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CONTRIBUTIONS

TO THE

TERTIARY FAUNA OF FLORIDA

WITH ESPECIAL REFERENCE TO THE

SILEX BEDS OF TAMPA AND THE PLIOCENE BEDS OF THE CALOOSAHATCHIE RIVER

INCLUDING IN MANY CASES

A COMPLETE REVISION OF THE GENERIC GROUPS TREATED OF AND THEIR AMERICAN TERTIARY SPECIES

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PART V.

TELEODESMACEA; SOLEN TO DIPLODONTA

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PREFACE

THE present continuation of the work on our Southeastern Tertiary fauna carries the text so far that it seems certain that another part will conclude the work. It includes a large part of the Teleodesmacea, but it was found that the family Veneridæ was too extensive to be finished without unduly delaying the publication of the manuscript already completed, and the discussion of that group is therefore deferred until the next instalment is printed.

The present part reviews the nomenclature of several groups in which great confusion had reigned, and their revision, it is hoped, will be useful to students both of fossil and recent shells. A very large number of hitherto unrecognized species are here first described and figured.

I have been, as heretofore, under obligations to the authorities of the Smithsonian Institution, the National Museum, and the Director of the United States Geological Survey for essential facilities for study and research without which this work could not have been carried on; to Mr. Joseph Willcox and other officers of the Wagner Free Institute of Science for the most liberal encouragement and assistance in the gathering and illustration of material; and to Dr. H. A. Pilsbry and the authorities of the Academy of Natural Sciences of Philadelphia for courtesies which they have freely rendered. To numerous correspondents I am also under serious obligations for information furnished and specimens submitted for comparison and study, among whom I cannot refrain from mentioning Mr. E. A. Smith, of the British Museum, and M. Maurice Cossmann, of Paris, France, whose courtesy has been unfailing and unlimited.

WILLIAM H. DALL.

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ORDER TELEODESMACEA (Continued)

TERTIARY FAUNA OF FLORIDA.

Superfamily SOLENACEA.

Family SOLENIDÆ.

THIS group is quite ancient if we assume that the Paleozoic *Paleosolen* is a member of it, which seems likely from the perfect correspondence of the exterior form, though the hinge of *Paleosolen* is unknown. Want of sufficient material obliges me to refrain from attempting any revision of the groups older than the Tertiary, among which *Solenaria* Stoliczka (1870), from the Turonian of Europe, and *Legumen* Conrad (1867), *Legumenaia* Conrad (1858), and *Solyma* Conrad (1870), from the Cretaceous, may be mentioned.

The *Solenidæ* form a compact group after the elimination of the soleniform *Psammobiidæ*, such as *Novaculina* and *Tagelus*. In the flattened species with thin shells the valve is usually strengthened by a dorsoventral rib or clavicle; in the strong cylindrical forms this is not needed and is not developed. The foot is strong, extensile, and larger distally, where usually it can be expanded laterally into a sort of disk by which the animal can pull itself rapidly into its burrow as if by a mushroom anchor. Perhaps the security against enemies which this arrangement gives is responsible for the great persistence of this type in time. The siphons are short, more or less papillose or filamented externally, and are more or less united, in those with long siphons only the tips are separated. The beaks vary from subcentral to anterior; the deep burrowers have them most anterior for obvious dynamical reasons.

The following arrangement is adopted:

Genus *Solen* (L.) Scopoli, 1777. Type *S. marginatus* Pulteney.

Hinge with one cardinal in each valve; beaks nearly anterior; external surface polished; valves usually straight.

Section *Solena* Mörch, 1853. Type *S. obliquus* Spengler.

Beaks subanterior; no anterior furrows; periostracum rude, unpolished.

Section *Plectosolen* Conrad, 1867. *P. protextus* Conrad.

Like *Solena,* with a furrow extending ventrally from the beaks.

Genus *Leptosolen* Conrad (Am. Journ. Conch., iii., p. 15, 1867). Type *Siliquaria biplicata* Conr., Journ. Acad. Nat. Sci., 2d Ser., iii., p. 324, pl. 34, fig. 17 (bad), 1858. Middle and Upper Cretaceous.

Shell like a small, thin *Solena,* but with a strong clavicular rib directed vertically from the beaks towards the ventral margin; the proximal portion of this rib in the type species is united with the hinge margin behind by a wing, between which and the valve is a deep recess. This genus has shell characters nearly intermediate between *Solen* and *Siliqua.* The nymphs are long and the pallial sinus very shallow.

Genus *Ensis* Schumacher, 1817. Type *S. magnus* Schumacher.

Like *Solen,* but with one right and two left vertical cardinals, and in each valve a posterior horizontal tooth; the valves usually more or less curved.

Genus *Siliqua* Megerle, 1811. Type *S. radiatus* Linné.

Shell ovate, flattened, straight, with a rib or clavicle ventrally directed; hinge like *Ensis,* but more feeble.

Genus *Cultellus* Schumacher, 1817. Type *S. lacteus* Spengler.

Shell more elongate and often arcuate, the beaks more anterior, the clavicle absent.

Genus *Solecurtus* (Blainville), 1824. Type *Solen legumen* Linné.

Shell more soleniform, ends rounded, beaks subanterior; a short clavicle below the beaks and another, less evident, passing obliquely forward; pallial sinus well marked; surface polished.

Subgenus *Pharella* Gray, 1854. Type *Solen javanicus* Lamarck.

Beaks central; teeth small, slender; surface rude; clavicle absent.

? Genus *Tanysiphon* Benson, 1858. Type *T. rivalis* Benson.

Shell resembling *Pharella,* but short, the anterior end shorter, ligament external, with a shorter broad internal resilium set on a short projecting nymph recalling that of *Sphenia;* pallial sinus deep, siphons long, with a tunic, but retractile; valves very slightly unequal.*

* This fresh-water shell was very naturally referred to the vicinity of *Mya,* but the teeth, when present, agree with those of *Pharella,* and I think it merely a somewhat peculiarly specialized solenoid.

Genus *Psammosolen* Risso, 1826. Type *S. strigilatus* Linné.

Shell subcylindric, short, not fully covering the retracted animal; beaks subcentral, ends subtruncate; teeth in each valve two, but no clavicle is present; typical section with incised oblique or divergent sculpture.

Section *Azor* (Leach), 1844. Type *S. antiquatus* Pulteney.

Sculpture concentric only.

Genus **SOLEN** Linné.

Solen Linné, Syst. Nat., ed. x., p. 672, 1758, *ex parte*.

Solen Scopoli, Intr. ad Hist. Nat., p. 397, 1777; Lamarck, Prodr., p. 83, 1799. Type *S. vagina* Lam., not Linné, = *S. marginatus* Pulteney.

> *Solenarius* Duméril, Zool. Anal., p. 168, 1811; not of Mörch, 1853.

Vagina Megerle, Mag. Ges. Nat. Fr., 1811, p. 44. Type *S. recta* Megerle = *S. vagina* L.

Solen Schumacher, Essai, p. 124, pl. vi., fig. 3, 1817; not of Megerle, *op. cit.*, p. 45, 1811.

Fistula Mörch, Cat. Yoldi, ii., p. 6, 1853 (after Martini, Conch. Cab., 1774, non-binomial).

Solenarius Mörch, Cat. Yoldi, ii., p. 6, 1853.

Hypogæa + *Hypogæoderma* (sp.) Poli, Test. Utr. Sicil., 1791-5.

Listera Leach (Gray), Synops. Moll. Gt. Brit., p. 261, 1852; sole ex. *Solen marginatus* Pulteney.

Solen Fischer, Man. de Conchyl., p. 1110, 1887; Newton, Syst. List Brit. Olig. and Eoc. Moll., p. 78, 1891.

Solena Mörch, Cat. Yoldi, ii., p. 7, 1853. Type *Solen obliquus* Spengler, not Sowerby, 1844; H. and A. Adams, Gen. Rec. Moll., ii., p. 342, 1856; Conrad, Am. Journ. Conch., iii., Supplem., p. 27, 1867; Fischer, Man. Conchyl., p. 1110, 1887 (after Browne, 1756, non-binomial; no type).

Hypogella Gray, Ann. Mag. Nat. Hist., xiv., p. 23, 1854. Type *Solen ambiguus* Lam. (= *S. obliquus* Spengler); Fischer, Man. de Conchyl., p. 1111, 1887.

Plectosolen Conrad, Am. Journ. Conch., ii., p. 103, 1866. Type (selected by Fischer, Man. de Conchyl., p. 1111, 1887) *Solen angustus* Desh.

Ensatella (*rudis*) Carpenter, Suppl. Rep. Brit. As., 1863, p. 39; not of Swainson.

The genus *Solen* as originally used by Linné was heterogeneous, but the diagnosis of Scopoli fixes the name on the species of the type of *S. marginatus*. Browne, of Jamaica, was not a binomial writer, and applied the classical name *Solena* indiscriminately to all soleniform bivalves. Mörch reintroduced the word to apply to the rude brackish-water forms like *S. obliquus* Spengler, while *Plectosolen* Conrad may be retained sectionally for the earlier fossils of the Tertiary, which differ from *Solena* by having a well-marked furrow externally from the beaks to the anterior ventral angle. There are several of these in the American Tertiaries.

Solen amphistemma n. sp.

PLATE 39, FIGURE 8.

Oligocene of the Chipola beds at Alum Bluff and on the Chipola River, Florida, and of the Oak Grove sands, Santa Rosa County, Florida.

Shell large, short, straight, rather convex; anterior end obliquely truncate, with the inner margin thickened, but no external furrow; posterior end squarely truncate; basal parallel with the dorsal margin; exterior smooth, except for incremental lines; beaks inconspicuous, slightly behind the anterior dorsal angle of the valve, the teeth normal, the nymphs narrow, elongate, not prominent; anterior adductor scar irregularly reniform, posterior rounded triangular; the pallial sinus shallow. Lon. of shell 112, alt. 27.5, diam. 18 mm.

This very fine species is almost invariably in fragments. It does not closely approach any other of our Solens.

Solen sicarius Gould.

Solen sicarius Gould, Shells of the Wilkes Exploring Exped., p. 387, fig. 501, 1852.

Miocene (Cooper) to recent on the Californian coast; not uncommon in the Pleistocene sands of San Pedro Hill. The living shell ranges from Vancouver Island to San Pedro, California, and is said to occur in Japan.

Solen rosaceus Carpenter.

Solen (*sicarius* var. ?) *rosaceus* Cpr., Suppl. Rep. Brit. As., 1863, p. 638; Ann. Mag Nat. Hist., 3d Ser., xv., p. 177, 1865.

Miocene (Cooper) and Pliocene of California; Pleistocene of San Diego; recent from Santa Barbara south to the Gulf of California.

Solen viridis Say.

Solen viridis Say, Journ. Acad. Nat. Sci. Phila., ii., p. 316, 1821; Conrad, Am. Mar. Conch., ii., p. 28, pl. 5, fig. 2, 1831.

Pleistocene of South Carolina at Simmons Bluff; recent from Rhode Island (Totten) to Georgia (Postell).

This appears to be a rather rare species, of which the largest and finest specimens I have seen are those obtained by General Totten in Narragansett Bay, and which passed with his collection into the possession of the National Museum.

Solen Conradi Dall.

Solen curtus Conrad, Am. Journ. Sci., 2d Ser., v., p. 432, fig. 14, 1848; not of Desmoulins, 1832.

Plectosolen curtus Conrad, S. I. Eocene Checkl., p. 8, 1866.

Ensis curtus Meek, S. I. Miocene Checkl., p. 12, 1864.

Oligocene? or Miocene of Astoria, Oregon; Conrad.

The type of this species appears to be lost, but it is certainly not a *Plectosolen*, and the figure looks more like a true *Solen* than an *Ensis*. It is of the general form of *S. sicarius*, but smaller. I have collected what I suppose to be this species from the Empire beds at Coos Bay.

Solen (Plectosolen) protextus Conrad.

Donax? protextus Conrad, Geol. Wilkes' Expl. Exp., p. 723, pl. 17, fig. 9, 1849.

Solena protexta Conrad, Am. Journ. Conch., i., p. 152, 1865.

Plectosolen protextus Conrad, Am. Journ. Conch., ii., p. 103, 1866; S. I. Eocene Checkl., p. 9, 1866.

Hypogella protexta Gabb, Pal. Cal., ii., p. 89, 1869.

Upper Eocene (?) or Miocene of Oregon, near Astoria, and at Coos Bay.

This species was badly figured from a poor cast. It is a member of the section *Plectosolen*, which is easily distinguished from *Solena* by the deep furrow in the anterior part of the valves. The type specimen is lost, but a similar shell is not uncommon in the Miocene of the Empire beds at Coos Bay, which are practically of the same horizon as the Miocene of Astoria, and the same or a very similar form is found in transitional (Oligocene?) beds above the Eocene of Cape Arago.

