

« This species differs from *Chlamys comparalis* (Tuomey and Holmes) in having a more convex left valve and lower, less distinct, and more closely set ribs. The margin of the ribs on *Chlamys comparalis* project over the interspaces are narrow, shallow and rounded.

» The new species is closely related to *Chlamys levicostatus* Toula from the Gatun formation of Panama and perhaps should be regarded as a subspecies of *C. levicostatus*. *C. levicostatus* has a smaller shell with more closely spaced ribs and a more inflated left valve than the new species. »

REMARKS. — Lamellae reflected toward the beak on the summits of the ribs; toward the periphery in the interspaces. Ctenolium and provinculum present.

DIMENSIONS. — Cotypes : Right, height 36, width 37, diameter 8 mm.; left, height 42, width 41, diameter 14 mm.

LOCALITIES. — Red Bay, Walton County, Fla. (type), Mansfield; Vaughan Creek, Walton County, Fla., Mansfield.

HORIZON. — Choctawhatchee (Miocene).

COTYPES. — U. S. National Museum, Cat. N° 371142.

***Chlamys* (Plagiocentrum) choctawhatcheensis redbayensis MANSFIELD.**

Pl. IV, fig. 24.

Chlamys (Plagiocentrum) choctawhatcheensis redbayensis MANSFIELD, Fla. Geol. Surv., Bull., 8 : 64, pl. 11, fig. 3, 1932.

DESCRIPTION. — Mansfield's original description :

« One left valve from Red Bay is a little different from *Chlamys choctawhatcheensis* n. sp. and appears to represent a new subspecies. It differs from *C. choctawhatcheensis* in having a less inflated shell and fewer, more widely spaces, and more distinct ribs. The ribs are 18 in number, moderately wide, and separated by interspaces about equal in width to ribs. In other features the shell is similar to the species. »

RANGE : Choctawhatchee (Miocene).

DIMENSIONS. — Holotype, a left valve, height 38, width 41, diameter 12 mm.

LOCALITY. — Red Bay, Walton County, Fla. (type), Mansfield.

HORIZON. — Choctawhatchee (Miocene).

HOLOTYPE. — U. S. National Museum, Cat. N° 371143.

***Chlamys (Plagiostenium) comparalis jacksonensis* MANSFIELD.**

Pl. IV, figs. 16, 17.

Chlamys (Plagiostenium) comparalis jacksonensis MANSFIELD, Fla. Geol. Surv., Bull., 8 : 62, pl. 8, figs. 4-5, 1932.

DESCRIPTION. — Mansfield's original description :

« Shell of moderate size, suborbicular in outline, both valves equally convex, inequilateral — the posterior region being more produced. Right valve sculptured with 21 moderately narrow, elevated ribs and sub-rounded above and nearly flat below and separated by deep interspaces that are a little wider than the ribs. The distal end of each rib has a raised median thread. Left valve similarly sculptured to right. Concentric sculpture on the disk of both valves consists of scaly, rather coarse lamellae. Right and left submargins steeply inclined and sculptured only with closely set concentric lamellae. Anterior ear a little longer than the posterior, sculptured with four moderately strong radials and transverse lamellae. Surface of posterior ear marked with about two more radials than the anterior. Byssal notch moderately deep. »

REMARKS. — This species differs from *comparalis* in being proportionately wider and in having one less rib. This subspecies usually has 22 ribs, while *comparalis* has 23.

DIMENSIONS. — Cotypes : Right, height 43, width 46, diameter 12 mm.; left, height 44, width 49, diameter 13 mm.

LOCALITIES. — Jackson Bluff, Leon County, Fla. (type), Mansfield; Clarks-ville, Calhoun County, Fla., Mansfield; Red Head Still, Washington County, Fla., Mansfield.

HORIZON. — Choctawhatchee (Miocene).

COTYPES. — U. S. National Museum, Cat. N° 371141.

***Chlamys (Plagioctenium) gibbus amplicostatus* (DALL).**

Pl. IV, figs. 18, 19; pl. V, fig. 24.

Pecten gibbus var. *amplicostatus* DALL, Wagner Free Inst. Sci., Trans., 3 : (4) : 747, 1898.

DESCRIPTION. — Dall's original description :

« This differs from the typical *gibbus* by its fewer and broader ribs. It is about the same size as the type, and occurs chiefly west of the Mississippi, on the Texas Coast, and south to Carthagen. It is usually white or nearly white on the right valve, and grayish with mottlings of white on the left valve. Of fourteen specimens, one had twelve; two, fourteen; four, fifteen; and seven, sixteen ribs. It is quite tumid and very solid, and probably inhabits coral or rocky bottom. One of the fossils had fourteen; ten, fifteen; and sixteen, sixteen ribs. »

REMARKS. — The right valve, cotype, has 16 flat, steep-sided ribs which are wider than the interspaces. Concentric lamellae reflected away from the beak in the interspaces. Margins scalloped. Submargins about 3 mm. wide, without radial or concentric sculpture. Posterior auricle has 6 radials; anterior, 6 much coarser radials; both auricles concentrically lamellated. Byssal notch deep; ctenolium present. Interior fluted to umbones. Strong cardinal crura present. Left valve, cotype, has 15 ribs which are narrower than the interspaces. Sculpture similar to that of the right valve. Auricles have 5 radials; auricles sub-equal in both valves.

DIMENSIONS. — Cotypes : Right, height 37.5, width 37.5, semi-diameter 9, hinge 27 mm.; left, height 36, width 36, semi-diameter 10, hinge 27 mm.; hypotype, height 55, width 46 mm.

LOCALITIES. — Caloosahatchie River, Monroe County (type), Fla., Dall; North Creek, Fla., Dall; Port Mayaca, Moore Haven, LaBelle, Okeechohee City, and Ft. Denaud, and Acline, Fla.

HORIZON. — Pliocene to Recent.

HYPOTYPES. — Collection H. I. Tucker-Rowland.

COTYPES. — U. S. National Museum, Cat. N° 154186.

***Chlamys (Plagioctenium) evergladensis* (MANSFIELD).**

Pl. IV, fig. 23.

Pecten (Plagioctenium) evergladensis MANSFIELD, U. S. Geol. Surv., Prof. Paper, 170-D : 47, pl. 17, figs. 1, 2, 4, 5, March, 1931.

DESCRIPTION. — Mansfield's original description :

« Shell small, broadly orbicular, probably nearly equivalve, inequilateral, the posterior region being more produced. Right valve of holotype inflated

and swollen behind the umbo; posterior region more gently sloping to submargins than anterior; base broadly rounded. Sculptured with 22 nearly flat laterally sloping ribs separated by much narrower interspaces. Sides of ribs and submargins of shell marked with moderately coarse, nearly erect, concentric lamellae. Submargins without any distinct radials. Right ear with a shallow byssal notch and ornamented with six radials; left ear bearing weak radials on the lower half. Left valve of immature and slightly corroded paratype sculptured with 20 ribs, which are a little lower than those on right valve; submargins without distinct radials. »

« The new species differs from *Pecten gibbus gibbus* Linnaeus in the absence of any distinct radials on the submargins and in having a much more inequilateral shell. In the latter feature it more closely resembles *Pecten circularis* Sowerby, a Recent species geographically ranging on the west coast from Monterey, Calif., to the Gulf of California and Paita, Peru. *Pecten (Plagioctenium) comparilis* Tuomey and Homles, an upper Miocene species, appears to be the ancestral form of the new species. *Pecten mendenhalli* Arnold, a Pliocene species collected at Santa Rosalia, Lower California, and also occurring at Alverson Canyon, San Diego County, Calif., is nearly related to the new species. »

DIMENSIONS. — Holotype, a right valve, height 52, width 58, semi-diameter 23 mm.

LOCALITIES. — Tamiami Trail, 6 miles west of the crossroads leading to Everglades, Collier County, Fla. (type), Mansfield.

HORIZON. — Pliocene.

HOLOTYPE. — U. S. National Museum, Cat. N° 371323.

Chlamys (Plagioctenium) eboreus senescens (DALL).

Pl. IV, fig. 15.

Pecten eboreus var. *senescens* DALL, Wagner Free Inst. Sci., Trans., 3 : (4) : 751, pl. 29, fig. 5, 1898.

Chlamys eboreus walkerensis TUCKER, Amer. Midl. Nat., 15 : (5) : 616, pl. 27, fig. 3, 1934.

DESCRIPTION. — Dall's original description :

« Shell of moderate size, rather convex; ribs (23) obsolete externally, their lirae strong within; the concentric sculpture fine, chiefly visible in the interspaces.

» The posterior ear is a little more oblique in my specimen than in any of the typical *eboreus* I have noticed, but the characters in general are so close that I hesitate to regard the form as of specific rank. »

REMARKS. — This subspecies has sub-equal, thin, inequilateral valves. Usually the left valve is slightly the more convex. Commonly 22 obsolete,

rounded ribs. Concentric sculpture of fine, wavy lamellae. Auricles sub-equal; lack radial sculpture. Slight flexure of byssal auricle. No ctenolium. Internal lirae resemble those of *Amusium*.

The valves from Walkers, N. C. are larger than *eboreus* s.s.; usually have 20 low, rounded, widely spaced ribs. Concentric sculpture of wavy, elevated lamellae which are more closely spaced from the umbonal region to the ventral margin. On large shells the ribs become nearly obsolete at the margins. Anteriorly and posteriorly the valves have only concentric sculpture. At the posterior margin the valve is markedly depressed and produced.

C. eboreus Conrad, s.s., from the type locality is more equilateral and more strongly ribbed. However, individual valves vary widely, and this subspecies represents the extreme of a line of development. This subspecies usually has fewer ribs; is often more strongly lamellated and, in adult valves, has the characteristic depression in the posterior portion of the left valve.

DIMENSIONS. — Holotype, height 60, width 62, semi-diameter 10 mm. Hypotype, height 88, width 113, hinge 41.5, semi-diameter 23 mm.

LOCALITIES. — Waccamaw River, S. C. (type), Dall; Walkers, N. C. (*walkersensis*), Tucker; Nixon's Landing on Waccamaw River, N. C., Tucker.

HORIZON. — Waccamaw (Pliocene).

HYPOTYPE. — Paleontological Research Institution, Cat. N° 1416.

HOLOTYPE. — U. S. National Museum, Cat. N° 107755.

SECTION *Placopecten* VERRILL, 1897.

Placopecten VERRILL, Conn. Acad. Sci., Trans., **10** : 69-70, pl. 17, figs. 1-7, pl. 20, figs. 7, 8, 8a, pl. 21, figs. 1, 1a, 2, 2a, 1897, type « *Pecten* » *clintonius* SAY, by original designation; DALL, Wagner Free Inst. Sci., Trans., **3** : (4) : 695, 1898; VERRILL and BUSH, U. S. Nat. Mus., Proc., **20** : 831, 1898.

TYPE. — *Chlamys clintonius* Say, by original designation, Verrill, 1897. St. Marys and Yorktown Miocene of the Atlantic Coast of North America.

DIAGNOSIS. — Verrill's original diagnosis :

« 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. »

REMARKS. — This group, although closely related to *Chlamys*, s.s., is a fairly distinct unit. In shape *Placopecten* resembles *Patinopecten* Dall, but it has much weaker radial sculpture.

LOCALITY. — Living from New Brunswick to North Carolina. Tertiary of the Atlantic Coast.

HORIZON. — Miocene to Recent.

Chlamys (*Placopecten*) *clintonius* (SAY).

Pl. I, fig. 11.

Pecten clintonius SAY, Acad. Nat. Sci. Phila., Jour., **4** : 135, pl. 9, fig. 2, 1824; CONRAD, Foss. Med. Tert. U. S. : 47, pl. 23, fig. 1, 1840; CONRAD, Acad. Nat. Sci., Phila., Proc., **14** : 581, 1862; MEEK, Smith. Misc. Coll., **7** : 5, 1864; HARRIS, Bull. Am. Pal., **1** : 311, pl. 9, fig. 2, 1898, reprint of Say's publication; HEILPRIN, Acad. Nat. Sci. Phila., Proc., **33** : 419, 1881.

Pecten magellanicus LAMARCK, CONRAD, Acad. Nat. Sci. Phila., Jour., **7** : 153, 1834, not of Gmelin, 1792.

Pecten principoides EMMONS, Geol. Surv., N. C., Rept. : 280, fig. 198, 1858.

Pecten (*Placopecten*) *clintonius* SAY, VERRILL, Conn. Acad. Sci., Trans., **10** : 78, 1897, *partim*; DALL, Wagner Free Inst. Sci. Trans., **3** : 726, 1898.

Pecten (*Chlamys*) *clintonius* SAY, GLENN, Md. Geol. Surv., *Miocene* : 376, pl. 99, fig. 5, 1904.

DESCRIPTION. — Say's original description :

« Auricles equal; surface with from one hundred forty to one hundred eighty elevater longitudinal lines.

« Shell suborbicular, compressed, with very numerous, regular, elevated striae, which are muricated with minute scales formed by transverse wrinkles, that are sparse in the middle of the length, and crowded each side of the shell; the intervening spaces are regularly concave, and in parts very distinctly wrinkled : auricles equal, striated like the general surface; within, simple, margins striated. »

The holotype, a left valve, is uniformly and rather finely threaded with rounded, closely spaced, elevated, scabrous threads, which extend across the sub-margins and auricles. About 31 mm. from the beak the radials become more scabrous, and intercostals appear. Auricles subequal.

Scabrous sculpture is well developed on valves from Murfreesboro Landing, Meherrin River, N. C. Shells from that locality are more equally, and less convex than those from other localities. Camptonectes marking somewhat less well developed than on valves from other localities.

Young individuals from Bellefield, Va., have a rather poorly developed radial sculpture, and conspicuous camptonectes marking extending to the

auricles. Wide byssal fasciole; ctenolium. Valves more ovate than those of adults.

Auricles small, equal, radially sculptured; only slight flexure of byssal auricle in adults. Interior obscurely grooved, or smooth.

REMARKS. — *C. magellanicus* Gmelin resembles *clintonius*, and may be its descendant. It differs from *clintonius* in having a shorter hinge line, and a much narrower chondrophore. The radial threads of *clintonius* are somewhat coarser than those of *magellanicus*. In each species the ctenolium is present in the young individuals.

DIMENSIONS. — Holotype, height 66, width 61 mm. Hypotype, height 111, width 105 mm.

LOCALITIES. — Maryland (type), Say; Kingsmill, Bellefield, Evergreen, Coggins Point, Grove Wharf, Lanexa, Claremont Wharf, Yorktown, Va.; Murfreesboro Landing, Meherrin River, N. C.

HORIZON. — St. Marys, and Yorktown (Miocene).

HYPOTYPE. — Collection Cornell University.

HOLOTYPE. — Academy of Natural Sciences of Philadelphia.

***Chlamys (Placopecten) clintonius rappahannockensis* (MANSFIELD).**

Pl. III, fig. 6; pl. IV, fig. 1 ⁽¹⁾.

Pecten (Chlamys) clintonius rappahannockensis MANSFIELD, Jour. Pal., **10** : (3) : 186, pl. 22, figs. 1-3, 1936.

DESCRIPTION. — Mansfield's original description :

« Shell large, thin and fragile, slightly inequilateral, weakly inflated, the left valve more so than the right. Hinge line rather short. Ears nearly equal in size; right anterior with a very shallow notch. Ears marked with 7 to 9 weak, finely crenulated radials. Surface of both valves similarly sculptured with many (about 10 to a centimeter) nearly flat radials. Some of the single radials on the early part of the valves divide into two radials distally, and a single radial may come in between the divided pair. Intercostal spaces concentrically crossed by fine diagonal lines. »

REMARKS. — This species has more uniform and more closely spaced radials than *clintonius*, s.s., and a longer hinge line.

DIMENSIONS. — Syntypes : Left valve, width 115, height 111, convexity 19 mm.; right valve, width 114, height 106, convexity 12 mm.

⁽¹⁾ See Explanation of Plate III for correction of text of figs. 6 and 7 on Plate III.

LOCALITIES. — Jones Point, right bank of Rappahannock River, Essex County, Va. (type), Mansfield.

HORIZON. — St. Marys (Miocene).

SYNTYPES. — U. S. National Museum Cat. N° 373072.

***Chlamys (Placopecten) clintonius donaldi*, subsp. nov.**

Pl. I, fig. 12.

DESCRIPTION. — This subspecies differs from *clintonius*, s.s. in its much greater degree of convexity, and definitely coarser radial sculpture. The radial cords are low, rounded, and more widely spaced than *clintonius* s.s. There is a marked tendency for the cords to curve near the periphery, following a line of growth. On the holotype the cords appear to be offset. Fine camptonectes sculpture in the interspaces of better preserved valves.

DIMENSIONS. — Holotype, height 125, width 125, convexity 30 mm.

LOCALITIES. — Grove Wharf, Va. (type); Kingsmill, Va.

HORIZON. — Yorktown (Miocene).

PARATYPES. — Cornell University.

HOLOTYPE. — U. S. National Museum, Cat. N° 144996.

***Chlamys (Placopecten) marylandicus* (WAGNER).**

Pl. IV, fig. 13; pl. V, fig. 16.

Pecten marylandicus WAGNER, Acad. Nat. Sci. Phila., Jour., **8** : 51, pl. 1, fig. 2, 1839; CONRAD, Acad. Nat. Sci. Phila., Proc., **14** : 581, 1862; MEEK, Smith. Misc. Coll., **7** : 4, 1864; HEILPRIN, Acad. Nat. Sci. Phila., **33** : 421, 1881.

Pecten (Placopecten) marylandicus WAGNER, DALL, Wagner Free Inst. Sci., Trans., **3** : 728, 1898, *partim*.

Pecten (Chlamys) marylandicus WAGNER, GLENN, Md. Geol. Surv., *Miocene* : 376, pl. 99, fig. 6, 1904.

DESCRIPTION. — Wagner's original description :

« Shell ovate, compressed; ribs numerous, consisting of narrow, nearly smooth striae, disposed in pairs; interstitial spaces each with a carinated line; ears unequal; inferior valve very slightly convex; ribs similar to those of the opposite valve; inner margin of the valve with profoundly elevated lines. »

The holotype of *marylandicus* can not be definitely established. The figured valve is one from the type locality which was identified by Wagner.

Valves tend to be equally convex. Adult specimens have a rounded sulcus on the summits of the broadly rounded ribs. Concentric sculpture of wavy, only slightly elevated, closely spaced lamellae. Auricles have radial sculpture

of scabrous threads which become definitely coarser on the byssal auricle. In size and shape the byssal auricle closely resembles that of *madisonius*. Byssal notch wide, deep, conspicuous; fasciole broad. Ctenolium coarse.

REMARKS. — *C. marylandicus* has much less well developed ribs and is more ovate in outline than *madisonius*. *C. clintonius* is sculptured with numerous radial cords, while this species has fairly well developed ribs.

DIMENSIONS. — Holotype, height 76, width 69 mm.

LOCALITIES. — Governor Run, 2 miles south of Governor Run, Flag Pond, St. Leonards Creek, Dover Bridge, Whites Landing, near Friendship in railway cutting, Jones Wharf, Md.; Meherrin River, N. C. (type) Wagner.

HORIZON. — Calvert, and Choptank (Miocene).

HYPOTYPES. — Collections Cornell University.

HOLOTYPE. — Academy of Natural Sciences of Philadelphia.

***Chlamys (Placopecten) virginianus* (CONRAD).**

Pl. IV, fig. 22; pl. V, fig. 14.

Pecten virginianum CONRAD, Foss. Med. Tert. U. S. : 46, pl. 21, fig. 10, 1840; CONRAD, Acad. Nat. Sci. Phila., Proc., **14** : 582, 1862; HEILPRIN, *op. cit.*, **33** : 420, 1881.

Pecten tenuis LEA, Am. Phil. Soc., Trans., sér. **2** : **9** : 246, pl. 35, fig. 33, 1845; CONRAD, Acad. Nat. Sci. Phila., Proc., **14** : 581, 1862; TUCKER, Amer. Midl. Nat. **15** : (5) : 617, 1934.

Pecten (Placopecten) virginianus CONRAD, DALL, Wagner Free Inst. Sci., Trans., **3** : 727, 1898.

Pecten (Placopecten?) marylandicus WAGNER, DALL, Wagner Free Inst. Sci., Trans., **3** : (4) : 728, 1898, *partim*.

Chlamys (Placopecten) virginianus CONRAD, TUCKER, Amer. Midl. Nat., **15** : (5) : 617, 1934.

DESCRIPTION. — Conrad's original description :

« Shell suborbicular; inferior valve convex, with numerous irregular impressed radiating lines; sinus of the ear profound, and a deep groove margins the ear to the apex, the groove minutely pectinated.

« This shell, of which I found only the lower valve, may be distinguished from *P. magellanicus* by the deep sinus of the ear and the greater convexity of the disk. »

The holotype of *virginianus* is a much worn right valve. Shell suborbicular, translucent. Surface covered with numerous strong, crowded, scabrous, radiating threads. Beak narrow, pointed. Auricles unequal, radially threaded: the right the larger. Fasciole wide, conspicuous; deep byssal sinus. Ctenolium of 4 denticles. Internally the obscure lirae are arranged in pairs.

Specimens which are not worn have a rather regular, fine concentric sculpture of slightly elevated lamellae. Auricles sculptured with numerous, lamellated, radial threads.

REMARKS. — This species is more convex than *clintonius*, has well developed ctenolium, broad fasciole and deep byssal sinus.

DIMENSIONS. — Holotype, height 59, width 56 mm. Hypotype, height 9, width 56 mm. Hypotype, height 61, width 58.5 mm.

LOCALITIES. — City Point, Va. (type), Conrad; Evergreen, Bellfield, Ruffins Creek, Va.; Murfreesboro Landing, Meherrin River, N. C.

HORIZON. — St. Marys, and Yorktown (Miocene).

HYPOTYPE. — Collection Cornell University.

HOLOTYPE. — Collection Academy of Natural Sciences of Philadelphia, Cat. N° 1620.

GENUS **AMUSIUM** BOLTEN, 1798.

Amusium RUMPHIUS, Amboinische Rariteitskammer : 144, 188, pl. 45, figs. A, B, 1705; KLEIN, Tent. Meth. Ostrac. : 134, 1753.

Amusium BOLTEN, Mus. Bolt., pt. 2 : 165, 1798, lists *A. pleuronectes* LINNÉ, *A. japonicum* GMELIN, etc.; DALL, Harvard Mus. Comp. Zool., Bull., 12 : 207, 1886, designates as type « *Ostrea* » *pleuronectes* LINNÉ; VERRILL, Conn. Acad. Sci., Trans., 10 : 57, 1897; DALL, Wagner Free Inst. Sci., Trans., 3 : 698, 755, 1898, lists as type « *Ostrea* » *pleuronectes* LINNÉ; VERRILL and BUSH, U. S. Nat. Mus., Proc., 20 : 826, 1898; ARNOLD, U. S. Geol. Surv., Prof. Paper, 47 : 50, 1906; WOODRING, Carnegie Inst. Wash., 366 : 73, 1925, lists as type « *Ostrea* » *pleuronectes* LINNÉ, by subsequent designation, Dall, 1886; GARDNER, U. S. Geol. Surv., Prof. Paper, 142-A : 50, 1926; COX, Rept. Zanzibar Protect. : 78, Sept. 1927; GRANT and GALE, San Diego Soc. Nat. Hist., Mem., 1 : 230, 1931, list as type « *Ostrea* » *pleuronectes* LINNÉ by subsequent designation, Herrmannsen, 1846; GARDNER, Univ. Texas, Bur. Econ. Geol., Bull., 3301 : 143, 1933; JOHNSON, Boston Soc. Nat. Hist., Proc., 40 : (1) : 25, 1934.

Amussium RUMPHIUS, 1711, = Klein, em., 1753, Sacco, I Moll. dei Terr. Terz. del Piemonte e della Liguria, pt. 24 : 47, 1897.

Amussium (RUMPHIUS, 1711) v. MUHLFELD, 1811 (emend.), COSSMAN and PEYROT, Actes de la Soc. Linn. de Bordeaux, 66 : 304, 1914, list as type « *Ostrea* » *pleuronectes* LINNÉ.

Amussium M. VON MUHLFELD, Entw. Mag. d. Gesellschaft f. Naturh. Freunde zu Berlin, V. 1 : 59, 1811.

Amusium MUHLF., SCHUMACHER, Essai d'un Nov. Syst. : 117, 1817, lists as type *Amusium japonicum* GMELIN.

Amussium BOLTEN, emended, HERRMANNSEN, Ind. Gen. Mal., 1 : 47, 1846, designates as type « *Ostrea* » *pleuronectes* LINNÉ.

Amussium KLEIN, MORCH, Cat. Conchyl., pt. 2 : 59, 1853; H. and A. ADAMS, Gen. Rec. Moll., 2 : 555, 1858; STOLICZKA, Geol. Surv. India, Mem., 3 : 426, 1871; FISCHER, Man. de Conch., : 945, 1887.

Amusium KLEIN, WOODWARD, Man. Moll. : 412, 1871.

GENOTYPE. — « *Ostrea* » *pleuronectes* Linné, by subsequent designation, Herrmannsen, 1846. Pliocene of Java. Living in the Indo-Pacific region.

DIAGNOSIS. — Shell large, orbicular, compressed; often gaping anteriorly and posteriorly; may be slightly and unequally inflated. Valves smooth, occasionally with radial grooves and concentric striations; sculpture of valves may be dissimilar. Margins thin. Auricles small, symmetrical, nearly equilateral; byssal notch small or absent. Ctenolium obsolete in adults. Byssus probably absent in adults. Strong, narrow lirae, often arranged in pairs, and usually not reaching the ventral margins of the valves may be present internally. Hinge plate simple; chondrophore large, shallow; a pair of cardinal crura diverge from it toward the side margins.

LOCALITY. — World wide (fossil). Living in the Indo-Pacific waters.

HORIZON. — Cretaceous to Recent.

SUBGENUS AMUSIUM S. S.

DIAGNOSIS. — Shell large, orbicular, thin; the right valve rather more inflated than the left; gaping anteriorly and posteriorly. Valves occasionally have faint radial grooves and concentric striae. Auricles small, equal; byssal sinus very small. Ctenolium absent in adults. Interior bearing a series of narrow, pointed ribs, conspicuously grouped in pairs in the right valve, and not reaching the ventral margins.

Amusium (*Amusium*) *ocalanus* (DALL).

Pl. V, fig. 15.

Pecten (*Amusium*) *ocalanus* DALL, Wagner Free Inst. Sci., Trans. 3 : (4) : 756, pl. 29, fig. 2.

DESCRIPTION. — Dall's original description :

« Shell of moderate size, nearly equivalve, quite inequilateral, moderately convex; right valve with the disk nearly smooth, posterior margin produced; ears subequal, nearly smooth, their outer angles a little raised, so that the cardinal margins form a very obtuse angle at the beak; byssal sinus represented by a marked flexure but not a distinct notch; left valve similar, slightly more convex, with about 18 obsolete rounded ribs separated by narrow, shallow grooves, sharpest near the beak, radiating nearly to the basal margin but becoming less visible there and at the submargins; ears vertically striated, subequal; interior of the disk with about twenty pairs of well marked lirae similar in striated cardinal crura, auricular crura each valve: hinge with developed cross-present; margins of the valves smooth, not crenulated.

« The fossils vary from nearly smooth to obviously ribbed; the byssal sinus

is more distinct than in the other species and sometimes verges on a notch, and there is a perceptible byssal fasciole. »

DIMENSIONS. — Holotype, height 35, width 35 mm.

LOCALITIES. — Ocala, Fla. (type), Dall; Martin Station, Marion County, Fla., Dall; Natural Bridge, Alachua County, Fla., Dall.

HORIZON. — Jackson (Eocene); Vicksburg (Oligocene), fide Dall.

HOLOTYPE. — U. S. National Museum, Cat. N° 137887.

***Amusium (Amusium) precursor* (DALL).**

Pl. II, fig. 1.

Pecten (Amusium) precursor DALL, Wagner Free Inst. Sci., Trans., 3 : (4) : 755, 1898.

Amusium (Amusium) precursor DALL, GARDNER, U. S. Geol. Surv., Prof. Paper, 142-A : 50, 1926.

DESCRIPTION. — Dall's original description :

« There are several species of *Amusium* ranging from the Oligocene to the recent fauna in this region. In general they appear extremely similar, so much so that such figures as are ordinarily given would show no differential characters. By careful and repeated study I find myself able to separate them by the umbonal sculpture, which differs in the different forms as follows :

« Nepionic shells perfectly smooth externally.

1. Shell more or less ovate : *P. papyraceus* Gabb.

2. Shell very large, orbicular : *P. mortoni* Rav.

» Nepionic left valve with obsolete radii and often feeble concentric undulations : *P. precursor* Dall.

» Nepionic left valve with distinct flattened ribs with shallow channeled interspaces crossed by concentric, evenly spaced, not crowded, elevated lines : *P. lyoni* Gabb. Left valve of the adult with obsolete rounded ribs extending, in the adult, well over the middle of the disk : *P. ocalanus* Dall.

« *P. precursor* is nearly as large as *P. mortoni*, but slightly rougher and more convex when adult; the young are nearly orbicular; a distinct trace of Camptonectes striation, near the beak and submargins, may be discerned with a magnifier in a good light. The right valve is much flatter than the other. As the material is much broken up, it seemed hardly worth while to figure it. »

REMARKS. — Since the type materials is fragmental, there seems little point to figuring it. The valve figured, from Ten Mile Creek, Fla., seems to be the only perfect one available.

Concentric lines of growth and fine radial striations are the only sculpture developed. Valve slightly convex, orbicular. In the same stage of development *mortoni* is somewhat more ovate, and lacks radial striae.

Young valves from the Chipola beds, Chipola River, Fla., have faint radial ribbing in umbonal area and on the byssal auricle. Strong concentric threads near the beak. Provinculum present.

DIMENSIONS. — Hypotype, height 91, width 89 mm.

LOCALITIES. — Ten Mile Creek, 1 mile west of Baileys Ferry, Fla., Dall.

HORIZON. — Chipola (Miocene).

HYPOTYPE. — Florida Geological Survey, Cat. N° 1-1094 (A).

COTYPES. — U. S. National Museum, Cat. N° 114773.

***Amusium (Amusium) mortoni* (RAVENEL).**

Pl. II, fig. 2.

Pecten mortoni RAVENEL, Acad. Nat. Sci. Phila., Proc., **2** : 96, 1844; RAVENEL, *op. cit.*, **3** : 38, 1846; TUOMEY and HOLMES, Pleioc. Foss. S. C. : 27, pl. 9, figs. 1-2, pl. 10, figs. 1-2, 1857; EMMONS, Geol. Surv. N. C., Rept. : 281, 1858; HEILPRIN, Acad. Nat. Sci. Phila., Proc., **33** : 421, 1881.

Amusium mortoni RAVENEL, CONRAD, Acad. Nat. Sci. Phila., Proc., **14** : 582, 1863; MEEK, Smith. Misc. Coll., **7** : (177) : 4, 1864; CONRAD, Am. Jour. Conch., **1** : 14, 1865; HEILPRIN, Acad. Nat. Sci. Phila., Proc. for 1891 : 142, 143, 1892; TUCKER and WILSON, Ind. Acad. Sci., Proc., **41** : 355, 1932, faunal list.

Pecten (Amusium) mortoni RAVENEL, DALL, Wagner Free Inst. Sci., Trans., **3** : (4) : 757, 1898; GLENN, Md. Geol. Surv., *Miocene* : 372, pl. 99, fig. 1, 1904.

Amusium mortoni (RAVENEL), MANSFIELD, Fla. Geol. Surv., Bull., **8** : 64, pl. 11, figs. 2, 4, 1932.

Pecten (Amusium) japonicus (GMELIN), GRANT and GALE, San Diego Soc. Nat. Hist., Mem., **1** : 231, 1931, *partim*.

DESCRIPTION. — Ravenel's original description :

« Orbicular, thin, both valves moderately convex, one more so than the other — outside, with numerous concentric obsolete striae : inside, — with from 18 to 24 radiating double ribs, slightly elevated; ears large; subequal, striated externally. »

REMARKS. — Valves equilateral; equi-convex. Shell orbicular, nearly transparent; sculptured externally only by concentric growth lines. Faint radial striae on disk. Auricles approximately equal. Slight flexure on byssal auricle. Interior sculptured by lirae arranged in pairs. Strong auricular crura. Young shells tend to be more nearly oval than adults.

DIMENSIONS. — Hypotype, height 143, width 143, semi-diameter 25 mm. Holotype, height 136, width 158 mm., an imperfect right valve.

LOCALITIES. — Smith's on Goose Creek, S. C. (type), Ravenel; Upper bed, Alum Bluff, Liberty County, Fla., Mansfield; cut in old road leading to Watsons

Landing, Liberty County, Fla., Mansfield; Jackson Bluff, Leon County, Fla., Mansfield; Gully Pond, Washington County, Fla., Mansfield; Rock Creek, near Knox Still Landing, Franklin County, Fla., Mansfield; Nansemond River, 18 miles below Suffolk, Va., Mansfield; Ft. Thompson, Fla., Dall; Ft. Denaud, Acline, Prairie Creek, Clewiston and Moore Haven, Fla., Tucker and Wilson; Lake Waccamaw, N. C.; Natural Well, N. C.; Yorktown, Va.

HORIZON. — Yorktown, Choctawhatchee, and Duplin (Miocene); Caloosahatchie (Pliocene).

HYPOTYPE. — U. S. National Museum, Cat. N° 154203.

HOLOTYPE. — Academy of Natural Sciences of Philadelphia.

Amusium (Amusium) holmesi (DALL).

Pl. III, fig. 13.

Janira affinis TUOMEY and HOLMES, Pleioc. Foss. S. C. : 26, pl. 8, figs. 5, 6, 1857, not Reuss, 1846, nor Risso, 1826.