Solen (Plectosolen) lisbonensis Aldrich.

Solen lisbonensis Aldrich, Bull. Ala. Geol. Survey, i., p. 37, pl. 4, fig. 4, 1886.

Eocene of the Chickasawan horizon at Lisbon, Alabama; Aldrich.

Variety abruptus Dall.

Claibornian Eocene of Clarke County, Mississippi; Burns.

This form, represented by numerous fragments, differs from Aldrich's figure by its more abrupt anterior truncation and relatively wider valves. It will probably, when more complete specimens are obtained, prove to belong to a distinct species.

Other forms in our Tertiary belonging to the true Solens are *Solena diegoensis* Gabb (Pal. Cal., i., p. 213, pl. 32, fig. 280, 1866; ii., p. 176, 1868) and a species reported by Conrad from Ocoya Creek (H. Ex. Doc. 129, p. 8, 1855). *Hypogella cuneata* Gabb (Pal. Cal., ii., p. 175, pl. 29, fig. 61, 1868) from the Eocene of Martinez, California, may prove to be a *Modiolus* or allied form; and his figure of *H. parallela* (*op. cit.*, ii., p. 233, 1869) looks more like a *Solecurtus*. It may be Cretaceous and not Eocene, as he supposed. A fragment figured by Harris (Bull. Pal., ii., p. 258, pl. 13, fig. 9, 1897) may belong to *S. lisbonensis* Aldrich. *Solen obliquus* Sowerby, 1844, of the Parisian Eocene, is a typical *Plectosolen*, but appears to be distinct from the *Solen* (*Solena*) *obliquus* Spengler, 1794, and should receive a new name.

Genus **ENSIS** Schumacher.

Solen (sp.) Linné, Syst. Nat., ed. x., p. 672, 1758.

Ensis Schumacher, Essai, p. 143, 1817. Type *E. magnus* Schum., pl. xiv., fig. 4 (Chemn. Conch. Cab., vi., p. 44, pl. 4, fig. 29, 1782).

Ensatella Swainson, Treatise Mal., p. 365, 1840. Type *Solen ensis* L.; Verrill, Inv. An. Vineyard Sound, p. 674, 1873.

Ensis Gray, P. Z. S., 1847, p. 189; List Brit. An., vii., p. 58, 1851; Ann. Mag. N. Hist., xiv., p. 24, 1854; Conrad, Cat. *Solenidæ*, Am. Journ. Conch., iii., p. 26 (Suppl.), 1867; Fischer, Man. Conch., p. 1110, 1887.

Solen Leach, Synops. Brit. Moll., p. 260, 1852.

This genus is well defined by its hinge, perfectly distinct from that of *Solen*. The name is masculine. Each north and south coast appears to have a large northern form (*E. magnus*, Europe, *E. directus*, eastern America) and a smaller similar southern form (*E. ensis*, Europe, and *E. minor*, southern American coast). *E. magnus* Schum. differs from our American form by being straighter and more slender; on the Pacific coast the large northern form is wanting and the small southern one represented by *E. californicus* Dall. A somewhat similar parallelism is found in the species of *Siliqua*.

Ensis directus Conrad.

Solen ensis Conrad, Bull. Nat. Inst., ii., p. 191, 1842; not of Linné.

Solen directus Conrad, Proc. Acad. Nat. Sci. Phila., i., p. 325, 1843.

Solen magnodentatus H. C. Lea, Trans. Am. Phil. Soc., 2d Ser., ix., p. 236, pl. 34, fig. 8, 1845.

? *Ensis "americana* Beck," H. and A. Adams, Gen. Rec. Moll., ii., p. 342, 1856.

Solen ensis Tuomey and Holmes, Pleioc. Fos. S. Car., p. 101, pl. 24, fig. 3, 1856; not of Linné.

Solen americanus Gould, Inv. Mass., 2d ed., p. 42, 1870.

Ensatella americana Verrill, Inv. An. Vineyard Sound, p. 674, pl. 32, fig. 245, 1873; Am. Journ. Sci., iii., pp. 212, 284, 1872.

Ensis americana Dall, Bull. 37, U. S. Nat. Mus., p. 72, pl. 53, fig. 4, pl. 55, figs. 4, 5, 1889.

Oligocene of the Oak Grove sands, Santa Rosa County, Florida. Miocene of Maryland (Conrad); of Virginia at Petersburg; of North Carolina at the Duplin County Natural Well; of Darlington, South Carolina; of Florida in the upper bed at Alum Bluff; Pliocene of South Carolina; Pleistocene of Heislerville, New Jersey; Cornfield Harbor, Maryland; Nantucket at Sankoty Head and Point Shirley, Massachusetts, and Portland, Maine; recent from Labrador to Indian Key, Florida.

I began the examination of the fossil material supposing that the Miocene form might be distinct from the recent shell, but after a series of careful comparisons I am unable to find any constant character by which they can be discriminated. From *E. ensiformis* the present species is distinguished by its larger size and more squarely truncated posterior end.

Ensis minor Dall.

Pleistocene of Simmons Bluff, South Carolina, Burns; recent from Cape May to Florida and Texas.

This form is the "small variety" of "*Solen ensis*" described by Conrad as long ago as 1831, and referred to by some authors as var. *minor*. It is constantly smaller and more slender than *E. directus,* and has a tendency to be wider at the posterior than at the anterior end. It is proportionately longer than *E. ensiformis,* and is wider instead of attenuated and rounded behind. It bears to the large *E. directus* the same relation that the true *E. ensis* of Europe bears to the north European *E. magnus* Schum.

Ensis ensiformis Conrad.

Solen ensiformis Conrad, Proc. Acad. Nat. Sci. Phila., i., p. 326, 1843; Fos. Medial Tert., p. 76, pl. 43, fig. 8, 1845.

Miocene of Maryland at St. Mary's River (type locality), Choptank River, and Cove Point; of Virginia on the York and Nansemond Rivers; the Natural Well and Magnolia, Duplin County, North Carolina; of Florida in the rock excavated from the city reservoir at Jacksonville. Distinguished by its straight, rather short, and posteriorly tapered and rounded form.

Genus **SILIQUA** Megerle.

Siliqua Megerle, Mag. d. ges. Naturf. Fr., 1811, p. 44. Type *Solen radiatus* Linné; Philippi, Handb. Conch., p. 331, 1853; H. and A. Adams, Gen. Rec. Moll., ii., p. 345, 1856; Fischer, Man. de Conchyl., p. 1109, 1887.

Aulus Oken, Allgem. Naturg., v., i., pp. iv., 297, 1835; sole ex. *Solen radiatus* Linné; not of Oken, Lehrb., p. 225, 1815.

Aulus Agassiz, Moules d'Aceph. Viv., p. 42, 1839, Oken, 1835. Type *Solen radiatus* Linné; not of Oken, 1815, type *S. diphos* L.

Leguminaria Schumacher, Essai, p. 126, 1817. Type *S. radiatus* Linné (L. *costata* Schum., pl. 7, fig. 1).

Solecurtus A, Blainville, Man. Mal., p. 568, 1825. Type *S. radiatus* Linné.

Solecurtoides Desmoulins, Actes Soc. Lin. de Bordeaux, v., p. 108, 1832. Type *S. radiatus* Linné.

Machæra Gould, Inv. Mass., p. 32, 1841. Type *Solen costatus* Say; not *Machæra* Cuvier, 1832.

Solenocurtus Sowerby, Man., p. 99, 1839; ed. ii., p. 262, 1842.

This genus is chiefly American and Oriental in its distribution. Megerle's name antedates all others. *Aulus* Oken, as originally proposed without a diagnosis, contained two species, both belonging to the older genus *Sanguinolaria* Lamarck. Subsequently Oken tried to transfer the name to *Siliqua radiata* and its congeners, which, of course, is inadmissible.

This genus was fully differentiated before the beginning of the Tertiary, and a thorough examination of the Eocene faunas will doubtless reveal several species, but hitherto the material collected has been sparse and fragmentary. One species, *S. Simondsi* Harris (Proc. Acad. Nat. Sci., 1895, p. 51, pl. 3, fig. 2), has been described from the Claibornian of Texas, another from the Oligocene of St. Domingo.

Siliqua subequalis Gabb.

Siliqua subequalis Gabb, Geol. St. Dom., p. 247, 1873.

Oligocene of St. Domingo, Gabb; and of the Chipola beds of Calhoun County, Florida, at Alum Bluff and on the Chipola River (?); Burns.

This species is smaller than *S. costata* and has centrally situated beaks. The specimens from Florida are fragmentary, but the beaks were evidently nearly central, and until better material is at hand I prefer to refer it to Gabb's species, which came from nearly the same horizon.

Siliqua Nuttallii Conrad.

Solecurtus Nuttallii Conrad, Journ. Acad. Nat. Sci. Phila., 1st Ser., vii., p. 232, pl. 17, fig. 9, 1838.

Siliqua californica Conrad, Am. Journ. Conch., iii., p. 193, 1867.

Siliqua patula auct. *ex parte.*

Machæra patula Gabb, Pal. Cal., ii., p. 89, 1869, in part, synonymy excluded.

Miocene of Santa Clara County, California; Pliocene, Santa Rosa County; Pleistocene of San Diego, California; recent from Lituya Bay, Alaska, to Monterey, California.

The nomenclature of this form has been much confused. Mr. Gabb wrongly united with it *S. lucida* Conrad, which is a distinct and good species; *Solemya ventricosa* Conrad, which is a fine, large Miocene species of *Solemya;* and *Solen patulus* Dixon, which is a much larger, coarser form, with a broader shell and straight clavicle, and is not authoritatively known from south of Alaska. The present species is longer, more slender, with a more oblique clavicle and more parallel dorsal and ventral margins. If it is merely a geographical race of *patula* it deserves a name on account of the differences of form.

Siliqua (**patula** Dixon var?) **oregonia** Dall.

Miocene of Astoria (?) and of Two-Mile Creek, near Coos Bay, Oregon (Diller).

A somewhat imperfect specimen from the Miocene shales collected by Mr. Diller; differs from *S. Nuttallii* by its strong and straight clavicle, its proportionately wider shell, and its somewhat rostrate posterior extremity. It appears to be adult, and if so is much smaller than *S. patula,* which also has a more rounded posterior end. I await better material before figuring this interesting form, which is probably the same as that referred to by Gabb as *S. patula* from the Astoria Miocene. The shell measures about 65 mm. long and 25 wide. The pallial sinus appears to be decidedly deeper and narrower than in *S. Nuttallii.*

Siliquaria edentula Gabb, from the Pliocene of California, is a *Psammobia* and will be found referred to under that genus.

The very young shells of *Siliqua* are donaciform and hardly recognizable as belonging to the same group as the adults.

Genus **CULTELLUS** Schumacher.

Cultellus Schumacher, Essai, p. 130, 1817. Type *Solen lacteus* Spengler, pl. 7, fig. 4 (Chemn. Conch. Cab., vi., p. 51, pl. 5, fig. 35) = *Solen maximus* Gmelin non Wood (cf. Dunker, Novit. Conch. Moll. Marina, p. 11, pl. iii., fig. 4, 1858) but not *Cultellus lacteus* and *maximus* of Sowerby, Conch. Icon., *Cultellus*, pl. 1, 1874.

Not *Cultellus* Conrad, Journ. Acad. Nat. Sci. Phila., vii., p. 232, 1838 (= *Tagelus* Gray); nor of G. B. Sowerby, Conch. Man., ed. ii., p. 129, 1842 (= *Lutraria* sp.).

Cultellus Gray, Ann. Mag. N. Hist., xiv., p. 24, 1854; *C. lacteus* Spgl., 1794, = *Solen magnus* Wood, Gen. Conch., p. 130, 1815, not *Ensis magnus* Schumacher, 1817.

Cultellus H. and A. Adams, Gen. Rec. Moll., ii., p. 344, 1856; Fischer, Man. de Conchyl., p. 1109, 1887.

Phaxas Leach, Synops. Moll. Gt. Brit., p. 262, 1852. Sole ex. *Solen pellucidus* Donovan.

Ensiculus Adams, P. Z. S., 1860, p. 369. Type *Solen cultellus* L.

In this group there is an ill-defined ridge which strengthens the shell in front of the narrow and elongate anterior adductor scar. In some of the more curved and rounded species (*Ensiculus*) this ridge is more curved downward, while in the typical species it is straight. In the absence of weightier characters this feature can hardly be held of even sectional value. The group is represented in the Parisian Eocene, and there is a single American species of the section *Ensiculus.*

Cultellus (Ensiculus) Conradi Cossmann.