Pecten (Euvola) holmesii DALL, Wagner Free Inst. Sci., Trans., 3 : (4) : 721, 1898.

DESCRIPTION. — Tuomey and Holmes' original description :

« *P. testa subrotunda, tenui; valva inferiore, convexa aequilaterali, extus laevigata, intus binis radiatim costata; auriculis sub-aequalibus.*

» Shell almost circular, thin; lower valve convex, equilateral; smooth on the outside, with radiating undulations or obsolete ribs; striated concentrically; on the inside rayed with narrow ribs in pairs; ears nearly equal. The ribs on the inside correspond with the intermediate spaces of the obsolete ribs on the outside. The buccal ear is slightly expanded and crossed by undulating striae, and with an obtuse ridge terminating in the sinus. Although but a single lower valve has been found, the wide channel and corresponding ridge, on the outside of the buccal ear, are sufficient to refer it to the genus *Janira*. The thinness of the shell and interior costae give it some resemblance to *P. mortoni*, but it is separated from it by the sinus for the byssus, and greater convexity of the shell.

» It also resembles *J. zizac*, of the coast of Florida; the latter, however, has the lower valve more convex, the umbones more prominent, and the flattened external ribs better defined, and marked by an impressed line towards the pallial margin.

» The genus *Janira* commenced its existence in the ocean of the Cretaceous period, is found in the Tertiary, and is still an inhabitant of the seas of warm and temperate climates. Both the Tertiary and recent species are of greater size than those of the Cretaceous. »

REMARKS. — Dall, 1898, having discovered that *affinis* was preoccupied by a Cretaceous species, renamed the species. At that time he stated that the

author's types were in the American Museum of Natural History. Diligent search has failed to bring to light any record of their having ever been deposited there. Nor have later collections included any shells identified as this species, so far as can be determined. It is, therefore, with considerable hesitation that the species is referred to *Amusium*. Tuomey and Holmes' original figures have been reproduced.

DIMENSIONS. — Holotype, height 96, width 115 mm.

LOCALITY. — Smiths on Goose Creek, S. C. (type), Tuomey and Holmes.

HORIZON. — Pliocene ?

HOLOTYPE. — American Museum of Natural History, fide Dall.

SUBGENUS PSEUDAMUSSIUM (KLEIN) MÖRCH, 1853.

Pseudamussium KLEIN, Tent. Meth. Ostrac. : 134, 1753, lists *Pecten laevis varigatus*, etc.; MÖRCH, Cat. Conch. Yoldi, pt. 2 : 59, 1853; H. and A. ADAMS, Gen. Rec. Moll., 2 : 553, 1858; CHENU, Man. de Conch., 2 : 184, 1862, lists as type *Pecten dispar* LAMARCK; STOLICZKA, Geol. Surv. India, Mem., 3 : 426, 1871, designates as type *Pecten exoticus* CHEMNITZ (*Pseudamussium-Pecten laevis*, etc., of KLEIN).

« *Propeamussium* DE GREGORIO », COSSMAN and PEYROT, Actes de la Soc. Linn. de Bordeaux, 66 : 305, 1914; WOODRING, Carnegie Inst. Wash., 366 : 74, 1925.

Pseudamussium H. and A. ADAMS, DALL, Mus. Comp. Zool. Harvard, Bull., 12 : 219, 1886, cites as type *Pecten dispar* LAMARCK and *Pecten pseudamussium* LAMARCK; VERRILL, Conn. Acad. Sci., Trans., 10 : 60, 1897; DALL, Wagner Free Inst. Sci., Trans., 3 : 697, 1898; VERRILL and BUSH, U. S. Nat. Mus., Proc., 20 : 828, 1898; ARNOLD, U. S. Geol. Surv., Prof. Paper, 47 : 50, 1906; GARDNER, U. S. Geol. Surv., Prof. Paper, 142-A : 48, 1926.

Pseudamussium MÖRCH, STEWART, Acad. Nat. Sci. Phila., Special Publ., 3 : 122, 1930; JOHNSON, Boston Soc. Nat. Hist., Proc., 40 : (1) : 25, 1934.

Pseudamussium emend. KLEIN, SACCO, I Moll. dei Terr. Terz. del Piemonte e della Liguria, pt. 24 : 51, 1897.

Pseudamussium KLEIN, in MÖRCH, GRANT and GALE, San Diego Soc. Nat. Hist., Mem., 1 : 235, 1931.

GENOTYPE. — « *Pecten* » *septemradiatum* Müller, by absolute tautonymy. Living, Norway to North England.

DIAGNOSIS. — Shell small, very thin, orbicular, not gaping; valves nearly equal and symmetrical. Sculptured with fine radial and concentric striations. Sometimes with only concentric striae on the right and only radial striae on the left valve, or both valves may be smooth. Auricles small, subequal, straight, obtuse angled. Right anterior auricle sculptured with radial riblets. Byssal notch small, deep; ctenolium sometimes lacking. Rather long hinge

line. Usually only one feeble longitudinal fold on each end of the hinge plate, nearly parallel to the marginal ligamental groove. Interior smooth.

REMARKS. — H. and A. Adams adopted this group from Klein, but failed to define it clearly, or to designate type. They gave a somewhat incongruous list of species.

Since Mörch placed « *P. pseudamussium* Ch. » in synonymy under *Pecten septemradiatum* Müller, it becomes the type by absolute tautonymy, International Rules of Zoological Nomenclature, Art. 30, d. *P. septemradiatum* is probably the same as Chemnitz's species, *Conch.-Cab.*, 7 : 298, figs. 601, 602, 1784.

Dall thought *Pseudamussium* was dated from H. and A. Adams, who considered that Klein's single species must be type since that name was ascribed to him by Mörch. Stewart is of the opinion that « The same principle may also be claimed for *Pseudamussium* Mörch, but in neither case does Klein's species necessarily become the type. Klein's species might be considered as one of the original species but it has no more claim as type than the original species cited by the author who is responsible for the name in modern zoological literature. »

Kobelt, *Illust. Conchyl.* : 373, 1881, designates the first of Mörch's species, « *Pecten* » *glaber* Linné, as type. However, type by absolute tautonymy takes precedence over the subsequently designated type, *Int. Rules Zool. Nomenclature*, Art. 30, d.

Hörnes, *Abhand. der Kaiserlich-Königlich Geolog. Reich.*, Bd. 11 : 412, Taf. LXIV, fig. 4a, 4b, 4c, 1870, describes *Pecten septemradiatum* Müller :

« *P. testa suborbiculari, inaequivalvi, inaequilatera, tenui, subcompressa, auriculis minimis, subaqualibus, striatis; valva superiori plano-convexa, costis quinque vel sex, vix elevatis, latisculis, leviter angulatis, ornata; costis tenuiliratis, interstitiisque undque tenuissime decussatim striatis; valva lateribus subrugos-liratis; margine crenulato.* »

Hörnes places « *Pecten* » *pseudamussium* Chemnitz, *Conchyl.-Cab.*, 7 : 298, tab. 63, fig. 601 u. 602, in synonymy under *Pecten septemradiatum* Müller.

Pseudamussium lacks the internal lirae which are characteristic of *Amussium*, s.s., and the valves are not gaping. It is distinguished from *Propeamusium* by its smooth interior.

LOCALITY. — World wide (fossil). Living in deep water, practically world wide. Less common in shallow water.

HORIZON. — Cretaceous to Recent.

Amusium (*Pseudamussium*) *hamiltonense* TUCKER.

Pl. V, fig. 17.

Pecten (*Chlamys*) *clarkeanus* ALDRICH, DALL, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 739, *partim*, 1898.

Pecten clarkeanus ALDRICH, HARRIS, Bull. Am. Pal., 6 : (31) : 25, *partim*, pl. 15, figs. 10, 11, 12, 1919.

Amusium (*Pseudamussium*) *hamiltonensis* TUCKER, Amer. Midl. Nat., 15 : (5) : 617, pl. 27, fig. 1, 1934.

DESCRIPTION. — Tucker's original description :

« Shell somewhat thin; valves nearly equally convex and discrepantly sculptured. Right valve resembles *scintillatus* Conrad in outline. Bank pointed, faint radial striations best developed over the central portion of the disk; concentrically sculptured. Auricles subequal, the right has 4 radials, the left is plain. The left valve slightly more convex than the right, having the quinque-costate structure noted by Harris. Sculpture perhaps slightly stronger on this valve. Extending back from the beak about 7 mm., the concentric and radial sculpture intersect, giving the shell a somewhat cancellate appearance. Disk obscurely striated radially. Concentric sculpture rather stronger than on the right valve. Auricles subequal, the posterior auricle has 4 radials, the anterior none. At the point where the auricles are attached to the disk there is a row of close set, elevated, rounded scale-like processes which are evidently formed by the continuation of the concentric sculpture of the disk. This character seems to be present in none of the related species. The holotype shows only traces of obscure camptonectes striation on the submargins.

» Two young valves from Talahatchee, Miss. may belong to this species. They show cancellate sculpture over the entire disk and strong camptonectes marking. The larger left valve, height 9 mm., has five strong radials on the posterior auricle, three feeble ones near the submargin on the anterior. The posterior one has the cancellate sculpture of the disk. »

REMARKS. — This species is separated from *scintillatus* by its sculpture. That species is never radially sculptured, has much more strongly developed camptonectes sculpture, and never has the row of scales at the base of the auricles of the left valve. It is separated from *clarkeanus* by its much less well developed radial sculpture. Some specimens of *clarkeanus* have the cancellate sculpture on the beaks of the left valves, but all such specimens examined show the fairly strong radial ribbing at the margin of the disk, sometimes also on the anterior and posterior slopes of the disk. Aldrich states in the description of *clarkeanus* that it combines the characters of two subgenera. Certainly the holotype of this species should be referred to *Pseudamussium*, while the

strongly ribbed forms referred to *clarkeanus* are properly included under *Chlamys*.

DIMENSIONS. — Holotype, a left valve, height 21, width 19 mm. Paratype, a right valve, height 20, width 16 mm.

LOCALITIES. — Hamilton Bluff, Ala. (type), Tucker; Talahatchee, Miss., Tucker.

HORIZON. — Claiborne (Eocene).

PARATYPE. — Paleontological Research Institution.

HOLOTYPE. — Paleontological Research Institution.

***Amusium (Pseudamussium) calvatus* (MORTON).**

Pl. IV, figs. 26, 27, 28; Pl. VI, fig. 7.

Pecten calvatus MORTON, Amer. Jour. Sci., sér. 3, 24 : Art. 11 : 130, pl. 10, fig. 3, 1833; MORTON, Syn. Organic Remains : 58, pl. 10, fig. 3, 1834; CONRAD, Acad. Nat. Sci. Phila., Jour., 7 : pt. 1 : 122, 1834; MORTON, Acad. Nat. Sci. Phila., Jour., 8 : pt. 1 : 216, 1839; CONRAD, Nat. Inst. Proc., Bull. 2 : 174, 1842; RAVENEL, Acad. Nat. Sci. Phila., Proc., 2 : 97, 1844; GIBBES, *op. cit.*, 2 : 254, 1845; CONRAD, Smith. Misc. Coll., 7 : Art. 6 : (200) : 33, 1866; HOPKINS, La. Geol. Surv., 2nd Ann. Rept. : 12, 17, 1870; HEILPRIN, Acad. Nat. Sci. Phila., Proc., 33 : 416, 1881; DE GREGORIO, Ann. de Geol. et de Pal., 7 et 8 liv. : 181, pl. 21, fig. 28, 1890; VAUGHAN, U. S. Geol. Surv., Bull., 142 : 50, 1896.

Pecten (Pseudamussium) calvatus MORTON, DALL, Wagner Free Inst. Sci., Trans., 3 : (4) : 752, 1898, *partim*.

DESCRIPTION. — Morton's original description :

« Orbicular, thin, smooth, with obsolete radiating lines. Diameter three-fourth of an inch. »

REMARKS. — Shell small, orbicular, thin. Obscurely threaded with low, broadly rounded radials which appear to bifurcate near the ventral margin. Radials intersected by obscure, concentric growth lines, giving the shell the slightly reticulated appearance shown in Morton's figures. Auricles subequal; the right has 2 obsolete radial threads near the byssal sinus.

DIMENSIONS. — Holotype, a right valve, height 20, width 18 mm. Hypotypes : Fig. 1, height 33, width 33 mm.; fig. 2, height 24, width 22.5 mm.; fig. 3, height 36, width 30 mm.

LOCALITIES. — Eutaw Springs, S. C. (type), Morton; Winnfield, La.; Hat-chetigbee Bluff, Ala.

HORIZON. — Wilcox, and Jackson (Eocene).

HYPOTYPES. — Cornell University.

COTYPES. — Academy of Natural Sciences of Philadelphia.

Amusium (Pseudamussium) corneoides (HARRIS).

Pl. V, fig. 13; pl. VI, fig. 11.

Pecten claibornensis CONRAD, HEIBPRIN, Acad. Nat. Sci. Phila., Proc., **33** : 416, 1881, *partim*;
 DE GREGORIO, Ann. de Geol. et de Pal., **7** et **8** liv. : 182, 1890; HEILPRIN, Acad. Nat.
 Sci. Phila., Proc., **41** : 403, 1891; HARRIS, Bull. Am. Pal., **1** : (1) : 11, 1895, *partim*;
 KENNEDY, Acad. Nat. Sci. Phila., Proc., **47** : 114, 1895; HARRIS, *op. cit.*, **48** : 470,
 pl. 18, figs. 1, 2, 1896, *partim*; VAUGHAN, U. S. Geol. Surv., Bull., **142** : 19, 46, 1896.

Pseudamussium claibornensis CONRAD, HARRIS, Bull. Am. Pal., **2** : (9) : 43, pl. 7, fig. 1,
 1897, *partim*.

Pecten (Pseudamusium) calvatus MORTON, DALL, Wagner Free Inst. Sci., Trans., **3** : (4) :
 752, 1898, *partim*, not Morton, 1833, or 1834.

Pecten (Pseudamusium) scintillatus MORTON, DALL, Wagner Free Inst. Sci., Trans., **3** : (4) :
 752, 1898, *partim*, not Conrad, 1865.

Pecten scintillatus var. *corneoides* HARRIS, Bull. Am. Pal., **6** : (31) : 28, pl. 15, figs. 15, 16,
 1919.

DESCRIPTION. — Harris' original description :

« Form and size as indicated by the figures (see also fig. in Bull. Am. Pal. referred to in the synonymy); substance of the shell thicker when adult than in *scintillatus* of the Jacksonian; appearance like the *corneus* of England, though smaller; surface practically without markings save the fine concentric lines of growth and a few radiating rays on the anterior ear, such rays when adult, separated by a rather broad, smooth space from the anterior margin of the shell as indicated in fig. 16; posterior ear in adult shell with exterior angle approximately 90° and not so obtuse as in *scintillatus* (fig. 14) nor so acute as in *calvatus*; young shells in Mississippi, St. Maurice stage; approaching close in outline to *scintillatus*, but here as elsewhere so far as observed no *Camptonectes* marking (so finely shown in *scintillatus*) have been observed; left valve very flat in umbonal region, becoming deeper centrally and basally, with a faint, medial fold expanding basally. »

REMARKS. — Shell orbicular; thicker than that of *scintillatus*; rather large, surface smooth except for the fine concentric lines of growth. Auricles of left valve equal, right anterior byssal auricle somewhat the longer. Byssal sinus present..

The shell of this species is larger, thicker, and lacks the *camptonectes* marking characteristic of *scintillatus*.

DIMENSIONS. — Cotypes; Right, height 37, width 36 mm.; left, height 29, width 25 mm.

LOCALITIES. — St. Maurice, La. (type) Harris; Alto, and Crockett, Texas; Hickory, and Wautubbee, Miss.; Hatchetighee, and base of bluff at Claiborne, Ala.

HORIZON. — Wilcox, and Claiborne (Eocene).

COTYPES. — Paleontological Research Institution.

Amusium (Pseudamussium) scintillatus (CONRAD).

Pl. V, fig. 12.

Pecten (Euburneopecten) scintillatus CONRAD, Am. Jour. Conch., **1** : 140, pl. 10, fig. 4, 1865, a young shell.

Camptonectes scintillatus CONRAD, Smith. Misc. Coll., **7** : Art. **6** : (200) : 23, 1866.

Camptonectes claibornensis CONRAD, *op. cit.* : 23, 1866.

Pecten scintillatus CONRAD, MEYER, Am. Jour. Sci., sér. **3** : **30** : Art. **10** : 69, 71, 1885; ALDRICH, *op. cit.*, Art. **40** : 302, 1885; HARRIS, Bull. Am. Pal., **6** : (31) : pl. 15, fig. 14, 1919.

Pecten claibornensis CONRAD, HARRIS, Geol. Surv. Ark., Rept., **2** : 145, 1892, *partim*.

Pseudamussium claibornensis CONRAD, HARRIS, Bull. Am. Pal., **2** : (9) : 43, pl. 7, fig. 1, 1897, *partim*.

Pecten (Pseudamussium) scintillatus CONRAD, DALL, Wagner Free Inst. Sci., Trans., **3** : (4) : 753, 1898, *partim*; KELLUM, U. S. Geol. Surv., Prof. Paper, **143** : 19, 1926.

DESCRIPTION. — Conrad's original description :

« Ovate, very thin in substance; umbo ventricose, narrow, apex acute; anteriorly the larger valve is marked with minute, fine lines, having a shagreen-like character.

« The smaller valve of this species is unknown. »

REMARKS. — Shell translucent, sub-orbicular, polished; valves slightly and nearly equally convex. Fine, obscure concentric lines; very rarely minute, obsolete radial striations on central portion of the disk. *Camptonectes* marking occurs on both valves at all stages in development. Sometimes the *camptonectes* marking occurs only on the portions of the auricles bordering the disk. more commonly it covers their entire surface. Auricles small; on left valve, subequal; on right, unequal, the anterior being much the longer. Right anterior auricle has 5 inconspicuous radial threads; on young valves appear much stronger. The byssal auricle of young shells is much longer in proportion to size of the valve than in adults. At no stage in its development does the left valve have radiated auricles. Byssal notch deep, narrow; fasciole wide, sulcus-like. Interior smooth or only obscurely radially striated. Ctenolium present. Provinculum of very minute striae. Auricular crura well developed.

Young shells are nearly ovate and proportionately much more convex than adults. Individuals vary in degree to which camptonectes sculpture is developed; frequently more marked than in adults.

Since *claibornensis* Conrad was not in the literature before Harris' description of it in 1892, *scintillatus* Conrad clearly has priority. The name, however, had appeared in various lists published by paleontologists who had access to Conrad's collections, although Conrad himself had never done more than to write a label for the species at the Academy of Natural Sciences of Philadelphia.

DIMENSIONS. — Hypotype, a right valve, height 24, width 23 mm.

LOCALITIES. — Enterprise, Miss. (type), Conrad; Jackson, Miss.; Castle Hayne Quarry, Pender County, N. C., Kellum; Hatchetigbee Bluff, Ala.; St. Maurice, La.; Wautubbee Hills, Miss.

RANGE. — Wilcox, Claiborne, and Jackson (Eocene).

HYPOTYPES. — Cornell University.

HOLOTYPE. — Academy of Natural Sciences of Philadelphia.

***Amusium (Pseudamusium) subminutus* (ALDRICH).**

Pl. VI, fig. 16.

Pecten subminutus ALDRICH, Nautilus, 16 : 100, pl. 4, figs. 16, 17, 1903.

DESCRIPTION. — Aldrich's original description :

« Shell minute, thin, surface smooth, not polished, valves rather flat, ears small, subequal in the right valve and unequal in the left. Fine rugose striae on the ears of the right valve, vertical to the hinge line but not reaching it, but they run down over the submargin. One ear in the left valve with five or six radiating ribs, the other smooth; interior smooth, the cardinal margin cross striated.

» Alt. 3 mm., lat. 3 mm. of the largest specimen.

» Localities : Red Bluff, Miss., Jackson, Miss.

» This little shell is evidently adult. It is probably found at Vicksburg also. It is no rare, closely resembles *P. guppyi* Dall in form, but is smaller. »

DIMENSIONS. — Cotypes: Right valve, height 3, width 3 mm.; left, height 3, width 3 mm.

LOCALITIES. — Red Bluff, Miss. (type), Aldrich; Jackson, Miss., Aldrich.

HORIZON. — Jackson (Eocene).

COTYPES. — The Johns Hopkins University.

Amusium (Pseudamussium) cerinus (CONRAD).

Pl. V, fig. 11; pl. VI, fig. 8.

Pecten cerinus CONRAD, Am. Jour. Conch., **5** : 39, pl. 2, fig. 2, 1869; HEILPRIN, Acad. Nat. Sci. Phila., Proc., **33** : 418, 1881.

Pecten (Pseudamussium) cerinus CONRAD, DALL, Wagner Free Inst. Sci., Trans., **3** : (4) : 753, 1898; GLENN, Md. Geol. Surv., *Miocene* : 373, pl. 99, fig. 2, 1904.

DESCRIPTION. — Conrad's original description :

« Subovate, extremely thin, compressed; ears equal; right valve radiately ribbed; ribs very slightly raised and rounded; surface ornamented by minute, close divaricating lines, left valve without ribs. »

REMARKS. — Shell nearly transparent; sculpture of concentric growth lines and obscure radial threads, which are better developed on left valves. On some valves from the type locality this radial sculpture is fairly strong. The holotype, a right valve, has obscure radial threads on the umbonal area. Right anterior byssal auricle has obscure radial threads. Auricles unequal. Internally smooth. Auricular crura strong.

In the collections of the United States National Museum, Cat. N° 154488, there are two left valves of *cerinus* and a fragment of a right valve from Charles County, Maryland.

Shells transparent, polished, slightly convex. One left valve has 17 low, rounded, obsolete ribs extending from umbonal area to the margin of the disk. Interior fluted to the beak. Auricular crura present. This valve measures : height 17, width 15 mm. The other left valve has only a concentric sculpture of growth lines.

The right valve has no trace of radial sculpture on the disk fragment. Camptonectes marking present; especially well developed on anterior and posterior slopes of disk. Two faintly scabrous radials on byssal auricle. Slight fasciole, ctenolium present. Provinculum developed about 2 mm. either side of resilifer.

DIMENSIONS. — Holotype, right valve, height 29, width 27 mm. Hypotype, left valve, height 23, width 20 mm.

LOCALITIES. — Charles County, Md. (type), Conrad; Plum Point, and Jones Wharf, Md., Glenn; near Patuxent River, Md., Cope; Ashley River phosphate rock, S. C., Dall.

HORIZON. — Calvert, and Choptank (Miocene).

HYPOTYPES. — U. S. National Museum, Cat. N° 154488; Academy of Natural Sciences of Philadelphia, Cat. N° 12577.

HOLOTYPE. — Academy of Natural Sciences of Philadelphia, Cat. N° 12577

Amusium (Pseudamussium) guppyi (DALL).

Pl. VI, fig. 13.

Pecten (Pseudamussium) guppyi DALL, Wagner Free Inst. Sci., Trans., **3** : (4) : 718, pl. 34, figs. 12, 13, 1898.

DESCRIPTION. — Dall's original description :

« Shell small, suborbicular, moderately convex, smooth, with the surface covered with microscopic *Camptonectes* striation; ears small, the anterior slightly larger, all with very minute radiation and concentric lines; notch narrow, small, with no ctenolium; interior smooth, without lirae or developed crura; traces of the auricular crura alone perceptible; cardinal margin bearing a sharply cross striated, very distinct provinculum; basal margins flattened, posterior margin slightly compressed.

« The abundance and uniformity of this little shell testify to its adult character. Occasional individuals show a thickened line internally on each side, on the lower edges of the submargins, like some recent species, and also traces of coloration in blotches. »

DIMENSIONS. — Cotypes : Left valve, height 5, width 5 mm.; right, height 6, width 6 mm.

LOCALITIES. — Jamaica (type), Dall; Oak Grove, Fla., Dall; Port Limon, Costa Rica, Hill.

HORIZON. — Bowden, and Oak Grove (Miocene); Limon (Pliocene).

COTYPES. — U. S. National Museum, Cat. N° 135779.

Amusium (Pseudamussium) defuniak (GARDNER).

Pl. VI, fig. 14.

Pseudamussium defuniak GARDNER, U. S. Geol. Surv., Prof. Paper, **142-A** : 49, pl. 12, figs. 10-12, 1926.

DESCRIPTION. — Gardner's original description :

« Shell very small, rather thick, porcellanous, the disk a rude sector of about 90°. Right valve moderately inflated, obliquely flattened toward the umbones. Left valve flattened. Umbones acute, rising a little above the hinge line. Anterior dorsal margins acutely angulated, slightly more produced than the obtusely angulated posterior margins. Surface of disk smooth except for exceedingly faint traces of a striation like that of *Camptonectes*, visible only under high magnification on a single individual. Traces of a blotchy color pattern are also discernible. Auricles rather small, those of the left valve subequal, the anterior auricle of the right valve higher and more produced than the

posterior; anterior auricle cut off from the disk by a narrow but well defined byssal groove. Margin sharply elevated along the groove and outlined by an obscure thread; traces of one or two more threadlets and a feeble concentric lamination commonly visible near the notch; right posterior auricle not sharply differentiated from the disk and apparently free from sculpture; left anterior auricle and submargins shagreened with an exceedingly fine concentric lamination and radial threading, which becomes obsolete toward the hinge; left posterior auricle and submargin merging smoothly into one another and into the disk, faintly lineated away from the hinge line but showing no trace of a concentric imbrication. No trace of a ligament area along the hinge margin. Resilial pit minute; provinculum still retained on all the individuals in the shape of fine ridges normal to the hinge margin, the ventral margin of the provinculum expanding slightly about half way between the ligament pit and the distal extremities of the hinge. Adductor scar very obscure, apparently rather small, quite strongly posterior, about midway between the dorsal and ventral margins. Pallial line also obscure. Inner surface of valve smooth.

« The relationship of this small form to *P. guppyi* Dall is certainly very close, but it is smaller, the right valve is less convex and the left valve more flattened than in *guppyi*. The dorsal margins are also less sharply defined as a rule. The *Camptonectes* sculpture has been observed on only a single individual of *defuniak* and very obscurely on that, and the ventral expansion of the provinculum is not so marked as in *guppyi*. The single valve from Oak Grove (Fla.) which was referred by Dall to *guppyi*, is possibly specifically identical. The threading upon the auricles is less fine, however, and not so restricted as in *defuniak*. »

DIMENSIONS. — Cotypes : Right valve, height 3.8, width 3.75 mm.; left valve, height 4.6, width 4.61 mm.

LOCALITIES. — 3 1/2 miles southwest of De Funiak Springs, Fla. (type) Gardner.

HORIZON. — Shoal River (Miocene).

COTYPES. — U. S. National Museum, Cat. N° 352453.

Amusium (*Pseudamussium*) *diktuotum* (GARDNER).

Pl. VI, fig. 15.

Pseudamussium diktuotum GARDNER, U. S. Geol. Surv., Prof. Paper, 142-A : 49, pl. 12, figs. 13, 14, 1926.

DESCRIPTION. — Gardner's original description :

« Shell small, relatively thick, porcellanous; the disk a rude sector of about 90°. Right valve moderately inflated, obliquely flattened toward the umbones; left valve compressed. Umbones acute, projecting a little beyond the hinge line.

Anterior extremity slightly more produced than the posterior. External surface covered with a crowded, microscopically fine threading crosses by sharp and regular incrementals, thus forming a rather regular reticulate sculpture. Auricles small, those of the left valve not so small as those of the right: anterior auricle of left valve more sharply differentiated from the disk than the posterior auricle; anterior auricle of the right valve larger than the posterior and more sharply threaded; cut off from the disk by a shallow but distinct byssal notch; resilial pit minute. Provinculum still retained in the form of fine ridges normal to the hinge margin, expanding slightly midway between the resilial pit and the distal extremities of the hinge. Adductor scar obscure, posterior in position. Pallial line ill defined. Inner margins smooth.

« There is a considerable degree of variation in the strength of the sculpture upon this remarkable little species. On some specimens the sculpture is almost obsolete, on others it is very sharply and evenly reticulate. However, the development of any sculpture other than the *Camptonectes* striation upon the disk is sufficient to distinguish this species from all other east coast Tertiary forms. »

DIMENSIONS. — Cotypes: Right valve, height 3.8 width 4 mm.; left, height 4.2, width 4.5 mm.

LOCALITIES. — Horse Creek, 1 1/2 miles south of Oak Grove, Fla. (type), Gardner.

HORIZON. — Oak Grove (Miocene).

COTYPES. — U. S. National Museum, Cat. N° 352454.

SUBGENUS PROPEAMUSSIUM DE GREGORIO, 1884.

Propeamussium DE GREGORIO, Il Natuuralista Siciliano, **3**: (4): 119, 1884; FISCHER, Man. de Conch.: 944, 1886; VERRILL, Conn. Acad. Sci., Trans., **10**: 64, 1897; VERRILL and BUSH, U. S. Nat. Mus., Proc., **20**: 829, 1898; STEWART, Acad. Nat. Sci. Phila., Spec. Publ., **3**: 122, 1930; GRANT and GALE, San Diego Soc. Nat. Hist. Mem., **1**: 232, 1931; JOHNSON, Boston Soc. Nat. Hist., Proc., **40**: (1): 26, 1934.

Propeamussium DE GREGORIO em., DALL, Mus. Comp. Zool. Harvard, Bull. **12**: 240, 1886; DALL, Wagner Free Inst. Sci., Trans., **3**: (4): 698, 1898, ARNOLD, U. S. Geol. Surv., Prof. Paper, **47**: 50, 1906.

Variamussium SACCO, Boll. Mus. Zool. ed Anat. Comp., R. Univ. Stud. Torino, **12**: 101, June 11, 1897; SACCO, I Moll. dei Terr. Terz. del Piemonte e della Liguria, pt. **24**: 49, 1897, type (by monotypy) *Pecten cancellatus* SMITH, not Phillips, 1829, nor Goldfuss, 1833, nor Hall, 1843; DAUTZENBERG, Res. Camp. Sci., Albert I, Prince de Monaco, **72**: 271, 1927.

Not « *Propeamussium* DE GREGORIO », COSSMAN and PEYROT, Actes de Soc. Linn. de Bordeaux, **66**: 305, 1914; WOODRING, Carnegie Inst. Wash., **366**: 74, 1925.

GENOTYPE. — « *Pecten* » (*Propeamussium*) *ceciliae* de Gregorio, by original designation, de Gregorio, 1884.

DIAGNOSIS. — de Gregorio's original diagnosis :

« *Propeamussium* n. sot. g. Questo sottogenre è da per la specie descritta di seguita. È ad esso forse che dovrebbero pure riferirsi i *P. semiradiatus* e *unguiculus* Mayer (in Hofman), etc.

» *Pecten* (*Propeamussium*) *Ceciliae* de Greg. Conchiglia estremamente tenue e compressa; con superficie interna ad esterna levigata. Diam. 35 mm. Spess 4 mm. La scultura consiste in filetti lineari sottilissimi, concentrici, e raggianti; nella regione periferica sono essi quasi del tutto cancellati solo ve ne rimane qualcuno dei concentrici confondentesi con i segni di accrescimento. I filetti raggianti sono distinti nella regione umbonale. Ciò che è più caratteristico in questa specie sono circa 9 raggi rossi color sangue, larghi abbastanza, quasi quanto gl'interstizi. Detti raggi non sono punto promienti all'esterno (né a quanto pare) all'interno, se se ne toglie forse parte della regione umbonale. Essi non nè coste, nè mere zone colorate; affettiano l'interna struttura e si possono isolare del resto della conchiglia come altrettante stecchette sottili.

» La valva destra è appena convessa quasi piana; i raggi restano incastrati nella parte interna, ma traspaiono; essi stano nella regione umbonale, arrivano alla mediana senza però traversarla tutta.

» La valva sinistra è ancor più piana; infatti è appena convessa nella regione umbonale, del resto è anche un po' concava, ciò però è forse dovuto a compressione subita nel fossilizzarsi. I raggi sono assai più marcati e appariscenti, traversano non solo la regione umbonale, ma anche la madicina.

» Ha molta analogia coll'*Amussium lucidum* Jeffr., da cui si distingue per le zone colorate e per la diversa scultura principalmente pei filetti raggianti. »

Shell small, orbicular, extremely thin, polished. Valves somewhat unequal in convexity, the right being the more convex. Valves somewhat unequal in convexity, the right being the more convex. Valves concentrically sculptured, the left sometimes radially striated. Radial striation more distinct in the umbonal region. Auricles well developed. Byssal notch moderately deep, narrow; Byssal auricle sometimes with radial riblets. In adult valves there are about 9 internal, elevated lirae which do not extend to the periphery. These may be absent in young individuals. Hing line varies in length.

REMARKS. — This group includes mostly small, deep sea species.

It is possible that *Propeamussium* may have no particular relationship to *Amusium*. The character of the byssal notch would seem to indicate that it is related to either *Chlamys*, s.s., or *Aequipecten*, s.s.

LOCALITY. — World wide (fossil). Living in deep water, normally, but sometimes in shallow seas; widely distributed.

HORIZON. — Cretaceous to Recent.

Amusium (Propeamussium) alabamensis (ALDRICH).

Pl. VI, fig. 18.

Pecten (Pleuropecten) alabamensis ALDRICH, Ala. Geol. Surv., Bull., **1** : 40, pl. 4, fig. 8, 1886.

Pecten (Amusium) alabamensis ALDRICH, DE GREGORIO, Ann. de Geol. et de Pal., **7** et **8** liv. : 183, pl. 21, fig. 26, 1890.

Pecten alabamensis ALDRICH, HARRIS, Geol. Surv. Ark., Rept., **2** : 41, 1892; HARRIS, Bull. Am. Pal., **1** : (4) : 162, pl. 2, fig. 3, 1896.

Pecten (Propeamussium) alabamensis ALDRICH, DALL, Wagner Free Inst. Sci., Trans., **3** : (4) : 752, 1898.