Ensiculus Conradi Cossmann, Notes Compl., p. 5, pl. 1, fig. 1, 1894.

Eocene of the Claiborne sands at Claiborne, Alabama.

Specimens of this small species have been obtained by Burns and Johnson, but mostly in a fragmentary condition. It is easily recognized by the curved ridge in front of the adductor scar.

Genus **Solecurtus** (Blainville).

< *Solecurtus* Blainville, Dict. Sci. Nat., xxxii., p. 351, 1824; Man. de Mal., p. 568, 1825.

= *Solecurtus* C, Blainville, Man. de Mal., p. 568, 1825. Type *Solen legumen* L., pl. 80, fig. 1.

Solenocurtus Brown, Rec. Conch. Gt. Brit., ed. ii., p. 113, 1844; not of Sowerby, 1839.

Pharus (Leach MS.) Brown, *op. cit.*, p. 113, in synonymy, 1844; Gray, P. Z. S., 1847, p. 189; Fischer, Man. de Conchyl., p. 1108, 1887.

Artusius Leach, Synops. Moll. Gt. Brit., p. 263, 1852. Sole ex. *Solen legumen* L.

Polia Orbigny, Pal. Franc. Terr. Cret., iii., p. 390, 1843; Hoernes, Foss. Moll. Wiener beck., ii., p. 16, 1870; not of Ochsenhausen, 1816.

Ceratisolen Forbes and Hanley, Hist. Brit. Moll., i., p. 255, 1848. Type *S. legumen* L.

Solecurtoides (sp.) Desmoulins, Actes Soc. Lin. de Bordeaux, v., p. 102, 1832.

Pharella Gray, Ann. Mag. Nat. Hist., xiv., p. 24, 1854. Type *Solen javonicus* Lamarck.

Blainville described his genus *Solecurtus* as consisting of three lettered sections (not otherwise named by him), a single example being cited under each. Section A had already been named *Siliqua* by Megerle von Muhlfeld; Section B was separated as *Psammosolen* by Risso the following year, leaving to bear the original name of Blainville only Section C, typified by *Solen legumen.* The subsequently proposed names above enumerated must therefore fall into synonymy. A slight difference in the hinge-teeth enables us to retain

Pharella (*javanica*) Gray with one or two other tropical species as a section under *Solecurtus*. The original Greek as shown by Herrmannsen would have been more appropriately Latinized as *Cyrtosolen*, which, however, comes too late, while the efforts of several emendators, who assumed a non-existent Græco-Latin compound in *Solecurtus*, have resulted in several unnecessary synonyms.

Solen parallelus Gabb (Pal. Cal., i., p. 146, pl. 22, fig. 117, 1864; *Plectosolen parallelus* Conrad, S. I. Eocene Checkl., p. 9, 1866) has the aspect of a *Solecurtus*, but I know it only from the figure. It is said to be from the Tejon Eocene of California by Gabb, but Dr. Boyle in his bibliography of American mesozoic fossils states that it is really Cretaceous.

Pharella alta Gabb (*op. cit.*, p. 147, pl. 22, fig. 118, 1864) appears to belong to the subgenus or section so named, and there are at least two other species, all of which are now regarded as Cretaceous. Neither *Solecurtus* proper nor *Pharella* have been identified from the American Tertiary. *Solecurtus Blainvillei* Lea (Contr. Geol., p. 39, pl. 1, fig. 7, 1833) is a *Psammobia*, and most of the other species cited under this generic name from our Tertiary belong to *Psammosolen*.

Genus **Psammosolen** Risso.

Psammobia Risso, Hist. Nat. Eur. Mer., iv., p. 375 (not p. 350), 1826 (err. typog.).

Psammosolen Risso, *op. cit.*, v., index, 1826 (corrig.). Type *Solen strigilatus* L.; Philippi, Handb. Conch., p. 331, 1853; Hörnes, Foss. Moll. Wiener beck., ii., p. 18, 1870.

Tellina (sp.) Oken, Lehrb. Naturg. Zoologie, p. 224, 1815.

Macha Oken, Allgem. Naturg., v., 1, p. 298, 1835. Type *Solen strigilatus* L.; Gray, P. Z. S., 1847, p. 189; List Brit. An., Moll., p. 61, 1851; Mörch, Yoldi Cat., ii., p. 8, 1853; H. and A. Adams, Gen. Rec. Moll., ii., p. 346, 1856; Fischer, Man. Conchyl., p. 1107, 1887.

Solecurtus β, Blainville, Dict. Sci. Nat., xxxii., p. 351, 1824; Man. Malac., p. 568, 1825.

Solecurtus Des Moulins, Actes Soc. Lin. de Bord., v., p. 100, 1832; Deshayes, in Lam., An. s. Vert., ed. ii., vi., p. 61, 1835; Traité élém., p. 113, 1840; An. s. Vert. bass. Paris. i., 158; not of Blainville, 1824.

< *Solenocurtus* Fischer, Man. de Conchyl., p. 1107, 1887.

< *Solenocurtis* Swainson, Treatise Mal., p. 366, 1840.

< *Cyrtosolen* Herrmannsen, Ind. Gen. Mal., ii., p. 468, 1848; corrig.

Adasius Leach, Syn. Moll. Gt. Brit., p. 266, 1852. Type *Solen strigilatus* Linné.

Not *Macha* Philippi, Handb. Conch., p. 331, 1853.

Not *Psammosolen* Hupé, Gay's Hist. de Chile, viii., p. 365, 1854.

Subgenus AZOR Leach.

Azor Leach (MS.), Brown, Rec. Conch. Gt. Brit., ed. ii., p. 113, 1844. Sole ex. *Solen antiquatus* Pulteney; Gray, P. Z. S., 1847, p. 189; List Brit. An., Moll., p. 62 (not p. 35), 1851; Leach, Synops. Brit. Moll., p. 264, 1852; Mörch, Cat. Yoldi, ii., p. 8, 1853; Fischer, Man. de Conchyl., p. 1107, 1887.

The genus *Psammosolen* was proposed by Risso, but the name by some accident of proof-reading was printed as *Psammobia,* an error corrected in the index of the next volume, printed during the same year. *Macha* Oken is frequently quoted as printed in his Lehrbuch der Zoologie in 1815, but the name does not appear in that work and I have not been able to trace it earlier than 1835. It formed one of the sections of Blainville's *Solecurtus,* and appears under the name of *Adasius* in Gray's edition of Leach's Synopsis. It is a *Solen* with short shell, with subcentral umbones, partially naked soft parts and, in the typical section, a curious oblique or angular surface sculpture superimposed upon the concentric incremental lines and not in harmony with them. In the group typified by *Solen antiquatus,* the shell, otherwise very similar, has only the incremental sculpture. In some of the species of *Psammosolen* the angular sculpture is obsolete, and these could hardly be separated from *Azor* except for certain differences alleged to exist in the soft parts. The name *Azor* was first published by Brown in his synonymy in 1844, in 1847 and 1851 was used by Gray for a species of *Psammobia,* but appeared with its original significance in Gray's edition of Leach's Synopsis in 1852.

Psammosolen vicksburgensis Aldrich.

Solecurtus vicksburgensis Aldrich, Cincinnati Journ. Nat. Hist., July, 1885, p. 145, pl. 2, fig. 1.

Macha vicksburgensis Aldrich, Bull. Ala. Geol. Surv., No. 1, p. 37, pl. 2, fig. 1, 1886.

Oligocene of the Vicksburgian horizon at Vicksburg, Mississippi; of the Chipolan on the Chipola River, Florida, and of the Bowden beds, Jamaica.

The species of this group are variable and all very similar in general appearance. The incised lines vary in strength with the individual, and are sharper and closer together in the young than in the adult. While I cannot be absolutely certain that the specimens from the Chipolan horizon are specifically identical with those from the Vicksburgian, I cannot, in the material before me, find characters by which to separate them. The best preserved specimens from Bowden are nearer the European *P. strigilatus* than to the existing recent American species.

Psammosolen Cumingianus Dunker.

Plate 28, Figure 15.

Macha Cumingiana Dunker, P. Z. S., 1861, p. 425.

Tagelus lineatus Gabb, Journ. Acad. Nat. Sci. Phila., 2d Ser., viii., p. 370, pl. 47, fig. 71, 1881.

Macha multilineata Dall, Trans. Wagner Inst., vol. iii., part iv., p. 938, pl. 28, fig. 15, 1898 (p. 923, *Mactra m.* by typographical error).

Pliocene clays of Costa Rica, near Port Limon, Gabb; Pliocene marls of the Caloosahatchie and Shell Creek, Florida, Dall and Willcox; recent from North Carolina to Texas and south to São Paulo, Brazil.

At first I supposed that the extent of the incised markings over the surface of the shell was a constant character and, as the material then in hand was very different in this respect from Gabb's figures, I named the Caloosahatchie form *multilineatus*. After more thorough study of a larger amount of material I have come to the conclusion that this view is erroneous, and that the differences referred to come within the range of individual variation. The drawing of the anterior adductor scar in Gabb's figure is obviously erroneous. This form is differentiated from *Psammosolen sanctæ-marthæ*, the other east American recent species, by its slenderness and greater relative length and size. Both species range through about the same geographical area, but only the former has yet been found fossil.

Superfamily TELLINACEA.

Family DONACIDÆ.

This group is very compact and simple in its characters, though requiring more close examination than has usually been given to it. I have not, so far, found in any of the manuals a description of the shell characters, and especially the hinge, which is accurate and complete.

In the genus *Donax* the hinge comprises an external ligament, short, convex, usually amphidetic, set in a deep groove which is often bordered by a rib externally. Below this is a small opisthodetic resilium, seated on a pair of small, short, usually excavated nymphs. The adult teeth comprise normally two cardinals, very discrepant in size in each valve; the major cardinal is frequently bifid, but may be bifid or simple in different individuals of the same species; there are two laterals normally on the left valve, which are received by sockets in the valve opposite; but the laterals are not always both in one valve, and in some of the peripheral forms of the family one or both of the laterals may be obsolete or practically absent. The anterior right dorsal margin is often distinctly grooved in front of the laterals, to receive the edge of the opposite valve. The posterior end of the shell is shorter than the anterior; there is no distinct lunule; the limits of the posterior truncation are often sharply angular and carinate, the sculpture of this part of the shell is generally more emphatic than that of the anterior region. There is sometimes a well-defined escutcheon, limited by a rib or ridge. In such cases the sculpture on the escutcheon differs more or less from that outside of it, and the limiting rib may appear on the distal margin as a prominent tooth or projection. The ventral and distal shell margins are usually sharply fluted; even those species which are said to have entire margins will show under magnification, in well-developed specimens, a fine serration on at least part of the edge. The nepionic shell of *Donax* exhibits a provinculum and three primary cardinal lamellæ in each valve, of which one eventually is smothered by the growth of the resiliar nymphs, except in *Machærodonax*. It is doubtful whether those forms like *D. ovalinus* Lamarck, which have been referred to *Heterodonax,* are congeneric with *H. bimaculatus,* the type of that genus. They have much more resemblance to the section *Latona,* but doubtless the question can be decided only by a comparison of the anatomical features.

The group may be arranged as follows:

Genus *Iphigenia* Schumacher, 1817 (*Donacina* Fér., 1821, and *Procos* Gistel, 1848). Type *Donax lævigata* Ch.

Shell large, subtriangular, subequilateral, without radial sculpture; thick, with entire ventral margins; two cardinals, the larger bifid, in each valve and two obsolete laterals in the right valve.

Genus *Egerella* Stoliczka, 1870 (*Egeria* Lea, 1833, not Roissy, 1806). Type *E. subtrigonia* Lea. Eocene.

Shell small, of variable form, with faint radial sculpture, thin, with serrate ventral margins; cardinals as in *Iphigenia,* but the laterals absent.

Genus *Donax* (L.) Lamarck, 1799. Type *D. trunculus* L.

Section *Donax* s. s.

Shell elongate, smooth, with no posterior carination; ventral margins with obsolete serration; cardinal teeth two in each valve, the larger often bifid; laterals both in the left valve, the anterior hardly distinguishable from the margin, of which it is a sort of modification.

Section *Chion* Scopoli, 1777. Type *D. denticulata* L.

Shell more solid and triangular, sharply truncated, the truncation sculptured; the ventral margins sharply fluted. Teeth as in *Donax* s. s., but the laterals distinct; the shell radially sculptured with the grooves punctate.

Section *Hecuba* Schumacher, 1817. Type *D. scortum* L.

Shell large, conspicuously carinate behind, with marked longitudinal sculpture in front of the carina. Teeth as in *Donax* s. s., with a sharp groove on the right dorsal margin in front of the socket for the anterior lateral.

Section *Machærodonax* Römer, 1870. Type *D. scalpellum* Gray.

Shell brilliantly polished, thin, smooth, elongated; with a sharp carina behind but no marked truncation; ventral margins serrate. Teeth as in *Donax* s. s., but a feeble posterior right cardinal present in addition to the usual two; the anterior right dorsal margin grooved for the edge of the opposite valve.

Section *Platydonax* Dall. Type *D. Finchii* Sby.

Shell like *Machærodonax* but compressed, with the carina obsolete; marginal serration feeble; cardinals as in *Donax* s. s. but laterals absent.

Section *Grammatodonax* Dall. Type *Donax madagascariensis* Lam.

Shell short, triangular, compressed; the surface of the valves deeply obliquely furrowed; the margins finely serrate; the right valve with a single bifid cardinal; the left with two simple cardinals, an anterior and a posterior lateral.

Section *Latona* Schumacher, 1817. Type *D. cuneata* L.

Shell compressed, rounded triangular, solid, the valves subequilateral, concentric sculpture more conspicuous and frequently rugose behind; there is no distinct truncation or posterior carination; right valve with a deep socket, its ventral edge conspicuous, for the posterior lateral of the opposite valve; a stout bifid and an obsolete anterior cardinal, and a feeble anterior lateral; left valve with a posterior lateral and two small simple cardinals; the ventral margins feebly radially striated. This section is intermediate between the true Donaces and *Heterodonax* in the characters of its shell.

Genus *Hemidonax* Mörch, 1870. Type *Cardium donaciforme*. Spengler (+ *Donax pictus* Tryon).

Shell resembling *Chion*, but the laterals elongated and the pallial line unsinuated.

Donacicardium Vest, 1875, is synonymous.

Genus **EGERELLA** Stoliczka.

Egerella Stoliczka, Cret. Pel. India, p. 133, 1870. Type *Egcria subtrigonia* Lea.
Egeria (pars) Lea, Contr. Geol., p. 49, 1833; not of Roissy, 1806.

Lea named no type, and his genus included species of *Diplodonta, Angulus* or *Mœra,* and *Abra,* as well as Donaces of the type of *E. subtrigonia,* for which Stoliczka proposed the name *Egerella.*

Egerella subtrigonia (Lea).

Egeria subtrigonia Lea, Contr. Geol., p. 53, pl. 1, fig. 22, 1833.
Egeria veneriformis Lea, *op. cit.,* p. 53, pl. 1, fig. 23, 1833.
Egeria donacea Conrad, Am. Journ. Conch., i., p. 146, pl. 11, fig. 12, 1865.

Eocene of the Claiborne sands, at Claiborne, Alabama.

This is an extremely common fossil at Claiborne, of variable outline but always tolerably plump.

Egerella triangulata (Lea).

Egeria triangulata Lea, Contr. Geol., p. 51, pl. 1, fig. 20, 1833.
Egeria Bucklandii Lea, *op. cit.,* p. 52, pl. 1, fig. 21, 1833.
Donax limatula Conrad, Fos. Tert. Form., p. 42, 1833; *fide* Conrad in Morton, App., p. 7, 1834.

Eocene of the Claiborne sands, at Claiborne, Alabama.

I have retained Lea's name for this species because Conrad's brief diagnosis without a figure does not contain data sufficient for discriminating the species from any of the others, and we know that his subsequent identifications in Morton's appendix are frequently only plausible guesses. On the other hand, there can be no doubt as to the shell which Lea described and figured in a perfectly satisfactory manner.

This species is comparatively rare, but the young of the same size as *E. subtrigonia* are much more compressed and triangular than the latter. *E. Bucklandii* Lea is merely one of the individual mutations of a rather variable species. *E. fragilis* Conrad (in Mort. App.) is a nude list-name and was perhaps based on the young of this species. It has never been described.

Genus **DONAX** (Linné).

< *Donax* Linné, Syst. Nat., ed. x., p. 686, 1758; Bruguière, Enc. Méth., i., p. xiv., pl. 260, 1797.
< *Cuneus* Da Costa, Brit. Conch., p. 202, 1778.
> *Donax* Scopoli, Intr. ad Hist. Nat., p. 398, 1777.

> *Chion* Scopoli, *op. cit.*, p. 398, 1777. Type *Donax denticulata* L.
Donax Bolten, Mus. Bolt., p. 173, 1798; ed. ii., p. 128, 1819.
Donax Lamarck, Prodrome, p. 85, 1799. Type *D. trunculus* L.
> *Capisteria* Meuschen, Mus. Gevers., p. 462, 1787.
Donax Megerle, Entw. Neuen Syst., pp. 49, 50, 1811.
> *Donax* Schumacher, Essai, p. 144, 1817. Type *D. rugosa* L.
> *Hecuba* Schumacher, Essai, p. 157, 1817. Type *D. scortum* L.
> *Latona* Schumacher, Essai, p. 156, 1817. Type *D. cuneata* L.
> *Serrula* Mörch, Cat. Yoldi, ii., p. 18, 1853. Type *D. trunculus* (L.) Hanley.
> *Cuneus* Gray, List Brit. An., Moll., p. 46, 1851. Type *C. vittatus* Da Costa.
> *Capsella* Gray, *op. cit.*, p. 47, 1851. Type *Donax politus* F. and H. = *Tellina violacea* Meuschen.
> *Capisteria* Gray, P. Z. S., 1847, p. 187; after Meuschen.
> *Machærodonax* Roemer, Conchyl. Cab., x., p. 77, 1870. Type *D. scalpellum* Gray; Zool. Rec., 1870, p. 172.
> *Liodonax* Fischer, Man. de Conchyl., p. 1102, 1887.
> *Peronæoderma* Mörch, Cat. Yoldi., ii., p. 12, 1853 (*T. polita Poli*).

Though so simple and compact a genus, an unusual number of names have been applied to different members of it, and the disentanglement of the synonymy is not without difficulty.

The original *Donax* of Linné was heterogeneous, containing a *Sunetta* and a *Venerupis* among the six identifiable species. Da Costa's *Cuneus* was a similar assembly, a substitution for rather than a dismemberment of the Linnean group, and may be regarded as a strict synonym of *Donax* L. Scopoli was the first to divide the genus, but unfortunately named no type for his restricted *Donax*. Bolten's *Donax* was purged of extraneous forms. Lamarck was the first to name a type, *D. trunculus*, in 1799, and in his selection he followed the Linnean rule of taking the "commonest, best known, or officinal species."

The name *Serrula*, applied by Chemnitz to *D. rugosa* and *D. trunculus*, was not used in a generic sense, but was merely a translation of the vernacular name of "Saw-shell" applied by some collectors to these species on account of their serrate margin. Megerle, in 1811, followed Bolten, but named no type. Duméril (Zool. Anal., p. 335, 1806) changed *Donax* into *Donaciarius* in pursuance of his fad for terminations in *us;* but Schumacher was the first, after Scopoli, to attempt a subdivision of the true Donaces, which was, unfortunately, chiefly based on trivial or misinterpreted characters. Fischer in 1887 violated the rules of nomenclature by proposing to include a number of groups already named under a wholly new designation. I have not been able to get any data or specimens to elucidate the standing of the brackish-water fossil, *Oncophora,* said by Tryon to be allied to *Donax,* nor of the Jurassic genus *Delia* De Loriol, 1891 (not of Robineau Desvoidy, 1830), which is said to belong to this family.

Donax funerata Conrad.

Donax funerata Conrad, Proc. Acad. Nat. Sci. Phila., iii., p. 292, 1848; Journ. Acad. Nat. Sci. Phila., 2d Ser., i., p. 123, pl. 13, fig. 9, 1848; S. I. Eoc. Checkl., p. 28, 1866.

Egeria funerata Conrad, Am. Journ. Conch., i., p. 5, 1865.

Four miles northwest of Vicksburg, Mississippi, Conrad; in the Vicksburgian Oligocene at Vicksburg, C. W. Johnson.

This is the earliest true *Donax* yet identified from our Tertiaries.

Donax æqualis Gabb.

Donax æqualis Gabb, Geol. St. Dom., p. 249, 1873.

Later Tertiary of Santo Domingo, Gabb; Bowden beds Oligocene at Bowden, Jamaica, Henderson and Simpson.

Small, faintly striated, and nearly equilaterally triangular, and moderately convex.

Donax chipolana n. sp.

PLATE 44, FIGURE 20.

Oligocene of the Chipola River, Calhoun County, Florida; Burns.

Shell small, thin, smooth, with faint radial striation behind; anterior end smaller, produced, rather bluntly rounded at the end; anterior dorsal margin rectilinear, basal margin nearly straight; posterior end wider, short, not carinate or markedly truncate but bluntly rounded; right valve with well-marked sockets for the laterals, the anterior one longer; ventral edge finely serrate, the serrations shorter below the beak; pallial sinus subquadrate, horizontal, ventral portion largely confluent with the pallial line. Lon. 9.5, alt. 5.5, diam. 3 mm.

A single valve was obtained by Burns which has been bored by a gastropod. The shell is remarkably fresh and still retains traces of purple coloration along the hinge-line. With it was another valve of smaller size which may represent a distinct species or an extreme variation of the preceding. The umbo is more posterior, the anterior end more pointed, and the posterior end shorter and more rounded. In view of the variability of species of this group I prefer, until more material comes to hand, to regard it as a variety *curtula* of the *D. chipolana.*

Doubtless a more thorough search of the Oligocene beds would reveal additional species of this family.

Donax Emmonsi Dall.

PLATE 28, FIGURE 16.

Donax Emmonsi Dall, Nautilus, v., No. 11, p. 126, March, 1892; Emmons, Geol. N. Car., p. 298, fig. 227, 1858; Dall, Trans. Wagner Inst., iii., p. 923, pl. 28, fig. 16, 1898.

Miocene of North Carolina, in Duplin County, at the Natural Well and Magnolia, Burns; Pliocene of the Cape Fear River, at Mrs. Guion's marl bed, C. W. Johnson.

This species is more triangular than any of the recent forms of the coast, faintly radially striate, ventrally somewhat flexuous, and with a sharply serrate margin. The teeth are normal and strong, especially the sockets for the laterals. Lon. 10, alt. 7, diam. 4 mm.

Donax fossor Say.

Donax fossor Say, Journ. Acad. Nat. Sci. Phila., ii., p. 306, 1822; Tryon, Am. Mar. Conch., p. 153, pl. 27, figs. 376, 377, 1873.

Donax variabilis Tuomey and Holmes, Pleioc. Fos. S. Car., p. 95, pl. 23, fig. 6, 1857; not of Say.

Donax angustatus Sowerby, Thes. Conch., iii., p. 309, pl. 281, fig. 44, 1866.

Donax protractus Conrad, Journ. Acad. Nat. Sci. Phila., 2d Ser., 1, p. 208, pl. 39, fig. 8, 1849 (senilé stage).

Donax parvula Phil., Zeitschr. Mal., p. 146, 1845 (young shell).

Miocene of Duplin County, North Carolina, at Magnolia, Burns; Pliocene of the Waccamaw beds, South Carolina; of the Cape Fear River, North Carolina; and of the Caloosahatchie beds of Florida; Pleistocene of Simmons Bluff, South Carolina, Burns; recent, from New Jersey to the Florida Keys.

Although *Donax variabilis* Say has several times been reported from the Miocene and Pliocene, the specimens when critically studied have so far turned out to be *D. fossor*.

Other Miocene forms are *D. idonea* Conrad (Proc. Acad. Nat. Sci. Phila., xxiv., p. 216, pl. 7, fig. 2, 1872), a large form supposed to have been washed out of submarine Miocene beds on the coast of North Carolina; *Donax tumida* Philippi (Zeitschr. Mal., p. 147, 1848), a recent Texan species, identified by Harris from the fossils of the Galveston artesian well, supposed to be Upper Miocene; and *D.* (*Machærodonax*) *galvestonensis* Harris, from the same source, described by Harris (Bull. Pal., ii., p. 92, 1895) as a variety of the Pacific coast recent *D.* (*Machærodonax*) *carinata* Hanley.

Donax æquilibrata Dall.

Plate 28, Figure 17.

Donax æquilibrata Dall, Nautilus, v., No. 11, p. 126, 1892; Trans. Wagner Inst., iii., p. 923, pl. 28, fig. 17, 1898.

Pliocene of the Cape Fear River, North Carolina, at Mrs. Guion's marl bed; C. W. Johnson.