DESCRIPTION. — Aldrich's original description :

« Shell small, suborbicular; upper valve covered with equidistant concentric lines which run over upon the anterior ear; a few raised radial lines upon the center and anterior side; ears small; right valve nearly smooth; within both valves eight raised prominent rounded ribs, becoming obsolete as they approach the beak. »

« Locality. — Matthew's Landing, Ala.

» Seems to unite *Pleuronectia* and *Pecten*. One specimen shows concentric striae and ribs in the younger part of the shell, these becoming obsolete toward the ventral margin. »

DIMENSIONS. — Holotype, height 4, width 3.8 mm.; hypotype, height 3, width 2.5 mm. Hypotypes : left, height 3, width 2.5 mm.; right, height 3.5, width 2.5 mm.; fig. 11, height 4, width 3.5, shows tendency to nodulation.

LOCALITIES. — Matthews Landing, Ala. (type), Aldrich; Dale's Branch. and Naheola, Ala., Dall; Little Rock, Ark., Harris.

HORIZON. — Midway (Eocene).

HYPOTYPE. — The Johns Hopkins University.

HOLOTYPE. — The Johns Hopkins University.

Amusium (Propeamussium) squamula (LAMARCK).

Pl. VI, fig. 17.

Pecten squamula LAMARCK, Ann. Mus. Hist. Nat., **8** : 354, 1906; LAMARCK, Hist. Nat. Anim. sans Vert., **6** : 183, 1819; DESHAYES, Descr. Coq. Foss. Env. Paris, **1** : 304, pl. 45, figs. 16-8, 1824; DIXON, Geol. Sussex : 94-172, pl. 3, fig. 29, 1850; DESHAYES, Descr. des An. sans Vert., **2** : 74, 1864; NEWTON, Syst. List F. E. Edwards Coll. Clig. and Eoc. Moll. Brit. Mus. : 6, 1891.

? *Amusium squamula* LAMARCK, COSSMANN, Ann. Soc. Roy. Malac. Belgique, **22** : 186, 1887.

Amussium squamulum LAMARCK, HARRIS, Bull. Am. Pal., **2** : (9) : 44, pl. 7, figs. 2a, 3, 1897; HARRIS, *op. cit.*, **6** : (31) : 26, pl. 15, figs. 17, 18, 1919.

Pecten (*Propeamusium squamula* LAMARCK? DALL, Wagner Free Inst. Sci., Trans., **3** : (4) : 757, 1898.

DESCRIPTION. — Lamarck's original description :

« *P. testa minimi, orbiculari, intus suboctoradiata.* »

REMARKS. — Deshayes, 1824, describes this species :

« Cette coquille est le plus petite du genre; elle est arrondie, lenticulaire, très déprimée, équivalve, équilatérale, à oreillettes égales, toute lisse en dehors et, comme le *Pecten pleuronectes*, ornée en dedans de côtes saillantes régulières et rayonnantes du sommet à la base. Ces côtes sont étroites, égales, distantes, et elles varient dans les individus de huit à dix. La charnière est droite, linéaire, simple; les oreillettes qui la prolongent sont égales, un peu obtuses, semblables sur les deux valves, si ce n'est l'antérieure de la valve droite, qui est échancrée assez profondément à la base. Ces oreillettes sont grandes relativement à la taille de la coquille. Cette espèce, assez rare, n'a que quatre à cinq millimètres de diamètre. »

Deshayes, 1819, described *squamula* :

« Cette petite espèce est peu commune. Elle apparaît dans cette partie des sables inférieurs qui se superpose aux lignites, et elle vient s'éteindre dans le calcaire grossier moyen. Elle est assez variable; les côtes intérieures sont les plus ordinairement au nombre de huit, mais elles varient de sept à onze. Dans les individus d'Aizy et de Laon, qui sont aussi les plus grand, les côtes intérieurs sont souvent d'un brun noirâtre, ce qu'il rend plus apparentes. Dans les individus le plus frais, la surface extérieurs, recouverte d'une mince couche corticale subcornée, est d'un gris peu foncé.

» Nos plus grand individus ont jusqu'à 9 millimètres de diamètre. »

Dixon's illustrations indicate that *squamula* is not always ribbed on the interior of the shell, as described by Deshayes, but that the ribs neither reach the ventral margin nor the umbonal region. His figures do show some faint external striation.

This species is separated from *alabamensis* by its lack of external sculpture. Only occasionally is a left valve of *squamula* striated.

DIMENSIONS. — Hypotypes : Fig. 8, height 4.5, width 3.5 mm.

LOCALITIES. — Negreet Bayou, La., Harris; Woods Bluff, Ala., Harris.

HORIZON. — Wilcox, and St. Maurice (Eocene).

HYPOTYPES. — Paleontological Research Institution.

INDEX OF SPECIES

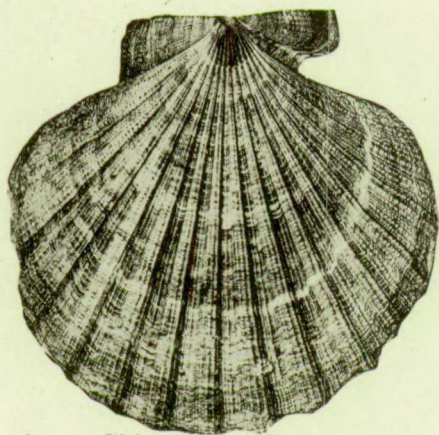
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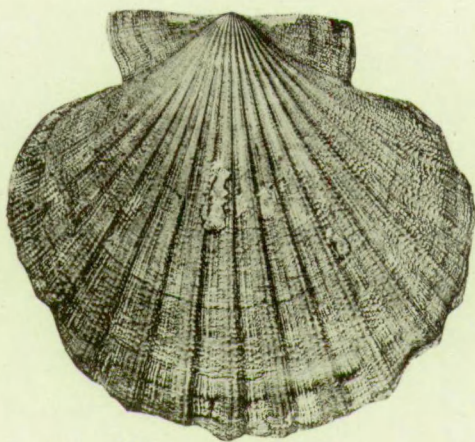
PLATE I

EXPLANATION OF PLATE I

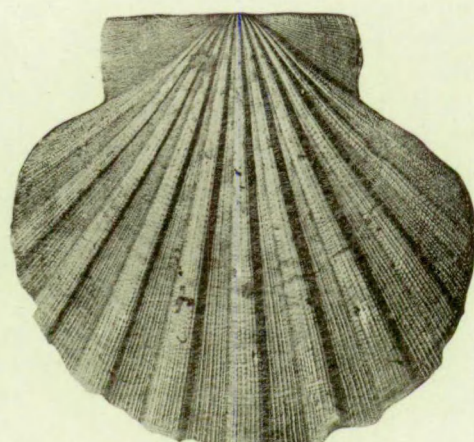
1. *Chlamys (Lyropecten) madisonius* (Say). ($\times \frac{1}{2}$).
St. Marys River, Md. — Hypotype. (St. Marys.)
 2. *Chlamys (Lyropecten) madisonius* (Say). ($\times \frac{1}{2}$).
St. Marys River, Md. — Hypotype. (St. Marys.)
 3. *Chlamys (Lyropecten) jeffersonius* (Say). ($\times \frac{1}{2}$).
Yorktown, Va. — Hypotype. (Yorktown.)
 4. *Chlamys (Lyropecten) jeffersonius* (Say). ($\times \frac{1}{2}$).
Kingsmill, Va. — Hypotype. (Yorktown.)
 5. *Chlamys (Lyropecten) santamaria* Tucker. ($\times \frac{1}{2}$).
St. Marys River, Md. — Hypotype. (St. Marys.)
 6. *Chlamys (Lyropecten) santamaria* Tucker. ($\times \frac{1}{2}$).
St. Marys River, Md. — Syntype. (St. Marys.)
 7. *Chlamys (Lyropecten) pontoni* Mansfield. ($\times \frac{1}{2}$).
Red Bay, Walton County, Fla. — Holotype. (Choctawhatchee.)
 8. *Chlamys (Lyropecten) peedeensis* (Tuomey and Holmes). ($\times \frac{1}{2}$).
Peedee River, S. C. — Neoholotype. (Waccamaw.)
 9. *Chlamys (Plagiectenium) solarioides* (Heilprin). ($\times \frac{1}{2}$).
Clewiston, Fla. — Hypotype. (Caloosahatchie.)
 10. *Chlamys (Plagiectenium) solarioides* (Heilprin). ($\times \frac{1}{2}$).
Clewiston, Fla. — Hypotype. (Caloosahatchie.)
 11. *Chlamys (Placopecten) clintonius* (Say). ($\times \frac{1}{2}$).
Bellefield, Va. — Hypotype. (Yorktown.)
 12. *Chlamys (Placopecten) clintonius donaldi* subsp. nov. ($\times \frac{1}{2}$).
Grove Wharf, Va. — Holotype. (Yorktown.)
-



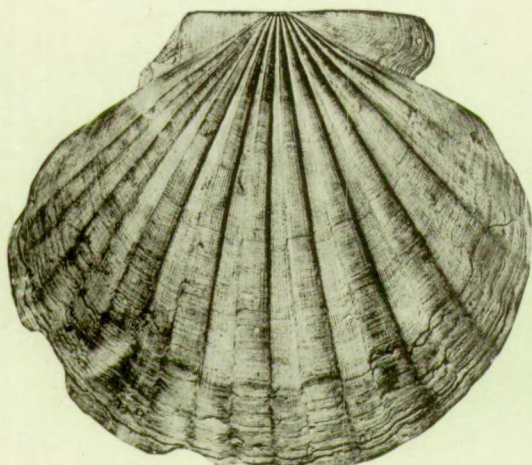
1. — *Chlamys madisonius* (Say).



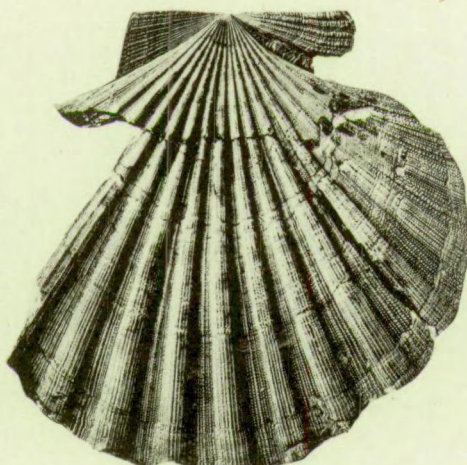
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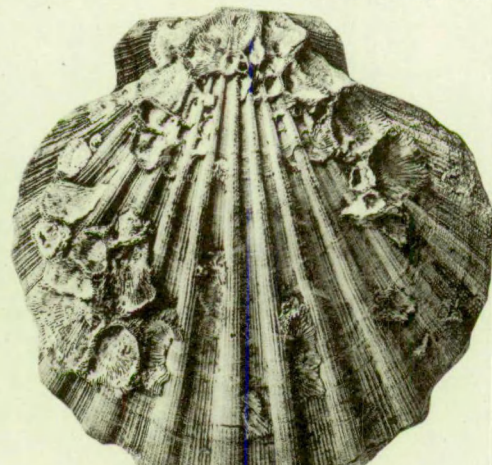
3. — *Chlamys jeffersonius* (Say).



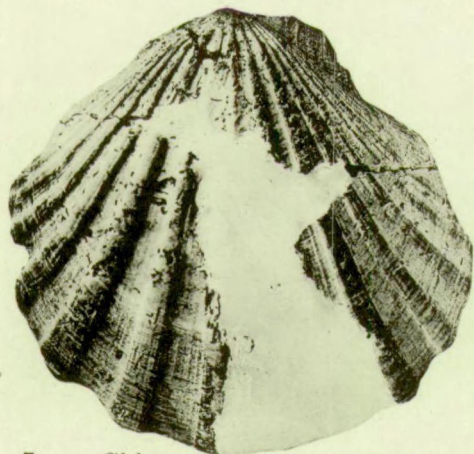
4. — *Chlamys jeffersonius* (Say).



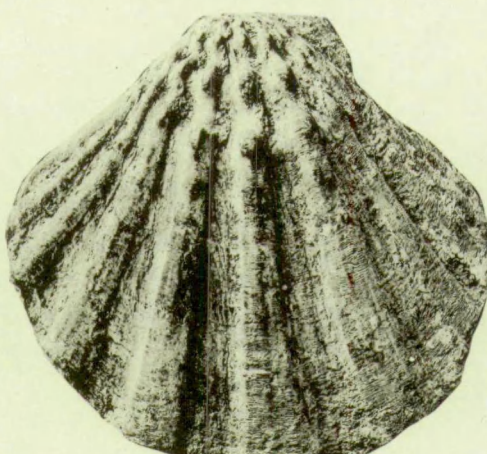
5. — *Chlamys santamaria* Tucker.



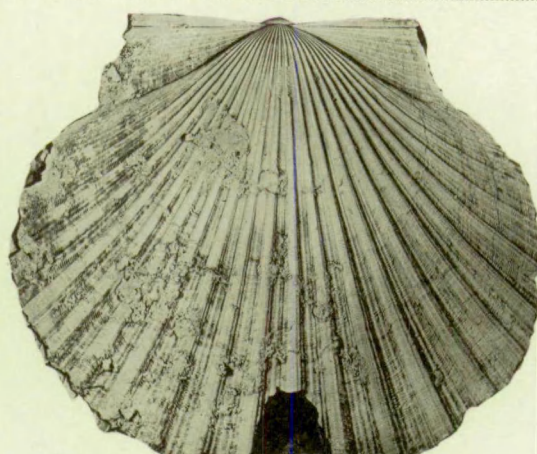
6. — *Chlamys santamaria* Tucker.



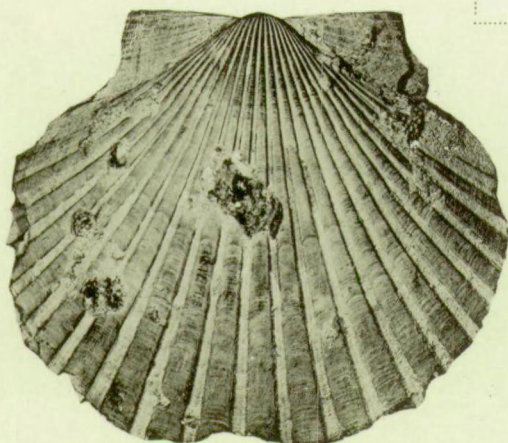
7. — *Chlamys pontoni* Mansfield.



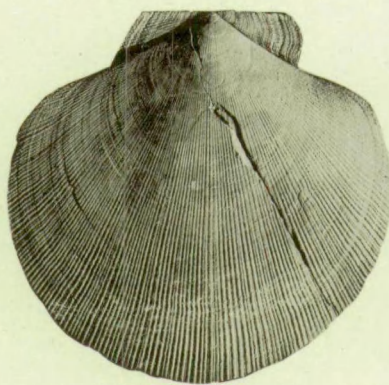
8. — *Chlamys peedeensis*
(Tuomey and Holmes).



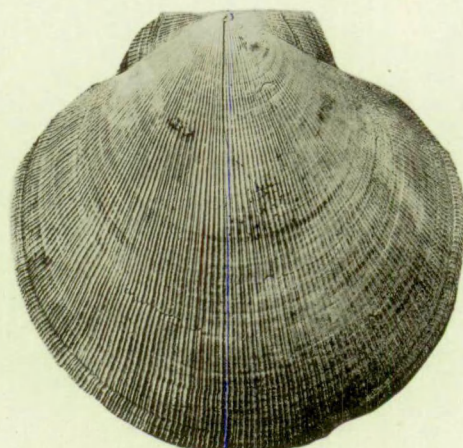
9. — *Chlamys solarioides* (Heilprin).



10. — *Chlamys solarioides* (Heilprin).



11. — *Chlamys clintonius* (Say).



12. — *Chlamys clintonius donaldi*
subsp. nov.