This species is not unlike *D. fabagelloides* Guppy (Proc. Sci. Assoc. Trinidad, Dec., 1867, pp. 62, 173), from the Pliocene of Matura, Trinidad, West Indies, but is more angular and attenuated behind.

Donax striata Linné.

Donax striata Linné, Syst. Nat., ed. xii., p. 1127, 1767; Guppy, Proc. Sci. Assoc. Trinidad, Dec., 1867, p. 162.

Donax flexuosus Gould, Bost. Journ. Nat. Hist., vi., p. 395, pl. xv., fig. 8, 1853; not of Cooper, Cat. Cala. Fos., p. 238, 1888.

Donax Lamarckii Deshayes, Reeve, Conch. Icon., viii., pl. 5, fig. 37, 1855.

Pliocene of Matura, Trinidad; Guppy.

It has long been a source of surprise that the *Donax flexuosa* described from specimens collected at Santa Barbara, California, by Colonel E. Jewett, has never turned up since, as the species of this genus are known to be very abundant when occurring at all. On a recent review of the recent Donaces in the collection of the National Museum a comparison of one of Jewett's specimens with specimens of *Donax striata* from the Antilles shows that the two are identical. Several of Colonel Jewett's species are known to have been confused as to locality, and there can be little doubt that this is another instance where shells from some West Indian locality were mixed with Pacific coast shells by some accident and described with an erroneous habitat. The shell referred to by Cooper under the name of *flexuosus*, from the Pliocene of San Diego, California, is the original *D. californica* of Conrad.

Donax californica Conrad.

Donax californica Conrad, Journ. Acad. Nat. Sci. Phila., vii., p. 254, pl. 19, fig. 21, 1838; not of Carpenter and the majority of Californian authors, nor of Deshayes.

Donax navicula Hanley, P. Z. S., 1845, p. 15; Reeve, Conch. Icon., viii., pl. 4, fig. 18, 1855.

Pliocene of the San Diego, California, Well; Pleistocene of San Pedro Hill and San Diego, Stearns and Dall; recent from San Pedro, California, south to Panama.

This species grows slightly larger and has more tendency to radiating coloration in tropical waters, but cannot be subdivided naturally. It is this shell which is usually referred to by Cooper and others when they cite *D. flexuosa* Gld. from various Californian horizons.

The only other unmentioned Pliocene species is *D. moenensis* Gabb (Journ. Acad. Nat. Sci. Phila., 2d Ser., viii., p. 371, pl. 47, fig. 72, 1881) from the Pliocene of Costa Rica near Port Limon. It is a small shell and may prove immature.

D. californica Deshayes was founded on pale specimens of *D. culter* Hanley, and has not yet been reported in the fossil state.

Donax lævigata Deshayes.

Donax lævigata Deshayes, P. Z. S., 1854, p. 352; Reeve, Conch. Icon., viii., pl. 5, fig. 31.

Donax obesus Gould, Proc. B. Soc. N. Hist., iv., p. 90, Nov., 1851; Boston Journ. Nat. Hist., vi., p. 395, pl. 15, fig. 9, Oct., 1853; Philippi, Zeitschr. Mal., 1851, p. 75; not of D'Orbigny, 1843.

Donax californica of several Californian authors (not of Conrad or Deshayes) and of Carpenter, Maz. Cat., p. 47, 1857.

Pleistocene of San Pedro Hill and of San Diego, California, Stearns and Dall; recent, from Santa Barbara southward.

This is the common species of California, used for food, and the west coast analogue in the fauna of the east coast *D. variabilis*. It varies, like all the other species, in outline, but in general has very uniform characters. Remarkably fine specimens of it are abundant in the Pleistocene of San Pedro Hill.

Donax variabilis Say.

Donax variabilis Say, Journ. Acad. Nat. Sci. Phila., ii., p. 305, 1822; Tryon, Am. Mar. Conch., p. 154, pl. 27, figs. 378-9, 1873; not of Tuomey and Holmes, 1857.

Pleistocene of Florida in many localities; recent from Cape Hatteras, North Carolina, to St. Thomas, West Indies.

This, the most abundant species of the eastern coast, has not turned up in any beds older than the Pleistocene, and of those, so far, only in Florida. Associated with the recent shells from South Carolina to Texas and usually confounded with *variabilis* is a form nearly intermediate between the latter and the Texan *D. Rœmeri* Phil., but this has not yet been found fossil.

In California the southern *D. culter* Hanley (1845, + *D. californica* Desh. *non* Conr., + *D. Conradi* Desh., 1854; + *D. contusus* Reeve) reaches to San Diego, but this also is not yet known as a fossil.

Family PSAMMOBIIDÆ.

The species belonging to this group were referred to *Tellina, Solen,* etc., by the earlier writers. A smooth, rather inflated species (referred by Hanley to *Psammotæa serotina* Lam.) was described by Rumphius in 1704 under the name of *Tellina gari.* The specific name here is the genitive case of a Latin noun of the second declension, *Garum,* meaning a sauce or pickle made of shell-fish. As the Amboyna species was used in a similar way (the recipe for the method is given by Rumphius) he very appropriately used the classical word, properly inflected, for his *nomen triviale.* The name was accepted without change by Linnæus in 1758, and the species placed in his genus *Tellina.* Linnæus, as was his habit when he did not possess a type of one of his species, referred to several figures in illustration of *Tellina gari,* and, as frequently happened, these figures did not both represent the same species. That of Rumphius must obviously be taken as typical, while another, in a plate of Argenville (pl. 26, fig. 1), also represents a smooth species, but is hardly identifiable. Later, in the Museum Ulricæ, in 1762, Linnæus described a common north European shell, *Ps. feroënsis* * of authors, under the name of *Tellina gari,* though he had a year previously named the former *Tellina incarnata;* notwithstanding it was not his *Tellina incarnata* of 1758, named in the *Systema Naturæ.*

In 1817 Schumacher subdivided the Linnæan Tellinas and erected, upon the *Tellina gari* (Linné, 1762; not of 1758, or of Rumphius) and another shell, the *Tellina papyracea* of Spengler, 1798, a genus which he called *Gari,* apparently not recognizing the Latinity of this word and without correcting the inflection. As he figures for his "Section α" of this new genus the *Ps. feroënsis,* it must be taken as his type. The other species is the *Tellina planata* (L.) of authors, figured by Lister. The name *gari* in this form is plainly inadmissible for a generic name. Before any one corrected the erroneous inflection, Lamarck proposed the name *Psammobia* for a mixed group, including species related to the original *Tellina gari* (but not including *gari* itself) and others now referred to *Macoma,* but without indicating a type. For the true *gari* (under the names of *violacea* and *serotina*) and others he proposed the genus *Psammotæa* at the same time. In 1822 Bowdich, a pupil of Lamarck, published his "Elements of Conchology," in which the genus *Psammobia* is illustrated by a figure of *P. feroënsis,* which may be regarded as fixing the type.

* Misprinted *fervensis* in Gmelin, and sometimes so quoted by authors. It is *feroënsis,* from the Færöe Islands, not from Ferro Island.

The difficulty of allotting the synonymy and fixing the names of the subdivisions of this family is greatly aggravated by the errors and uncertainties of the earlier authors in regard to species, and by the excessive and obscure subdivisions proposed by them, including Lamarck himself. To discuss the whole subject would occupy too much space and time, and therefore I shall content myself with stating the results of a long-continued and laborious investigation of perhaps as confused a lot of nomenclature as exists in the literature of the subject.

Hiatula Modeer, 1793.

The name *Hiatula* is an ancient synonym of *Mya* Linné, indicating the gaping species, and is so cited by Schroeter as early as 1784. It was revived by Modeer for a group containing *Mya arenaria* and *truncata, Saxicava,* and *Sanguinolaria diphos.* He used *Mya* for the group named *Unio* by Retzius some years earlier. *Hiatula* should therefore be regarded as a synonym of the heterogeneous *Mya* of Linné, and the use of the name is barred by its previous synonymic character, as pointed out by Fischer.

Asaphis Modeer, 1793.

This genus is founded upon a single type, the *Venus deflorata* of Linné, and is generally accepted. The synonyms include *Capsa* (sp.) of Bruguière, 1792; *Capsa* Lamarck, 1801, but not of 1799 or 1818; *Corbula* (sp.) Bolten, 1798, not of Bruguière, 1792; *Psammocola* (pars) Blainville, 1824; *Capsula* Schumacher, 1817; *Sanguinolaria* Deshayes, 1835, not of Lamarck, 1799; *Pliorhytis* Conrad, 1863, and probably *Heteroglypta* von Martens, 1880. The last-mentioned will probably form a distinct section by itself, as restricted to its typical species, though its author intended to include all the diversely sculptured Psammobias.

Capsa (Bruguière, 1797) Lamarck, 1799.

Lamarck selected as an example of the genus *Capsa* in 1799 the *Tellina angulata* of Linné. This Mörch identifies (J. de C., vii., p. 134, 1858) with figure 1 of Bruguière's plate 231. But Lamarck does not refer to that plate, his diagnosis is not distinctive, and Hanley identifies the *T. angulata* of Linné, not with the *Gastrana* figured by Bruguière, but with the *Tellina* (*Arcopagia*) *plicata* Valenciennes, of which a specimen still remains in the Linnæan cabinet. Owing to this fact and the extraordinary confusion which has always attended this generic name, it would best be dropped altogether, especially as its original status merely depends on a name at the head of a plate of heterogeneous unnamed bivalves.

Gastrana Schumacher, 1817.

Though not a member of this family, this genus is mentioned here because of the entanglement of its synonymy with the others. The type is *Tellina fragilis* L. The synonyms are *Diodonta* Deshayes, 1846 (not *Diodon* Linné, 1766, nor *Didonta* Schumacher, 1817); *Fragilia* Deshayes, 1848; and *Capsa* Mörch, 1858, not Lamarck, 1799.

Sanguinolaria Lamarck, 1799.

Sole example *S. sanguinolentus* Gmelin, the *S. rosea* of Lamarck and many later authors. This is very closely related to *S. diphos* Gmelin, but they will be kept in separate sections here for clearness in the synonymy. This is exactly *Aulus* Oken, 1815, not *Aulus* Oken, 1821 or 1835, *Lobaria* Schumacher, 1817, not Muller, 1776, and *Isarcha* Gistel, 1848. It is not *Sanguinolaria* Blainville, 1825, nor of Deshayes, 1835.

Soletellina Blainville, 1824.

Sole example figured in Blainville's Manual is *S. diphos* Gmelin, called *radiata* by Blainville. Synonyms: *Aulus* (sp.) Oken, 1815; *Hiatula* (sp.) Modeer, 1793; *Solenotellina* Mörch, 1853. The group will probably only form a section of *Sanguinolaria*. It is not *Soletellina* Cossmann, 1886, whose use of the name seems due to a confusion of species called *radiata* by the early authors.

Asaphinella Cossmann, 1886.

Founded on *Capsa minima* Deshayes. This seems, from the figures, to be but doubtfully established in its relations, and may possibly belong in another family, though some of the species associated with it by Cossmann are minute Psammobias, others he has since (1891) removed to the *Tellinidæ* under the name of *Herouvalia* (*semitexta*).

Psammobia (Lamarck, 1818) Bowdich, 1822.

Type *P. feroënsis* Gmelin, = *T. gari* L., 1762, not of L., 1758; this is not *Psammobia* Cossmann, 1886. Synonyms: *Gari*, pars, Schumacher, 1817; *Haplomochlia* Gistel, 1848.

Psammotæa (Lamarck, 1818) Bowdich, 1822.

Example cited, *P. serotina* Lam.; identified by Hanley (Ips. Lin. Conch.) with *Tellina gari* of Rumphius and Linné in 1758. The type is fixed by Bowdich, as Lamarck selects none. Blainville endeavored in 1824 to bring together a group which he realized was closely related, though previously divided into several genera. To do this, instead of consolidating the unnecessary genera under the prior name of those already given, he made the mistake of giving a wholly new name, *Psammocola,* and arranging the others under it as sections. The name *Psammocola* is therefore inadmissible. He cites under it *P. vespertina* Gmelin (as *vespertinalis*) and an *Asaphis,* but the genus must be regarded as void. Subsequently Deshayes applied the name of *Capsella* (1854, not *Capsella* Gray, 1851; *Capsula* Reeve, on plates, 1857, not *Capsula* Schumacher, 1817) to Lamarck's group, which is almost exactly intermediate between *Gobræus* and *Asaphis.*

Gobræus (Leach) Gray, 1852.

Type *Psammobia vespertina* Lam. Synonyms: *Solen* Megerle, 1811, not Linné, 1758; *Psammobia* Blainville, 1825, not (Lamarck, 1818) Bowdich, 1822; *Sanguinolaria* Blainville, 1825, not Lamarck, 1799; *Azor* Gray, 1851 (Brit. An., p. 51, not p. 62), *?Psammobella* Gray, 1851; *Psammocola* (sp.) Blainville, 1825.

For convenience may be mentioned here also:

Psammotellina Fischer, 1887. Type *Psammotella ambigua* Desh. Synonyms: *Psammotella* Deshayes, 1856, and Reeve, 1857; not of Blainville, 1826 (Hermannsen, 1852). This will form merely a section under *Sanguinolaria.*

Psammotella (Blainville, 1826, as *Psammotelle*) Hermannsen, 1852. Type *Tellina rufescens* Chemn., not *Psammotella* Deshayes in H. and A. Adams, 1856, and Reeve, 1857. *Peronæa* sp. H. and A. Adams, 1856. The correct name of the type is *Tellina operculata* Gmelin; it is also the *Tellina semiplanata* of Spengler. It will form a section of *Sanguinolaria,* having nothing in common, conchologically, with the Tellinas, among which it is usually classed. It is not the *Tellina rufescens* of Hanley from Peru, = *T. Hanleyi* V. Bertin.

Elizia Gray, 1854. Type *E. orbiculata* Wood (sp.). This shell, except in its excessive inequilaterality and free pallial sinus, does not appear to differ much from the orbicular species heretofore referred to *Sanguinolaria* or *Soletellina.*

Amphichæna Philippi, 1847. Sole example *A. Kindermannii* Phil. ?*Amphidona* Mörch, 1858 (*lapsus ?*); not *Amphichæna* H. and A. Adams, 1856. This very remarkable shell should not be associated with such forms as *Psammobella* Gray.

Heterodonax Mörch, 1853. Type *Tellina bimaculata* Linné. Synonyms: *Arcopagia* Orb., 1853, not of (Leach MS.) Brown, 1827; *Liodonax* (pars) Fischer, 1887. The anatomy, shell, coloration, and habit of this form are conclusive as to its relations with *Psammobia* rather than the Donaces.

Genus **PSAMMOBIA** (Lam.) Bowdich.

Psammobia Lam., An. s. Vert., v., p. 511, 1818; Bowdich, Elem. Conch., ii., p. 6, pl. 1, fig. 10, 1822. Type *P. feroënsis* Gmelin.

The fossil species in the Paris Basin Eocene appear to show a transition towards *Tellina* both in general form and in the tendency for the line marking the pallial sinus to be free from the line due to the attachment of the mantle below it. This is true of the species which in general form are nearest to *Psammotæa* as well as those more like the typical *Psammobia*. The specialization of form thus increases with the progress of the group in geological time, as ought, on the theory of evolution, to be the case. A careful scrutiny of a large number of recent species shows that the majority of the typical *Psammobia* have the lower line of the sinus nearly or quite coalescent with the main pallial line; most of the species of *Gobræus* show a little more of the sinus free, anteriorly; some (ex. *P. occidens*) have a considerable part of it free; and in some individuals there is more of it free in one valve than in the other. It appears to be a variable character of very little physiological importance; nevertheless, the generalization holds good that the Eocene species, as a whole, have the sinus less coalescent than the more recent or the living forms. There does not seem to be any marked difference between the recent and fossil American forms in this respect, but it is obvious in the French fossils. Owing to the variations observed, I am able to regard this character as at most of only subordinate value, though taken into account with other differences it may be recognized as sectional or subgeneric. The hinge-teeth in this group are also rather variable, which is probably due to the fact that these animals are more sedentary than their allies the Tellens, and more given to burrowing. All burrowers, if sedentary, tend to degeneration in such features as hinge-teeth. Throughout the groups the normal formula for the teeth is, $\frac{\text{L. }10101}{\text{R. }01010}$, but this is almost always reduced until the left valve may have but two and the right one tooth. It sometimes happens also that the angle of the cardinal margin in front of the socket for the left anterior tooth may be perceptibly thickened, or even project as a toothlike mass of considerable prominence. In one species I have noticed a projection of the cardinal margin itself before the hinge on one side which is received by a shallow groove on the edge of the valve opposite and behind the hinge, the same in reversed position, which may be regarded as a reminiscence of the lateral teeth of the original *Tellina* stock. In the very small species the teeth are most reduced, both in size and number. The bifurcation or grooving of the distal end of the chief teeth, though sometimes present, is a rare and uncertain character in the recent species I have examined. The posterior tooth which lies on the anterior end of the nymph is usually very slender or obsolete, and often only slight if any traces of it remain. In the small species the posterior tooth of the right valve is usually entirely absent. The genus *Psammobia* will fall naturally into two subgenera and several sections, as follows:

Subgenus *Psammobia* s. s. Type *S. feroënsis* Gmel.

Shell elongated, more or less pointed behind, compressed, somewhat rudely concentrically sculptured, the posterior dorsal area frequently sculptured diversely from the disk, the pallial sinus elongated and, for the most part, coalescent below with the pallial line.

Section *Garum* Dall (*Gari* Cossmann non Schum.).

Shell telliniform, concentrically grooved, the pallial sinus short, detached from the pallial line for about half its length or more, not deeper than the vertical of the beaks.

As Cossmann has named no type, *Psammobia Dutemplei* Desh. of the Parisian Eocene may be selected.

Section *Psammoica Dall* (*Soletellina* Cossmann, not Blainville).

Shell small, *Angulus*-like, smooth, flattish, and pointed behind; the hinge with two teeth in each valve, the pallial sinus elongated and coalescent below with the pallial line.

This differs from *Psammobella* most obviously in its compressed and more tellinoid form. Type *P. appendiculata* Desh. of the Parisian Eocene.

Section *Psammodonax* Cossmann. Type *P. caillati* Desh.

Shell small, compressed, short, and often angular behind with radial striæ on the posterior dorsal area, the left valve with two teeth, the posterior feeble or obsolete, pallial sinus short, oval, and wholly free from the pallial line.

The striæ are found in many species of different sections; most recent ones show traces of them.

Section *Grammatomya* Dall, 1898. Type *P. squamosa* Lam.

Shell with strong oblique sculpture, not interrupted at the borders of the posterior dorsal area; two teeth in each valve; sinus rounded, short, and more or less detached in front from the pallial line. This is *Gari* Fischer, 1887, not Schum., 1817.

Subgenus *Gobræus* Leach, Moll. Gt. Brit., 1852, p. 265. Type *G. variabilis* Leach = *Solen vespertinus* Gmel.

Shell inflated, more or less truncate behind; concentrically striate or nearly smooth, often with fine radial striæ, especially evident on the posterior dorsal region; teeth variable, not more than three in the right and two in the left valve; sinus rounded in front, rarely shorter than the vertical of the beaks, and often more or less detached from the pallial line.

This group has no circumscription of the dorsal areas, and differs from *Psammobia* most obviously in its blunt and inflated form, with a distinct posterior gape. Chiefly recent.

? Section *Psammobella* Gray, 1851. Type *P. tellinella* Lam.

Shell small, with feeble hinge, the sinus coalescent below.

Section *Psammotæna* Dall. Type *P. effusa* Lam., Parisian Eocene.

Shell resembling *Psammobella,* but with the sinus largely free from the pallial line.

The Psammobias begin in the Cretaceous of America (*P. cancellato-sculpta* Roemer, Texas, and *P. obscura* White, Washington), and so far all known North American species belong to the subgenus *Gobræus,* except two in the Claibornian.

In the Lignitic or Chickasawan stage of the Eocene is found *P. ozarkana* Harris; in the Claibornian *P. Blainvillei* Lea (as *Solecurtus*), *P. eborea* and *P. filosa* Conrad, and on the Pacific *P. Hornii* Gabb (as *Tellina*), of the Tejon, and *P. obscura* White, of the Puget Group. In the Jacksonian appear *P. eborea* Conrad and *P. papyria* Conrad, which seems to extend through the Vicksburgian (which also has *P. lintea* Conrad) to the Chipolan Oligocene. The cold water of the Miocene seems to have excluded the genus on our southeastern coast, but with the warmer temperatures of the Pliocene came *P. Wagneri* Dall in Florida and *P. edentula* Gabb (as *Siliquaria*) on the Pacific. The latter has persisted in deep water to the recent stage, being joined in the Pleistocene by *P. californica* Conrad (+ *rubroradiata* Carpenter), also found recent. The genus has retreated from the North American Atlantic shores in the present epoch, though a single species, *P. vaginata* Reeve, is doubtfully reported from Charlotte Harbor on the Gulf coast. *P. circe* Mörch and another unnamed species are extremely rare in the Antilles, while two or three very rare forms, such as *P. maxima* Deshayes, *P. fucata* Hinds, and *P. regularis* Carpenter, are found between California and Panama on the Pacific coast.

Psammobia (Gobræus) Wagneri Dall.

PLATE 25, FIGURE 10.

Psammobia (*Gobræus*) *Wagneri* Dall, Trans. Wagner Inst., iii., part iv., p. 920, pl. 25, fig. 10, 1898.

Shell moderately elongated, thin, somewhat compressed, the anterior end shorter, both ends rounded; posterior dorsal margin straight, with an almost linear escutcheon; surface concentrically sculptured in harmony with the lines of growth, middle of the disk almost smooth, the lines a little stronger anteriorly, on the posterior end periodical, rising in subequally spaced sharp, thin, low lamellæ; nymphs about half the length of the posterior dorsal margin; hinge $\frac{\text{L. } 0101}{\text{R. } 1010}$, the anterior teeth stronger; pallial sinus not reaching the vertical of the beaks, round in front, rather narrow, and partly free from the pallial line below; valves gaping slightly at both ends. Lon. 77, alt. 40, diam. 20 mm.

Pliocene marls of the Caloosahatchie, Florida, and the Waccamaw River, South Carolina; Dall and Johnson.

This fine species is similar to, but smaller than, the Pliocene *P. edentula* Gabb of California, which reaches a length of one hundred and twenty-five millimetres.

A number of species have been referred, chiefly by the earlier authors, to *Psammobia* which do not belong to that genus as now understood. Of these *Gari texta* Gabb, of the Tejon, and *Gari alata* Gabb, from the Pliocene of California, appear to belong to *Sanguinolaria; P. lusoria* Say is a *Macoma; P. mississippiensis* Conrad, of the Vicksburgian, is probably an *Abra* or a *Semele; Psammocola regia* H. C. Lea, of the Miocene, is an Asaphis, while *P. lucinoides*, of the same author and locality, is perhaps a *Diplodonta; Psammocola pliocena* of Tuomey and Holmes is a mere individual mutation of *P. regia* Lea, and both are referable to *Asaphis centenaria* Conrad; *Psammobia perovata* Conrad, of the Vicksburgian, is an *Abra*.

With the exception of *P. Blainvillei* Lea, the Claibornian species are unfigured and the descriptions very inadequate. *P. eborea* Conrad is a *Gobræus*, not unlike *P. papyria* Conrad. It is thirty-five millimetres long and nineteen high. Though Conrad describes the posterior end as the longer, the type is almost exactly equilateral, and the truncation of the posterior end is not more evident than in *P. Wagneri*. It has been referred to *P. Blainvillei* Lea by Heilprin, probably through some inadvertence, since the outlines are not at all similar. *P. filosa* Conrad belongs to the section *Garum* of the typical Psammobias. It is elongated and somewhat arcuate; the concentric sculpture pretty close and uniform on the disk, but elevated into low, somewhat broken small laminæ on the posterior dorsal slope; the type is forty-two millimetres long and about fifteen millimetres high. The teeth and pallial sinus are as in *Garum.*

On the same card with Conrad's type in the collection of the Academy of Natural Sciences is another shell thirty-nine millimetres long and seventeen millimetres high, more equilateral, less arcuate, with a blunter and less decurved posterior end and generally straighter dorsal margin. This is probably a distinct species for which I would propose the name of *Psammobia* (*Garum*) *clailbornensis.* It, with the other Eocene species, will be illustrated elsewhere. In the Gregg's Landing beds of Claibornian age Mr. Aldrich has found a specimen of a species having almost exactly the outline of *P. eborea* Conrad, but which differs from that form by having conspicuous radiating striæ on the dorsal slopes, especially distally, which granulate the incremental ridges. The latter often form in *P. eborea* small, sharp, concentric waves dorsally, but not raised laminæ, as in *P. filosa.* Aldrich's species is hardly perfect enough to receive a name.

Genus **SANGUINOLARIA** Lamarck.

Sanguinolaria Lam., Prodr., p. 84, 1799, and Syst. des An. s. Vert., p. 125, 1801. Type *Solen sanguinolentus* Gmelin (= *S. rosea* Gmelin and Lamarck).