PLATE II

EXPLANATION OF PLATE II

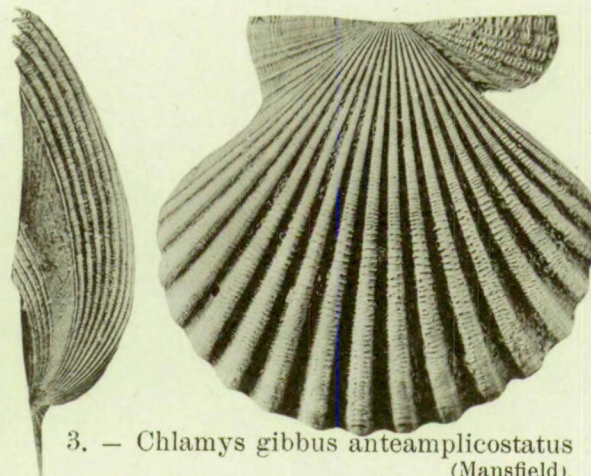
1. *Amusium* (*Amusium*) *precursor* (Dall). ($\times \frac{1}{2}$).
Ten Mile Creek, 1 mile west of Baileys Ferry, Fla. — Hypotype. (Chipola.)
 2. *Amusium* (*Amusium*) *mortoni* (Ravenel). ($\times \frac{1}{2}$).
Ft. Thompson, Fla. — Hypotype. (Caloosahatchie.)
 3. *Chlamys* (*Plagioctenium*) *gibbus anteamplicostatus* (Mansfield). ($\times \frac{1}{2}$).
a) Caloosahatchie River, Fla. — Syntype. (Caloosahatchie.)
b) Caloosahatchie River, Fla. — Syntype. (Caloosahatchie.)
 4. *Chlamys* (*Plagioctenium*) *gladensis* (Mansfield). ($\times \frac{1}{2}$).
18 miles south of Immokalee, Fla. — Holotype. (Pliocene.)
 5. *Chlamys* (*Lyropecten*) *jeffersonius edgecombensis* (Conrad). ($\times \frac{1}{2}$).
Bellefield, Va. — Hypotype. (Yorktown.)
 6. *Chlamys* (*Lyropecten*) *sayanus* (Dall). ($\times \frac{1}{2}$).
Oak Grove, Santa Rosa County, Fla. — Holotype. (Oak Grove.)
 7. *Chlamys* (*Lyropecten*) *ernestsmithi* (Tucker). ($\times \frac{1}{2}$).
Acme, N. C. — Holotype. (Waccamaw.)
 8. *Chlamys* (*Lyropecten*) *nodosus* (Linné). ($\times \frac{1}{2}$).
Holotype.
 9. *Chlamys* (*Lyropecten*) *nodosus* (Linné). ($\times \frac{1}{2}$).
3.2 miles east of Ft. Denaud, Fla. — Hypotype. (Caloosahatchie.)
 10. *Chlamys* (*Lyropecten*) *santamaria* Tucker. ($\times \frac{1}{2}$).
St. Marys River, Md. — Syntype. (St. Marys.)
 11. *Chlamys* (*Lyropecten*) *jeffersonius palmyrensis* (Mansfield). ($\times \frac{1}{2}$).
Palmyra Bluff, right bank Roanoke River, Halifax County, N. C. — Holotype. (Yorktown.)
 12. *Chlamys* (*Lyropecten*) *santamaria middelsexensis* (Mansfield). ($\times \frac{1}{2}$).
Urbanna, Va. — Syntype. (St. Marys.)
-



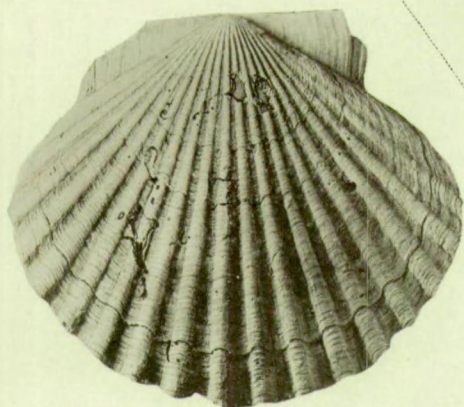
1. — *Amusium precursor* (Dall).



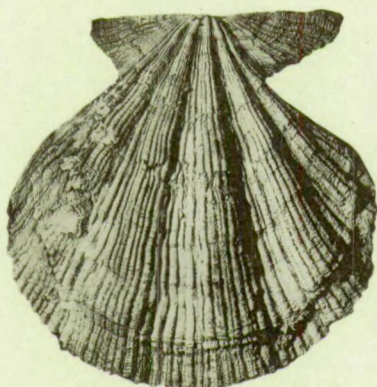
2. — *Amusium mortoni* (Ravenel).



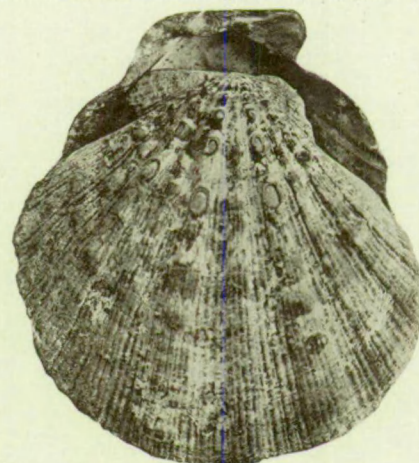
3. — *Chlamys gibbus anteamplicostatus* (Mansfield).



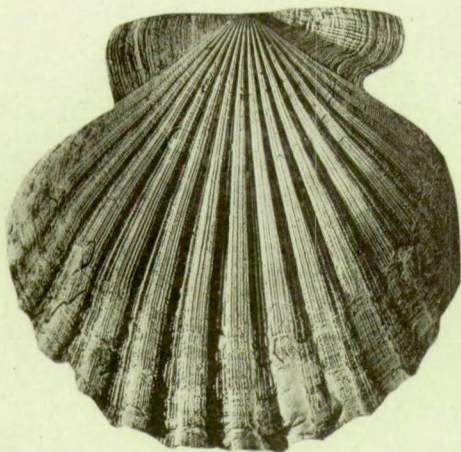
4. — *Chlamys gladensis* (Mansfield).



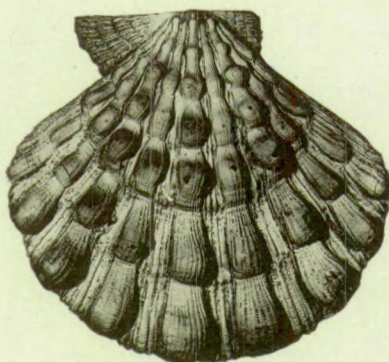
7. — *Chlamys ernestsmithi* (Tucker).



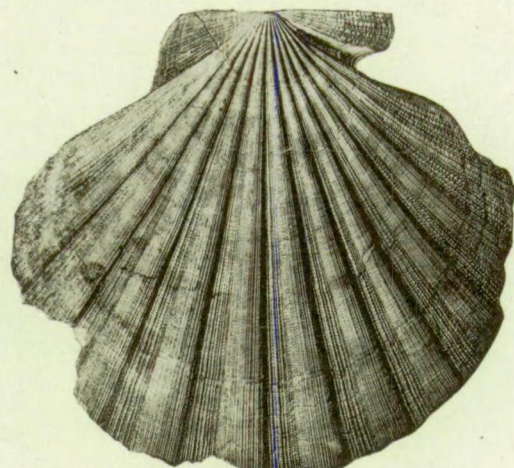
8. — *Chlamys nodosus* (Linné).



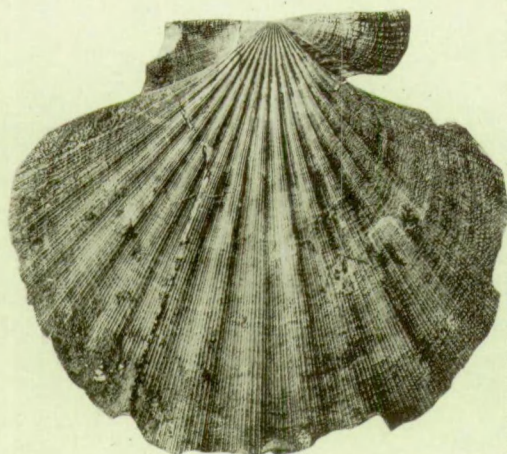
5. — *Chlamys jeffersonius edgecombensis* (Conrad).



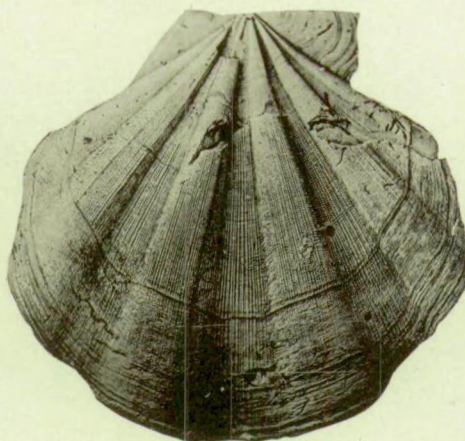
9. — *Chlamys nodosus* (Linné).



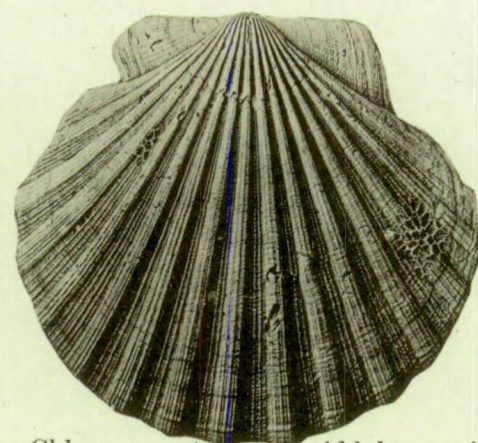
10. — *Chlamys santamaria* Tucker.



6. — *Chlamys sayanus* (Dall).



11. — *Chlamys jeffersonius palmyrensis* (Mansfield).



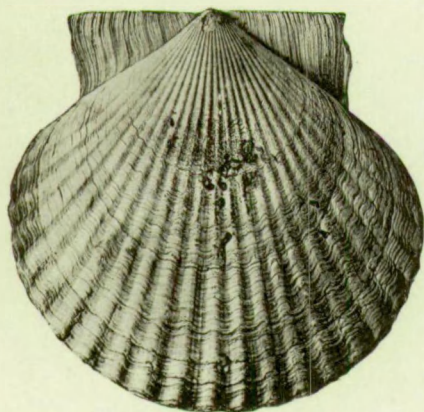
12. — *Chlamys santamaria middelsexensis* (Mansfield).

PLATE III

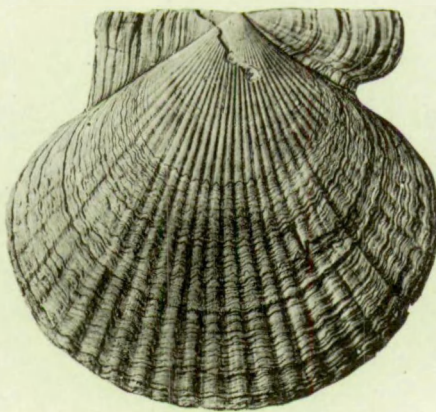
EXPLANATION OF PLATE III

1. *Chlamys (Plagioctenium) urbannaensis* Mansfield. ($\times \frac{1}{2}$).
Urbanna, Va. — Cotype. (St. Marys.)
2. *Chlamys (Plagioctenium) urbannaensis* Mansfield. ($\times \frac{1}{2}$).
Urbanna, Va. — Cotype. (St. Marys.)
3. *Chlamys (Plagioctenium) gibbus anteauplicostatus* (Mansfield). ($\times \frac{1}{2}$).
Caloosahatchie River, Fla. — Syntype. (Caloosahatchie.)
4. *Chlamys (Lyropecten) madisonius richardsi* subsp. nov. ($\times \frac{1}{2}$).
Grays Creek, Surrey County, Va. — Syntype. (St. Marys.)
5. *Chlamys (Lyropecten) madisonius richardsi* subsp. nov. ($\times \frac{1}{2}$).
Grays Creek, Surrey County, Va. — Syntype. (St. Marys.)
6. *Chlamys (Placopecten) clintonius rappahannockensis* (Mansfield). ($\times \frac{1}{2}$).
Old Kings Mill Wharf, North Shore James River, Va. — Paratype. (St. Marys.) ⁽¹⁾
7. *Chlamys (Lyropecten) santamaria middlesexensis* (Mansfield). ($\times \frac{1}{2}$).
Urbanna, Va. — Syntype. (St. Marys.)
8. *Chlamys (Plagioctenium) eboreus watsonensis* (Mansfield). ($\times \frac{1}{2}$).
Watson's Landing, 2 miles north Alum Bluff, Fla. — Paratype. (Yorktown.)
9. *Chlamys (Plagioctenium) eboreus darlingtonensis* (Dall). ($\times \frac{1}{2}$).
Darlington, S. S. — Cotype. (Duplin.)
10. *Chlamys (Plagioctenium) eboreus darlingtonensis* (Dall). ($\times \frac{1}{2}$).
Darlington, S. S. — Cotype. (Duplin.)
11. *Chlamys (Plagioctenium) comparalis* (Tuomey and Holmes). ($\times \frac{1}{2}$).
Ft. Denaud, Fla. — Neoholotype. (Caloosahatchie.)
12. *Chlamys (Plagioctenium) eboreus* (Conrad). ($\times \frac{1}{2}$).
Jennys Bluff, near Suffolk, Va. — Hypotype. (Yorktown.)
13. *Amusium (Amusium) holmesi* (Dall). ($\times \frac{1}{2}$).
Smith's on Goose Creek, S. C. — Holotype, after Tuomey and Holmes. (Pliocene ?)
14. *Chlamys (Lyropecten) pittieri collierensis* (Mansfield). ($\times \frac{1}{2}$).
18 miles south of Immokalee, Collier County, Fla. — Hypotype. (Pliocene.)
15. *Chlamys (Lyropecten) jeffersonius septenarius* (Say). ($\times \frac{1}{2}$).
Petersburg, Va. — Hypotype. (Yorktown.)

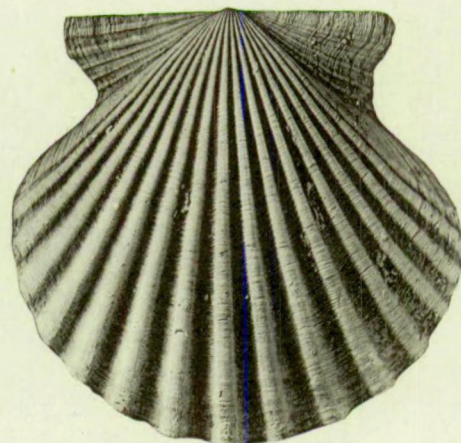
⁽¹⁾ See Explanation of Plate III for correction of text of figs. 6 and 7 on Plate III.



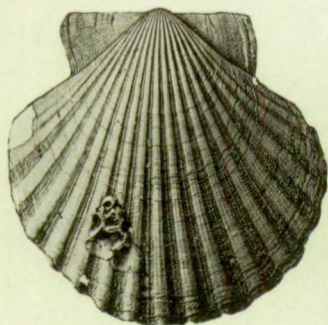
1. — *Chlamys urbannaensis* Mansfield.



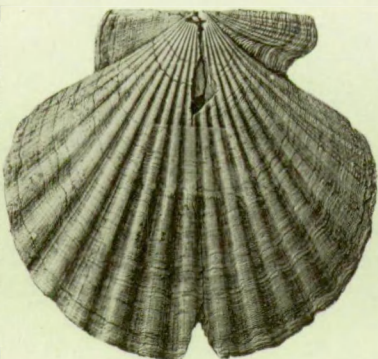
2. — *Chlamys urbannaensis* Mansfield.



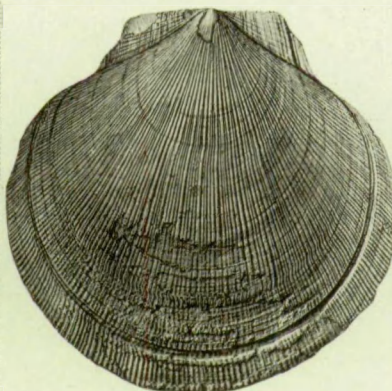
3. — *Chlamys gibbus*
anteaplicostatus (Mansfield).



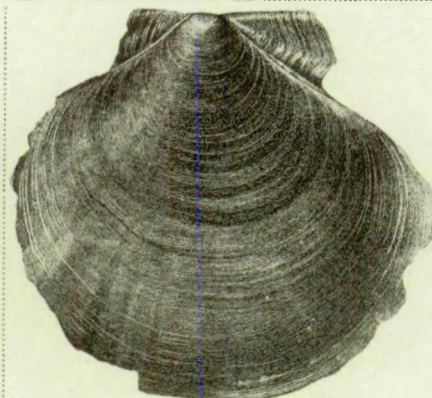
4. — *Chlamys madisonius*
richardsi subsp. nov.



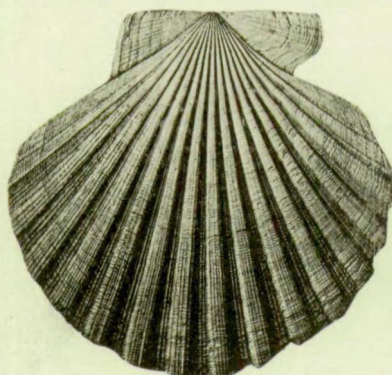
5. — *Chlamys madisonius*
richardsi subsp. nov.



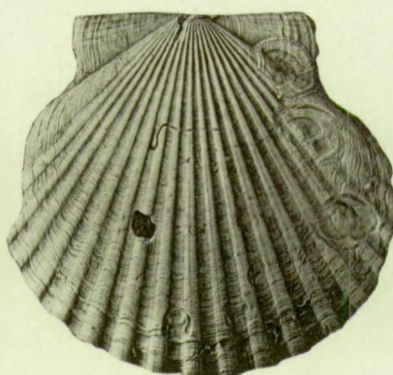
6. — *Chlamys santamaria*
middlesexensis (Mansfield).