This group may be subdivided as follows:

Section *Sanguinolaria* s. s.

Shell moderately large, thin, equivalve, short, rose-colored or white, with short, inconspicuous nymphs, two bifid cardinal teeth in each valve; pallial sinus deep, widest in front, confluent with the pallial line below, the epidermis thin, dehiscent.

Section *Psammotella* (Blainville, 1826) Herrmannsen, 1852. Type *P. operculata* Gmelin (= *Tellina rufescens* Chemn.).

Shell elongate, rostrate, inequivalve, the left valve flattened; pallial sinus discrepant in the two valves, narrower in front, partly confluent with the pallial line, otherwise like *Sanguinolaria.*

Section *Soletellina* Blainville, 1824. Type *Solen diphos* Gmelin.

Shell large, equivalve, with a conspicuous, dark epidermis and more or less bluish purple coloration, hinge as in *Sanguinolaria;* sinus narrowing to a point in front, below wholly confluent with the pallial line; pallial impressions rude and irregular.

From the elongate, rostrate form of the type the species vary to broad and truncate, forming a transition towards the next section.

Section *Nuttallia* Dall, 1898. Type *S. Nuttallii* Conrad.

Shell large, suborbicular, inequivalve, more or less twisted, the right valve slightly flatter, the posterior cardinal in the left valve obsolete; the pallial sinus narrower in front and somewhat detached from the pallial line.

This group comprises a few species from California and Japan.

Section *Psammotellina* Fischer, 1887. Type *Psammotella ambigua* Desh.

Shell like *Sanguinolaria* but more compressed, with the pallial sinus long and narrow, confluent with the pallial line below; the callosities of the nymphs wide and more or less excavated, as if for an internal ligament, below; hinge as in *Nuttallia.*

Section *Elizia* Gray, 1854. Type *Solen orbiculatus* Wood.

Shell very inequilateral, equivalve, with the anterior side reduced; suborbicular; the pallial sinus free from the pallial line and ascending; otherwise as in *Nuttallia,* except that a third cardinal is persistent in the right valve.

There are several species in the American Cretaceous which have been referred to *Sanguinolaria,* but the Tertiary species are few and all more or less doubtful in their generic relations. *S. unioides* Guppy is from the Tertiary (Oligocene?) of Trinidad. The following are tellinoid and probably Macomas: *S. Whitneyi* Gabb, *S. californica* Conrad, *S. fusca* Say, and *S. lusoria* (Say) Conrad. *S. miniata* Gould and *S. purpurea* Deshayes, of the Gulf and Central American Pacific coast, are synonyms of *S. tellinoides* A. Adams. *S. decora* Hinds is a synonym of *S.* (*Nuttallia*) *Nuttallii* Conrad. *Sanguinolaria? caudata* White, from the basal Eocene beds of Puget Sound, at Carbonado, Washington, is a remarkable shell, like a greatly prolonged *Unio,* of which the hinge and systematic relations are not yet known.

The superficial appearance of *Gari alata* Gabb is that of a *Sanguinolaria.* The *Gari texta* of the same author recalls *Psammotella,* but of neither is the hinge or interior known. The former is said to be Pliocene, and the latter is referred to the Tejon Eocene of Martinez, California, by Gabb.

Genus **AMPHICHÆNA** Philippi.

Amphichæna Philippi, Arch. f. Naturg., xiii., p. 61, 1847; Fischer, Man. Conchyl., p. 1104, 1887. Type *A. Kindermannii* Phil., *loc. cit.,* pl. iii., fig. 7; Mazatlan.

Amphidona "Phil.," Mörch, Journ. de Conchyl., vii., p. 137, 1858 (? lapsus calami).

Not *Amphichæna* H. and A. Adams, Gen. Rec. Moll., ii., p. 391, 1856.

It is probable that to the rarity of this very remarkable shell is due the little attention which it has attracted, and the incongruous species which have been associated with it. It has the form of *Tagelus divisus*, with the color, texture, solidity, and strong internal marginal grooving of *Donax*. The surface is smooth, with the caducous periostracum and suppressed radial sculpture of such species as *Donax variabilis*. The nymphs are slender and short, the pallial sinus short, rounded in front, and partially free below. There are two cardinals on the right and three on the left valve, the posterior tooth in the latter being more or less merged with the nymph. It is perhaps nearest in the family to some of the species of *Psammotæa*. It occurs recent and in the quaternary of the west American coast near Mazatlan, Mexico.

Genus **HETERODONAX** Mörch.

Heterodonax Mörch, Yoldi Cat., ii., p. 15, 1853.

Arcopagia Orbigny, 1853, not of Brown, 1827. Type *H. bimaculata* L.

This is one of the few species which are abundant unmodified on both sides of the isthmus connecting the two Americas, extending on the Atlantic side from Fernandina, Florida, to Brazil, and on the Pacific from Southern California to Panama. It is found in the Pleistocene of south Florida, the Antilles, and both shores of Central America and Mexico. The typical species was described by Conrad from San Diego as *Psammobia pacifica*, and occurs in the Pleistocene of Southern California.

Genus **ASAPHIS** Modeer.

Asaphis Modeer, K. vetensk. Acad. nya Handl., xiv., pp. 176, 182, 1793. Type *Venus deflorata* L.

Capsa (sp.) Bruguière, Enc. Méth., 1792.

Capsa Lamarck, Syst. An. s. Vert., p. 125, 1801; not of Prodrome, p. 84, 1799, or An. s. Vert., v., p. 553, 1818.

Corbula (sp.) Bolten, 1798; not of Bruguière, 1792.

Capsula Schumacher, Essai, pp. 130-31, 1817.

Psammocola (pars) Blainville, Man. Conch., p. 567, 1825.

Sanguinolaria Deshayes, 1835; not Lamarck, 1799.

Pleiorhytis Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 286, 1863.

Pliorytis Conrad, *ibid.*, p. 576.

Heteroglypta Martens, Meeresf. von Mauritius, p. 331, 1880 (*ex parte*).

This group, which is rather closely allied to the typical *Psammotæa*, may be divided as follows:

Section *Asaphis* s. s.

Shell large, thin, gaping behind, with rather uniform radial sculpture; two prominent cardinal teeth in each valve, the larger bifid; the pallial sinus moderate, rounded in front, partly confluent with the pallial line below.

A. undulata and *multicostata* are described by Gabb from the Cretaceous of California, but neither has the aspect of genuine *Asaphis*.

Section *Heteroglypta* von Martens, 1880. Type *Psammobia contraria* Deshayes. Isle Bourbon.

Shell with diverse sculpture converging in angles like that of *Goniomya,* otherwise like *Asaphis.* The original use of the term by von Martens was more inclusive, but I have preserved the name for the typical species.

Asaphis centenaria Conrad.

Petricola centenaria Conrad, Am. Journ. Sci., xxiii., p. 341, 1833; Fos. Medial Tert., p. 17, pl. x., fig. 1, 1838.

Pliorhytis centenaria Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 576, 1863.

Psammocola regia H. C. Lea, Trans. Am. Phil. Soc., ix., p. 234, pl. 34, fig. 17, 1845.

Psammocola pliocena Tuomey and Holmes, Pleioc. Fos. S. Car., p. 91, pl. 22, fig. 8, 1857 (var.).

Capsa centenaria Orbigny, Prodr. Pal., iii., p. 103, 1852.

Pleiorytis ovata Conr., Proc. Acad. Nat. Sci. Phila. for 1862, p. 286, 1863.

Miocene of Charles County, Virginia, of Magnolia, Duplin County, North Carolina, and of Peedee, Waccamaw, and Black Rivers, South Carolina. The reference to the Pliocene is unconfirmed.

Genus **TAGELUS** Gray.

Tagelus Gray, P. Z. S., 1847, p. 189. Type *Solen gibbus* Spengler.

Siliquaria Schumacher, Essai, Nouv. Syst., p. 129, 1817; Conrad, Cat. *Solenidæ,* p. 22, 1867.

Not *Siliquaria* Bruguière, Encyc. Méth., 1789 (*Vermetidæ*), nor Lam. Syst., p. 98, 1801.

Solecurtus Orbigny, Moll. Cuba, ii., p. 230, 1853.

Not *Solecurtus* Blainville, Man. Conchyl., pp. 568-9, 1825.

Psammosolen Hupé, Moll. Chile, p. 365, 1848; not of Risso, 1826.

Cultellus Conrad, Journ. Acad. Nat. Sci. Phila., vii., p. 232, 1837; Medial Tert., p. 75, 1845; not of Schumacher, 1817.

Mesopleura Conrad, Cat. *Solenidæ,* App., p. 23, Am. Journ. Conch., 1867.

Silicaria Mörch, Mal. Blatt., 1861, p. 185; as of Blainville, 1827; not of Daudin, 1800.

Tagalus Fischer, Man. de Conchyl., p. 1107, 1887.

The genus *Tagelus* is distinguished from any of the *Solenidæ* by its long and distinct siphons. In its other characters it approaches closely to *Psammotæa.* Adanson in describing his *Solen tagal* has given it the siphons of a true *Solen,* which is doubtless erroneous, since if his figure and description were correct the species would belong not only to a distinct species, but to a different family from the American shells, which have usually been specifically united with it on conchological grounds.

The group to which this genus belongs may include the following divisions, all of which are more closely related to *Psammobia* than to the *Solenidæ,* among which they were formerly placed.

Genus *Novaculina* Benson, 1830. Type *N. gangetica* Benson.

Beaks subanterior; teeth (when fully developed), three in the left and two in the right valve; the anterior left tooth often obsolete or wanting, the anterior right tooth bifid; valves without a median constriction or clavicular internal rib; pallial sinus short, not reaching the beaks; posterior adductor scar rounded; the ventral portion of the pallial sinus distinct from the pallial line below it; *situs* in fresh water of Indian rivers.

Loncosilla Rafinesque, 1820, as pointed out by Stoliczka, was probably founded on a defective specimen of *Novaculina,* but is unidentifiable.

Section *Clunaculum* Dall. Type *Solecurtus mollis* (Gould MS.) Sowerby, Conch. Icon., pl. vi., fig. 26, 1874. Coasts of Brazil and Uruguay.

Beaks subanterior; teeth two in each valve, the posterior left tooth bifid (with in some species an obsolete tooth behind it); valves obliquely constricted, the constriction reflected by an internal thickened elevation (not a rib or clavicle); the pallial sinus not reaching the beaks; posterior adductor scar triangular; the ventral part of the pallial sinus wholly coalescent with the pallial line; *situs* estuarine or marine.

Genus *Tagelus* Gray, 1847. Type *Solen gibbus* Spengler. West Africa and East America.

Beaks median or subposterior; teeth two in each valve, simple, pedunculate; valves without constriction or clavicle, straight; pallial sinus deep, reaching to or beyond the beaks; posterior adductor scar rounded; pallial sinus with the ventral part partially coalescent with the pallial line; *situs* estuarine or marine.

The shell figured by H. and A. Adams to illustrate *Tagelus* is a *Novaculina,* and their diagnosis is a mixture of the characters of *Novaculina* and *Tagelus.*

Tagelus gibbus Spengler.

Solen gibbus Spgl., Skrift. Nat. Selsk., iii., p. 304, 1794.

Solen guineensis Chemn., Conch. Cab., xi., p. 202, pl. 198, fig. 1937, 1795; Dillwyn, Descr. Cat., i., p. 62, 1817; Wood, Gen. Conch., p. 129, 1835.

Solen declivis Turton, Conch. Dict., p. 164, fig. 80, 1819.

Psammobia declivis Turton, Dithyra Brit., p. 91, 1822.

Solen caribæus Lam., An. s. Vert., v., p. 454, 1818.

Siliquaria notata Schum., Essai, p. 129, pl. vii., figs. 2-3, 1817.

Solecurtus caribæus, Blainv., Dict. Sci. Nat., xxix., p. 240, 1825; Conrad, Am. Mar. Conch., p. 22, pl. 4, fig. 3, 1831; Gould, Inv. Mass., p. 30, 1841; Mighels, Bost. Journ. Nat. Hist., iv., p. 312, 1843; Sowerby, Conch. Icon., *Solecurtus,* fig. 21 *a-b,* 1874.

Solen Adansonii Bosc, Hist. Nat. Coq., iii., p. 12, 1802.

Cultellus caribæus Conrad, Am. Journ. Sci., 2d Ser., i., p. 404, 1846; not of Medial Tert., pl. 43, fig. 1, 1845.

Siliquaria gibba H. and A. Adams, Gen. Rec. Moll., ii., p. 347; not pl. 93, figs. 5, 5a, 1856.

Siliquaria caribæa Holmes, Post-Pleioc. Fos. S. Car., p. 54, pl. viii., fig. 14, 1858.