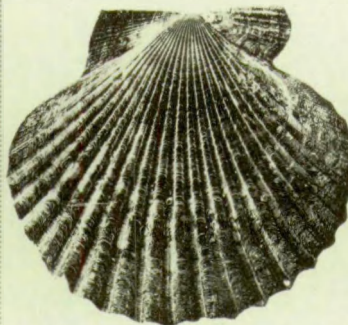
13. — *Amusium* (*Amusium*)
holmesi (Dall).



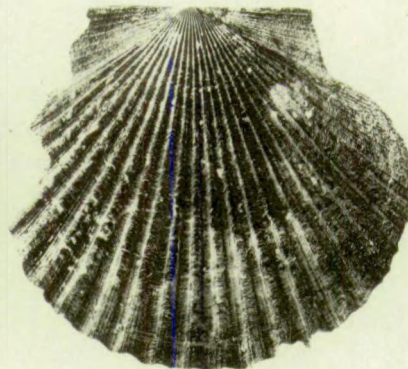
7. — *Chlamys clintonius*
rappahannockensis (Mansfield).



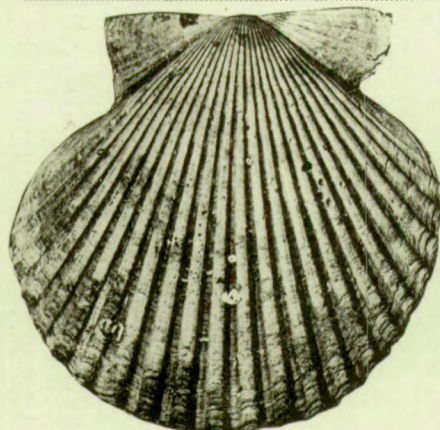
8. — *Chlamys eboreus*
watsonensis (Mansfield).



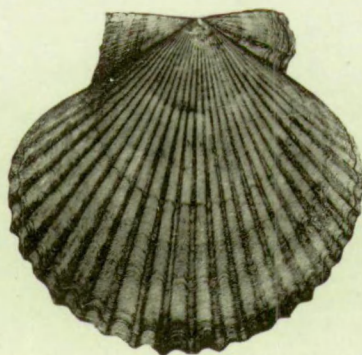
9. — *Chlamys eboreus*
darlingtonensis (Dall).



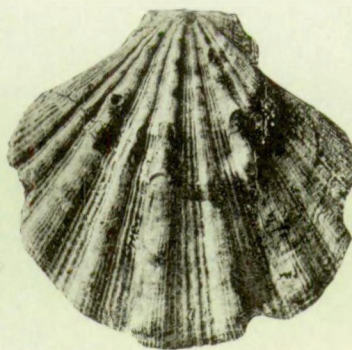
10. — *Chlamys eboreus*
darlingtonensis (Dall).



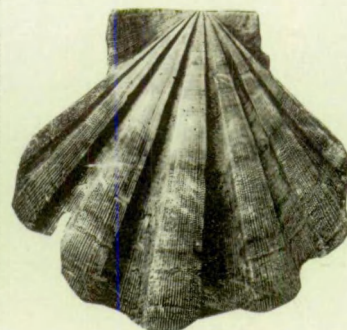
11. — *Chlamys comparalis*
(Tuomey and Holmes).



12. — *Chlamys eboreus*
(Conrad).



14. — *Chlamys pittieri*
collierensis (Mansfield).



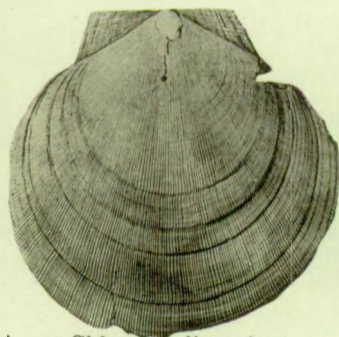
15. — *Chlamys jeffersonius*
septenarius (Say).

PLATE IV

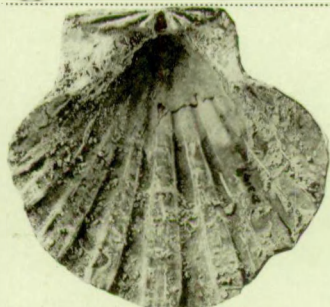
EXPLANATION OF PLATE IV

1. *Chlamys* (*Placopecten*) *clintonius rappahannockensis* (Mansfield). ($\times \frac{1}{2}$).
Old Kings Mill Wharf, North Shore James River, Va. — Syntype. (St. Marys.)
2. *Chlamys* (*Lyropecten*) *pittieri collierensis* (Mansfield). ($\times \frac{1}{2}$).
Immokalee, Collier County, Fla. — Hypotype. (Pliocene.)
3. *Chlamys* (*Lyropecten*) *pittieri collierensis* (Mansfield). ($\times \frac{1}{2}$).
Immokalee, Collier County, Fla. — Hypotype. (Pliocene.)
4. *Chlamys* (*Lyropecten*) *tamiamiensis* (Mansfield). ($\times \frac{1}{2}$).
Tamiami Trail, 6 miles west of cross roads leading to Everglades, Collier County, Fla. --
Holotype. (Pliocene.)
5. *Chlamys* (*Plagioctenium*) *eboreus watsonensis* (Mansfield). ($\times \frac{1}{2}$).
Old Road to Watson's Landing, 2 miles of Alun Bluff, Fla. — Holotype. (Yorktown.)
6. *Chlamys* (*Lyropecten*) *jeffersonius edgecombensis* (Conrad). ($\times \frac{1}{2}$).
Tarboro, Edgecombe County, N. C. — Hypotype. (St. Marys.)
7. *Chlamys* (*Lyropecten*) *caloosaensis* (Dall). ($\times \frac{1}{2}$).
Shell Creek, Fla. — Holotype. (Caloosahatchie.)
8. *Chlamys* (*Lyropecten*) *madisonius* (Say). ($\times \frac{1}{2}$).
Jericho, N. J. — Holotype ?
9. *Chlamys* (*Lyropecten*) *dysoni* sp. nov. ($\times \frac{1}{2}$).
Ocala, Fla. — Holotype. (Jackson.)
10. *Chlamys* (*Lyropecten*) *vaccamavensis* (Olsson). ($\times \frac{1}{2}$).
Lake Waccamaw, N. C. Holotype. (Waccamaw.)
11. *Chlamys* (*Lyropecten*) *pulchricostata* (Aldrich and Mayer). ($\times \frac{1}{2}$).
Wautubbee, Miss. — Holotype. (Claiborne.)
12. *Chlamys* (*Lyropecten*) *madisonius acanikos* (Gardner). ($\times \frac{1}{2}$).
Chesapeake Beach, Md. — Hypotype. (Calvert.)
13. *Chlamys* (*Lyropecten*) *marylandicus* (Wagner). ($\times \frac{1}{2}$).
Meherrin River, N. C. — Holotype ? (Miocene.)
14. *Chlamys* (*Plagioctenium*) *comparalis* (Tuomey and Holmes). ($\times \frac{1}{2}$).
Buckingham, Fla. — Hypotype. (Caloosahatchie.)

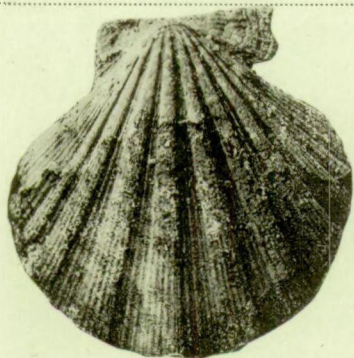
15. *Chlamys (Plagiostenium) eboreus senescens* (Dall). ($\times \frac{1}{2}$).
Waccamaw River, S. C. — Holotype. (Waccamaw.)
16. *Chlamys (Plagiostenium) comparalis jacksonensis* Mansfield. ($\times \frac{1}{2}$).
Jackson Bluff, Fla. — Cotype. (Choctawhatchee.)
17. *Chlamys (Plagiostenium) comparalis jacksonensis* Mansfield. ($\times \frac{1}{2}$).
Jackson Bluff, Fla. — Cotype. (Choctawhatchee.)
18. *Chlamys (Plagiostenium) gibbus amplicostatus* (Dall). ($\times \frac{1}{2}$).
Caloosahatchie River, Monroe County, Fla. — Cotype. (Caloosahatchie.)
See also pl. V, fig. 24 (Cotype).
19. *Chlamys (Plagiostenium) gibbus amplicostatus* (Dall). ($\times \frac{1}{2}$).
Acline, Fla. — Hypotype. (Miocene ?)
20. *Chlamys (Plagiostenium) choctawhatcheensis* Mansfield. ($\times \frac{1}{2}$).
Red Bay, Walton County, Fla. — Cotype. (Choctawhatchee.)
See also pl. V, fig. 25 (Cotype).
21. *Chlamys (Plagiostenium) gibbus* (Linné). ($\times \frac{1}{2}$).
Canal Bank between Clewiston and La Belle, Fla. — Hypotype. (Caloosahatchie.)
22. *Chlamys (Placopecten) virginianus* (Conrad). ($\times \frac{1}{2}$).
Ruffins Creek, Va. — Hypotype. (St. Marys.)
23. *Chlamys (Plagiostenium) evergladensis* (Mansfield). ($\times \frac{1}{2}$).
Tamiami Trail, 6 miles west of crossroads leading to Everglades, Collier County, Fla. —
Holotype. (Pliocene.)
24. *Chlamys (Plagiostenium) choctawhatcheensis redbayensis* Mansfield. ($\times \frac{1}{2}$).
Red Bay, Walton County, Fla. — Holotype. (Choctawhatchee.)
25. *Chlamys (Plagiostenium) evergladensis charlottensis* (Mansfield). ($\times \frac{1}{2}$).
Shell Creek, Fla. — Syntype. (Caloosahatchie.)
26. *Amusium (Pseudamusium) calvatus* (Morton). ($\times \frac{1}{2}$).
Eutaw Springs, S. C. — Hypotype. (Wilcox.)
27. *Amusium (Pseudamusium) calvatus* (Morton). ($\times \frac{1}{2}$).
Eutaw Springs, S. C. — Hypotype. (Wilcox.)
28. *Amusium (Pseudamusium) calvatus* (Morton). ($\times \frac{1}{2}$).
Ocala, Fla. — Hypotype. (Jackson.)
-



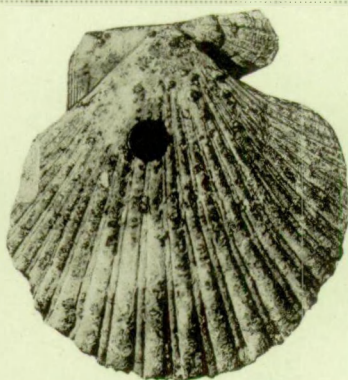
1. — *Chlamys clintonius rappahannockensis* (Mansf.)



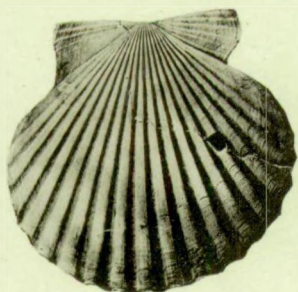
2. — *Chlamys pittieri collierensis* (Mansfield).



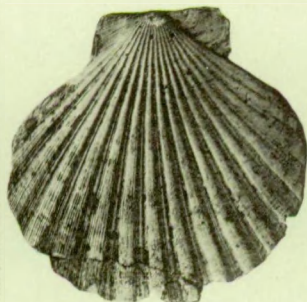
3. — *Chlamys pittieri collierensis* (Mansfield).



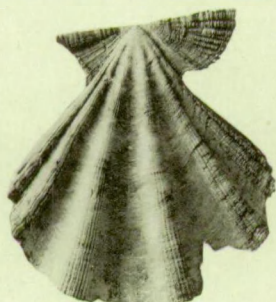
4. — *Chlamys tamiamiensis* (Mansfield).



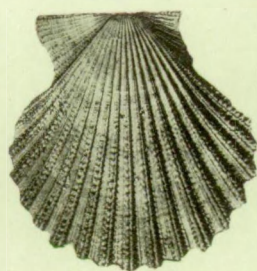
5. — *Chlamys eboreus watsonensis* (Mansfield).



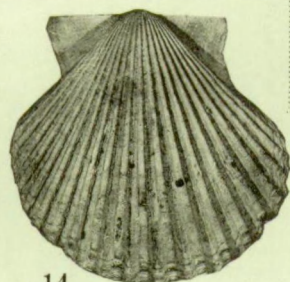
6. — *Chlamys jeffersonius edgecombensis* (Conrad).



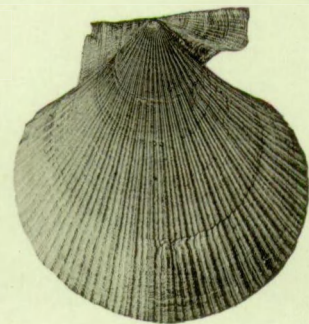
7. — *Chlamys caloosaensis* (Dall).



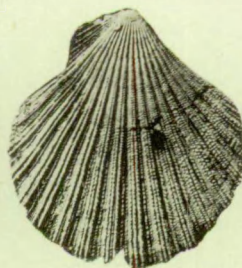
12. — *Chlamys madisonius acanikos* (Gardner).



14. — *Chlamys comparalis* (Tuomey & Holmes).



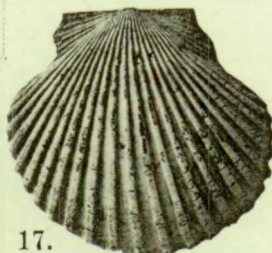
13. — *Chlamys marylandicus* (Wagner).



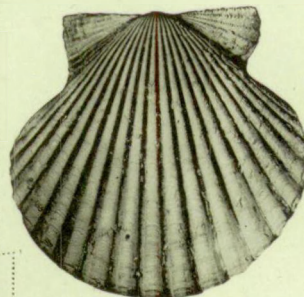
8. — *Chlamys madisonius* (Say).



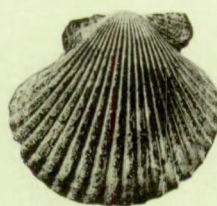
11. — *Chlamys pulchricostata* (Ald. and Meyer).



17. — *Chlamys comparalis jacksonensis* Mansf.



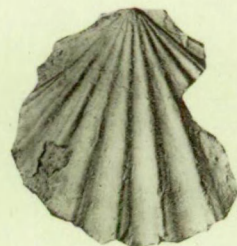
21. — *Chlamys gibbus* (Linné).



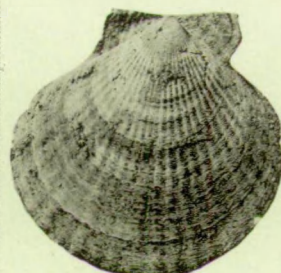
23. — *Chlamys evergladensis* (Mansf.).



26. — *Amusium calvatus* (Morton).



9. — *Chlamys dysoni* sp. nov.



15. — *Chlamys eboreus senescens* (Dall).



18. — *Chlamys gibbus ampicostatus* (Dall).



20. — *Chlamys choctawhatcheensis* Mansf.



24. — *Chlamys choctawhatcheensis* Mansf.



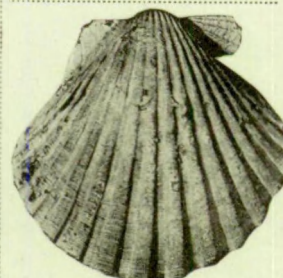
27. — *Amusium calvatus* (Morton).



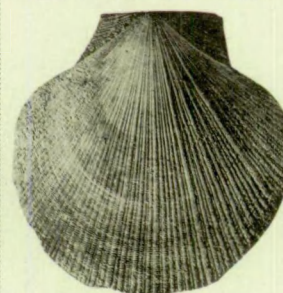
10. — *Chlamys vaccamavensis* (Olsson).



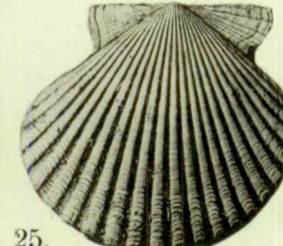
16. — *Chlamys comparalis jacksonensis* Mansf.



19. — *Chlamys gibbus ampicostatus* (Dall).



22. — *Chlamys virginianus* (Conrad).



25. — *Chlamys evergladensis charlottensis* (Mansf.).



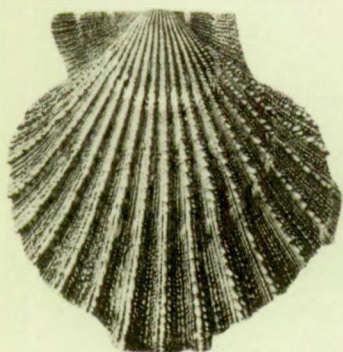
28. — *Amusium calvatus* (Morton).

PLATE V

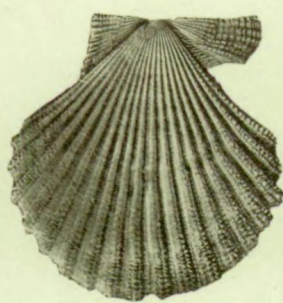
EXPLANATION OF PLATE V

1. *Chlamys (Lyropecten) madisonius bassleri* subsp. nov. ($\times \frac{2}{3}$).
Plum Point, Md. — Holotype. (Calvert.)
2. *Chlamys (Lyropecten) madisonius acanikos* (Gardner). ($\times \frac{2}{3}$).
Chesapeake Beach, Md. — Hypotype. (Calvert.)
3. *Chlamys (Lyropecten) incertae* sp. nov. ($\times \frac{2}{3}$).
Ocala, Fla. — Holotype. (Jackson.)
4. *Chlamys (Lyropecten) madisonius acanikos* (Gardner). ($\times \frac{2}{3}$).
Boynton Landing, Fla. — Holotype. (Chipola.)
5. *Chlamys (Lyropecten) interlineatus* (Gabb). ($\times \frac{2}{3}$).
Buckingham, Fla. — Hypotype. (Caloosahatchie.)
6. *Chlamys (Aequipecten) burnetti* Tucker. ($\times \frac{2}{3}$).
Six Mile Creek, Fla. — Holotype. (Tampa.)
7. *Chlamys (Plagiectenium) nicholsi* Gardner. ($\times \frac{2}{3}$).
Mossyhead, Fla. — Cotype. (Shoal River.)
8. *Chlamys (Plagiectenium) nicholsi* Gardner. ($\times \frac{2}{3}$).
Mossyhead, Fla. — Cotype. (Shoal River.)
9. *Chlamys (Lyropecten) caloosaensis* (Dall). ($\times \frac{2}{3}$).
Young shell. Clewiston, Fla. — (Caloosahatchie.)
10. *Chlamys (Plagiectenium) eboreus yorkensis* (Conrad). ($\times \frac{2}{3}$).
York River, Va. — Hypotype. (Yorktown.)
11. *Amusium (Pseudamussium) cerinus* (Conrad). ($\times \frac{2}{3}$).
Charles County, Md. — Holotype. (Calvert.)
See also pl. VI, fig. 12 (Hypotype).
12. *Amusium (Pseudamussium) scintillatus* (Conrad). ($\times \frac{2}{3}$).
Jackson Miss. — Hypotype. (Jackson.)
13. *Amusium (Pseudamussium) corneoides* (Harris). ($\times \frac{2}{3}$).
St. Maurice, La. — Cotype. (St. Maurice.)
See also pl. VI, fig. 15 (Cotype).

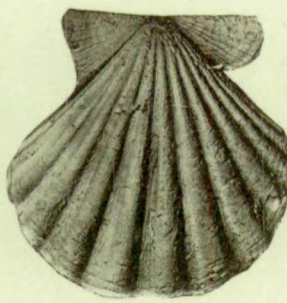
14. *Chlamys (Placopecten) virginianus* (Conrad). ($\times \frac{2}{3}$).
Shell Bank near Petersburg, Va. The worn valve with Lea named *tenuis*.
U. S. National Museum, Cat. no 145131.
15. *Amusium (Amusium) ocalanus* (Dall). ($\times \frac{2}{3}$).
Ocala, Fla. — Holotype. (Jackson.)
16. *Chlamys (Placopecten) marylandicus* (Wagner). ($\times \frac{2}{3}$).
Jones Wharf, Maryland. After Glenn.
17. *Amusium (Pseudamusium) hamiltonense* Tucker. ($\times \frac{2}{3}$).
Hamilton Bluff, Ala. — Holotype. (Claiborne.)
18. *Chlamys (Lyropecten) interlineatus* (Gabb). ($\times \frac{2}{3}$).
Santo Domingo. — Holotype. (Oligocene, fide Gabb.)
19. *Chlamys (Lyropecten) jeffersonius* (Say). ($\times \frac{2}{3}$).
Young shell. Kingsmill, Va. — (Yorktown.)
20. *Chlamys (Lyropecten) jeffersonius* (Say). ($\times \frac{2}{3}$).
Young shell. Kingsmill, Va. — (Yorktown.)
21. *Chlamys (Lyropecten) pittieri collierensis* (Mansfield). ($\times \frac{2}{3}$).
Tamiami Trail, about 11 miles east by north of Marco, Collier County, Fla. — Hypotype.
(Pliocene.)
22. *Chlamys (Lyropecten) duncanensis* (Mansfield). ($\times \frac{2}{3}$).
Duncan Church, Fla. — Holotype. (Glendon.)
23. *Chlamys (Lyropecten) skiptonensis* (Mansfield). ($\times \frac{2}{3}$).
Skipton, Md. — Holotype. (Choptank.)
24. *Chlamys (Plagiectenium) gibbus amplicostatus* (Dall). ($\times \frac{2}{3}$).
Caloosahatchie River, Monroe County, Fla. — Cotype. (Caloosahatchie.)
See also pl. IV, fig. 18 (Cotype).
25. *Chlamys (Plagiectenium) choctawhatcheensis* Mansfield. ($\times \frac{2}{3}$).
Red Bay, Walton County, Fla. — Cotype. (Choctawhatchee.)
See also pl. IV, fig. 20 (Cotype).
-



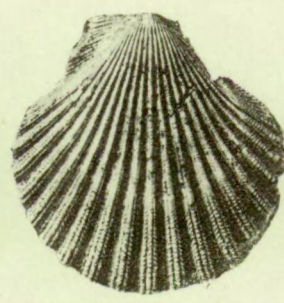
1. — *Chlamys madisonius bassleri* subsp. nov.



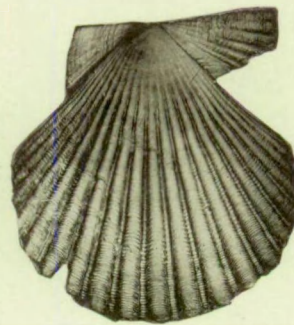
2. — *Chlamys madisonius acanikos* (Gardner).



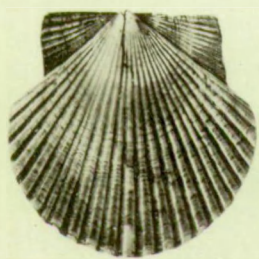
3. — *Chlamys incertae* sp. nov.



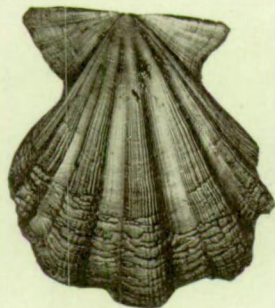
4. — *Chlamys madisonius acanikos* (Gardner).



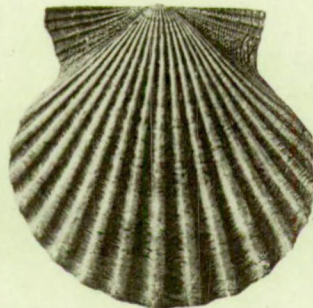
5. — *Chlamys interlineatus* (Gabb.).



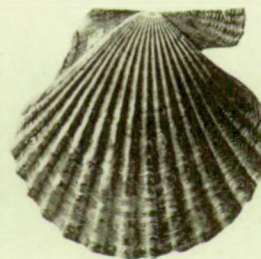
10. — *Chlamys eboreus yorkensis* (Conrad).



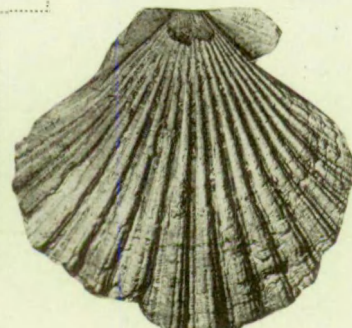
9. — *Chlamys caloosaensis* (Dall).



8. — *Chlamys nicholsi* Gardner.



7. — *Chlamys nicholsi* Gardner.



6. — *Chlamys burnetti* Tucker.



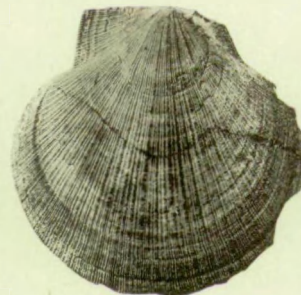
11. — *Amusium cerinus* (Conrad).



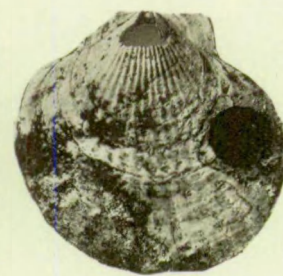
12. — *Amusium scintillatus* (Conrad).



13. — *Amusium corneoides* (Harris).



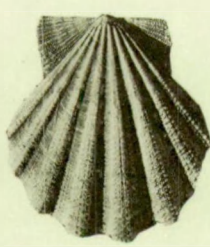
14. — *Chlamys virginianus* (Conrad).



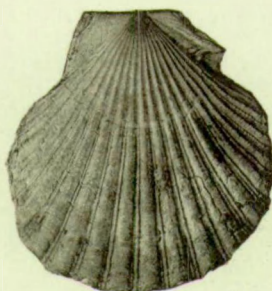
15. — *Amusium ocalanus* (Dall).



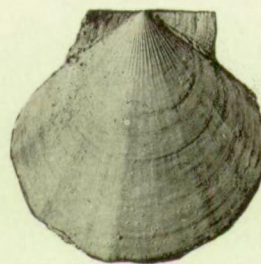
20. — *Chlamys jeffersonius* (Say).



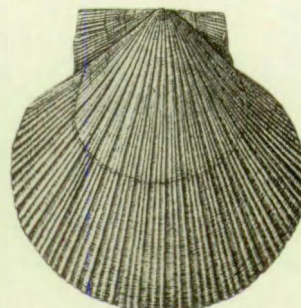
19. — *Chlamys jeffersonius* (Say).



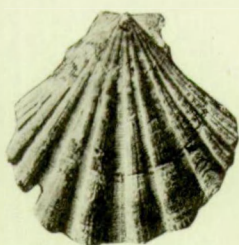
18. — *Chlamys interlineatus* (Gabb.).



17. — *Amusium hamiltonense* Tucker.



16. — *Chlamys marylandicus* (Wagner).



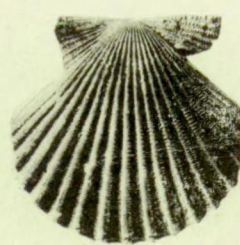
21. — *Chlamys pittieri collierensis* (Mansf.).



22. — *Chlamys duncanensis* (Mansf.).



23. — *Chlamys skiptonensis* (Mansf.).



24. — *Chlamys gibbus amplicostatus* (Dall).



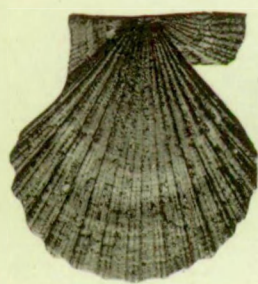
25. — *Chlamys choctawhatcheensis* Mansf.

PLATE VI

EXPLANATION OF PLATE VI

1. *Chlamys (Lyropecten) sayanus* (Dall). (× 1).
Young shells. Oak Grove, Fla. — (Oak Grove.)
2. *Chlamys (Lyropecten) pulchricostata* (Aldrich and Mayer). (× 1).
Wautubbee, Miss. — Hypotypes. (Claiborne.)
3. *Chlamys (Lyropecten) condylomatus* (Dall). (× 1).
a) Baileys Ferry, Fla. — Hypotype. (Chipola.)
b) Chipola River, Fla. — Holotype, after Dall. (Chipola.)
4. *Chlamys (Lyropecten) alpha* (Dall). (× 1).
Flint River, Decatur County, Ga. — Squeeze of Holotype. (Vicksburg.)
5. *Chlamys (Plagioctenium) charltonius* (Mansfield). (× 1).
Atlantic Coast Line R. R. bridge St. Marys River, Nassau County, Fla. — Syntypes.
(Charlton.)
6. *Chlamys (Aequipecten) perplanus centrotus* (Dall). (× 1).
St. Augustine, Fla. — Holotype. (Eocene.)
7. *Amusium (Pseudamussium) calvatus* (Morton). (× 1).
Eutaw Springs, S. C. — Holotype. (Eocene.)
8. *Amusium (Pseudamussium) cerinus* (Conrad). (× 1).
Charles County, Md. — Hypotype. (Calvert.)
See also pl. V., fig. 11 (Holotype).
9. *Chlamys (Lyropecten) alpha* (Dall). (× 1).
Bainbridge, Ga. — Holotype. (Vicksburg.)
10. *Chlamys (Aequipecten) suwanneensis* (Dall). (× 1).
Suwannee River, Fla. — Holotype. (Oligocene.)
11. *Amusium (Pseudamussium) corneoides* (Harris). (× 1).
St. Maurice, La. — Cotype. (St. Maurice.)
See also pl. V, fig. 13 (Cotype).
12. *Chlamys (Aequipecten) perplanus* (Morton). (× 1).
Jackson, Miss. — Hypotype. (Jackson.)

13. *Amusium* (*Pseudamussium*) *guppyi* (Dall). (× 1).
Bowden marl of Jamaica. — Cotypes (Bowden.)
Figs c, d, after Dall.
14. *Amusium* (*Pseudamussium*) *defuniak* (Gardner). (× 1).
Defuniak Springs, Fla. — Cotypes. (Shoal River.)
Fig. b, shows hinge area.
15. *Amusium* (*Pseudamussium*) *diktuotum* (Gardner). (× 1).
Horse Creek, ½ mile south of Oak Grove, Fla. — Cotypes. (Oak Grove.)
16. *Amusium* (*Pseudamussium*) *subminutus* (Aldrich). (× 1).
Red Bluff, Miss. — Cotypes. (Jackson.)
Figs c, d, after Aldrich.
17. *Amusium* (*Propeamussium*) *squamula* (Lamarck). (× 1).
Negreet Bayou, La. — Hypotypes. (St. Maurice.)
After Harris.
18. *Amusium* (*Propeamussium*) *alabamensis* (Aldrich). (× 1).
Matthews Landing, La. — Hypotypes. (Midway.)
-



1. — *Chlamys sayanus* (Dall).



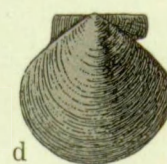
2. — *Chlamys pulchricostata* (Ald. & Meyer).



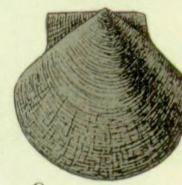
a



b

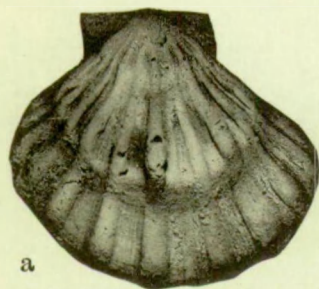


d

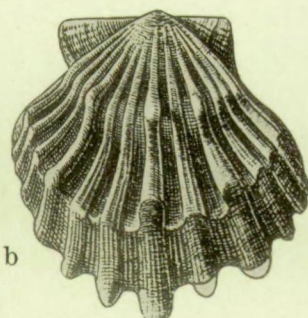


c

13. — *Amusium guppyi* (Dall).

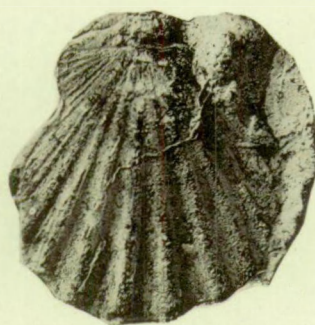


a

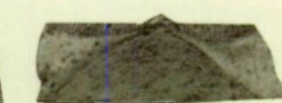


b

3. — *Chlamys condylomatus* (Dall).



4. — *Chlamys alpha* (Dall).

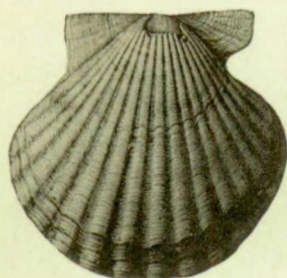


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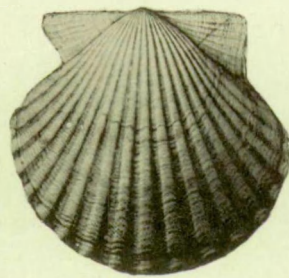


c

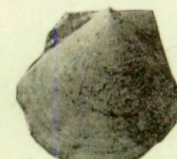
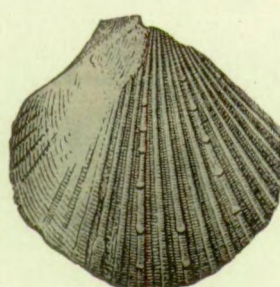
14. — *Amusium defuniak* (Gardner).



5. — *Chlamys charltonius* (Mansfield).



6. — *Chlamys perplanus centrotus* (Dall).



15. — *Amusium diktuotum* (Gardner).



a



b



c



d

16. — *Amusium subminutus* (Aldrich).



7. — *Amusium calvatus* (Mort.).



8. — *Amusium cerinus* (Conrad).



9. — *Chlamys alpha* (Dall).



17. — *Amusium squamula* (Lmk).



10. — *Chlamys suwaneensis* (Dall).



11. — *Amusium corneoides* (Harris).



12. — *Chlamys perplanus* (Mort.).



18. — *Amusium alabamensis* (Aldrich).

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