Siliquaria carolinensis Conrad (*ex parte*), Proc. Acad. Nat. Sci. Phila. for 1862, p. 571, 1863.

? Solecurtus angulatus Sowerby, Conch. Icon. *Solecurtus,* pl. viii., fig. 23, 1874.

Solecurtus centralis Sowerby, Conch. Icon., fig. 18, 1874; not of Say.

Tagelus gibbus Dall, Proc. Bost. Soc. Nat. Hist., xiii., p. 251, 1870.

Fossil in the Miocene of York River, Virginia, near Yorktown (Harris), in the Pliocene of the Caloosahatchie marls, Florida, and the Waccamaw district, South Carolina, and in the Pleistocene from New Bedford, Massachusetts, to Florida and the Gulf Coast. Recent from Cape Cod south to Brazil and on the west coast of Northern Africa. Adventitious on the British coast.

All the specimens collected from the Caloosahatchie marls appear to be young, at which stage they much resemble the adults of *T. divisus,* which, however, has longer nymphs, a shorter pallial sinus, and a median clavicle.

Tagelus gibbus var. **carolinensis** Conrad.

Siliquaria carolinensis Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 571, 1863; *ex parte.*

Miocene of Wilmington, North Carolina; Emmons and Stanton.

This form differs from the typical *gibbus* in being somewhat shorter and stouter and with a shorter pallial sinus. The differences are, however, little greater than appear between specimens of the recent shell from different localities.

Tagelus californianus Conrad.

Cultellus californianus Conrad, Journ. Acad. Nat. Sci. Phila., 1st Ser., vii., p. 233, pl. 18, fig. 3, 1838.

Solecurtus californianus Carpenter, Suppl. Rep. Brit. As., p. 638, 1863.

Pliocene of the San Diego well, Hemphill; Pleistocene of San Pedro and San Diego, California, and San Ignacio Lagoon, Lower California, Hemphill; recent from San Pedro to Lower California.

This species is extremely abundant in the Pleistocene sands of San Pedro Hill.

Section *Mesopleura* Conrad.

Mesopleura Conrad, Cat. *Solenidæ,* Am. Journ. Conch., iii., App., p. 23, 1867. Type *Solen divisus* Spengler.

Shell with an internal radial rib, ventrally directed from the submedian beaks; ends of the valves rounded, and the form of the shell usually more or less arcuate; otherwise like *Tagelus.*

Tagelus divisus Spengler.

Solen divisus Spengler, Skrift. Nat. Selsk., iii., p. 96, 1794.

Solen bidens (etc.) Chemnitz, Conch. Cab., xi., p. 203, pl. 198, fig. 1939, 1795; Dillwyn, Cat. Rec. Sh., p. 65, 1817.

Solen bidentatus Spengler, *op. cit.*, iii., part 2, p. 104, 1794.

Solen fragilis Pulteney, Hist. Dorset, p. 28, pl. 4, fig. 5, 1799.

Psammobia tæniata Turton, Dithyra Brit., p. 85, pl. 8, fig. 3, 1822.

Solen centralis Say, Journ. Acad. Nat. Sci. Phila., ii., p. 316, 1822; Binney's Say, p. 104, 1858; not of Sowerby.

Solecurtus fragilis Conrad, Am. Mar. Conch., p. 19, pl. 4, fig. 1, 1831; Proc. Acad. Nat. Sci., iii., p. 24, 1846.

Solecurtus bidens Forbes and Hanley, Brit. Moll., i., p. 266, 1850.

Leguminaria floridana Conrad, Proc. Acad. Nat. Sci. Phila., iv., p. 121, 1848.

Solecurtus Carpenteri Dunker, P. Z. S., 1861, p. 426.

Mesopleura bidentata Conrad, Am. Journ. Conch., iii., App., p. 26, 1867.

Solecurtus subteres Emmons, Geol. N. Car., p. 299, fig. 228, 1858; not of Conrad, 1838.

Solecurtus equalis Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 571, 1863.

Tagelus divisus Dall, Proc. Bost. Soc. N. Hist., xiii., p. 251, 1870.

Machæra pellucida (de Gerville MS.) *et M. fragilis* Dautzenberg, Nantes et la Loire inf., Moll., p. 15, 1898.

Not *Solecurtus centralis* Sowerby, Conch. Icon., fig. 18, 1874.

Fossil in the Pliocene of the Carolinas and in the Caloosahatchie marls, Shell Creek, the Myakka River, etc., south Florida; in the Pleistocene of North Carolina and of North Beach, near Osprey, Florida. Recent from New Bedford, Massachusetts, to St. Thomas, West Indies. Adventitious on the British coast and elsewhere.

The radial rib always perceptible in normal species, in others is distinct in the young, but gradually becomes obsolete in the mature shell, showing that *Mesopleura* is the older type. When the rib is imperceptible the most obvious distinguishing characters of this species are the long nymphs and short pallial sinus. I have seen nothing older than the Pliocene, which seems referable to this species. Emmons' figure is very poor but distinctly different from *T. divisus* and, if not a young *gibbus,* may prove to be a distinct species as assumed by Conrad.

Tagelus (*Mesopleura*) *subteres* Conrad (1838), from the Pacific coast (not *subteres* Emmons), is larger than the east coast species and has the same range as *T. californianus.* The rib is entirely obsolete in the fully matured adults. It is found in the Pleistocene and also living.

Tagelus lineatus Gabb, 1881, from the Pliocene of Costa Rica, is a *Psammosolen.* There are several species of true *Tagelus* in the West Indies and southward, which should be compared with any supposed new species which may turn up.

Family SEMELIDÆ.

Genus SEMELE Schumacher.

Semele Schumacher, Essai, p. 165, 1817. Type *Tellina reticulata* Spengler, Fischer, Man., p. 1153, 1887, = *T. proficua* Pult.

Amphidesma Lamarck, An. s. Vert., v., p. 489, 1818; Bowdich, Elem. Conch., ii., p. 8, pl. 2, fig. 18, 1822. Type *A. variegata* Lam., = *Venus purpurascens* Gmelin.

The *Amphidesma* of Lamarck was a heterogeneous assembly with no type cited, the first species being *A. variegata,* which was taken to illustrate the genus by Bowdich four years later. Fortunately Schumacher had proposed *Semele* a year earlier than Lamarck with a single type, about which there is no uncertainty. The genus makes its appearance in the Eocene and is well represented subsequently up to the present fauna. It differs from *Scrobicularia,* which has a very similar hinge, by the characters of its ctenidia, which are like those of *Tellina.* The genus is divisible into two sections.

Section *Semele* s. s. Type *S. proficua* Pulteney.

Shell large, sculpture radial and concentric or oblique, reticulate, or nearly absent; chondrophore elongate, resilium large and strong, ligament external, feeble; left valve with feebler laterals, the posterior cardinal slender; right valve with well developed laterals, cardinals subequal, entire; pallial sinus large, rounded, obliquely ascending, free of the pallial line.

Section *Semelina* Dall. Type *S. nuculoides* Conrad.

Shell small, nuculiform; sculpture uniform, close, concentric; chondrophore short; left valve without distinct laterals, the dorsal margins fitting above the laterals of the right valve; left posterior cardinal absent or obsolete, the anterior cardinal bifid; otherwise as in *Semele* s. s.

The species of this section are very similar to one another, and have extended from the Oligocene through all the Tertiary horizons to the present fauna. For this reason it seems worthy of sectional rank. The characters by which the shell differs from *Semele* proper are only such as are usually correlated with diminished size.

The Eocene species are *S. linosa* Conrad, a fine, large, thin, concentrically sculptured species very much like some recent ones, but very rare at Claiborne; and *S. profunda* Conrad, also from the Claibornian, which is a small, smooth species, conchologically near to *Abra* but having the characteristic *Semele* outline. Both these species are figured on supplementary plate 19 of Harris's reprint of Conrad's " Fossils of the Tertiary Formations," but *S. profunda* has never been described.

In the Lower Oligocene (Vicksburgian) are known *S. mississippiensis* Conrad,* a smooth, very equilateral shell; and perhaps another described by Conrad from the same horizon at Vicksburg under the name of *Corbis staminea.* The fauna of the Upper Oligocene is better explored or richer in species of this group.

Semele chipolana n. sp.

PLATE 37, FIGURE 3.

Upper or Chipolan Oligocene at the base of Alum Bluff, Florida, also at Bailey's Ferry (now the county bridge) and McClellan's farm, on the Chipola River, Calhoun County, and in the Oak Grove sands at Oak Grove, Santa Rosa County, Florida.

Shell large, solid, rather inflated, nearly equilateral, slightly inequivalve; beaks low, adjacent; anterior end longer, sloping above, rounded in front and below into the arcuate base; posterior end high, bluntly rounded, subtruncate

* A specimen, apparently of this species, with the manuscript name of *S. perovata* Conrad, is in the collection of the Academy of Natural Sciences, Philadelphia.

near the base, the posterior flexure feeble; escutcheon long and narrow, lunule wider, elongate, both chiefly impressed on the dorsal edge of the left valve; sculpture of regularly spaced, numerous low, sharp, thin concentric lamellæ, with wider, microscopically radially striate interspaces; there are about fifteen lamellæ to the centimeter; hinge and other internal characters normal. Alt. 46, lat. 54, diam. 21 mm.

This fine shell is not unlike the Pliocene *S. Leana*, but the sculpture in the latter is coarser and more prominent and the valves thinner and flatter.

Semele silicata n. sp.

Plate 38, Figure 6.

Oligocene silex beds at Ballast Point, Tampa Bay, Florida; Dall.

Shell small, moderately convex, inequilateral, with low beaks; anterior end longer, evenly rounded from the lunular slope; posterior end shorter, higher, hardly folded; sculpture of numerous close-set, rounded, little elevated, concentric threads, separated by narrower grooves with no indication of radial striation; lunule and escutcheon very narrow, teeth rather strong. Alt. 20, lat. 23, diam. 8 mm.

The figure was taken from a siliceous pseudo-morph on which the sculpture was indistinct. Subsequently other specimens showing the sculpture better were obtained. It is not unlike that of *S. subovata* Say, var. *duplinensis*, but the threads are finer, closer, and more numerous.

Semele Smithii n. sp.

Plate 43, Figure 6.

Upper Oligocene of the Chipola horizon at McClellan's farm, Calhoun County, Florida; Burns.

Shell small, slightly inequilateral, thick, solid, the valves moderately convex, with a perceptible posterior fold; beaks low, small; lunule and escutcheon narrow; anterior end slightly longer, sloping above, rounded in front and on the base; posterior end higher, rounded, scarcely truncate below; sculpture of hardly perceptible incremental lines and obscure sparse radial striations, imperceptible on some parts of the shell; teeth well developed; pallial sinus obliquely ascending, rounded in front and rather shorter than usual. Alt. 19, lat. 23, diam. 7 mm.

Fragments of two valves were obtained of this interesting nearly smooth species, which is named in honor of Professor Eugene A. Smith, State Geologist of Alabama, whose valuable work on the geology of the Southern States is well known.

Semele mutica n. sp.

PLATE 43, FIGURES 2, 12, 16.

Upper Oligocene of the Chipola River, at McClellan's farm, Calhoun County, Florida; Burns.

Shell small, compressed, thin, rather elongate, with small, low, pointed beaks; anterior end slightly longer, rounded; posterior end shorter, obscurely folded and subtruncate below; sculpture variable, as follows:

Variety *Stearnsii* Dall; with few obscure concentric waves stronger about the middle of the disk; there is no radial sculpture, and the umbones have a slightly compressed appearance. (Fig. 16.)

Variety *mutica* Dall; with the waves numerous, compressed, elevated into narrow, somewhat irregular lamellæ, with wider interspaces over the whole, sharper and more crowded near the posterior dorsal slope; no radial sculpture. (Fig. 12.)

Variety *scintillata* Dall; with sculpture like either of the preceding, to which is added radial threading visible first towards the ends of the shell, in some specimens covering the whole disk with rounded radial threads with wider interspaces; in the specimens with the strongest sculpture the threads overrun the ridges, and even become nodulous towards the ends of the shell at the intersections. (Fig. 2.)

All these forms show a pretty uniform, minute, concentric threading, close and almost microscopic, most evident in the interspaces, but covering the whole surface, though often worn from the more projecting portions, such as the tops of the waves. Alt. 7.5, lat. 11.5, diam. 3.0 mm.

The variations of this pretty little shell are much greater than in any of the recent species I have seen. but it appears to be a precursor of such species as the Miocene *S. bella* Conrad and the Pliocene and recent *S. cancellata* Orbigny.

Semele carinata Conrad.

PLATE 36, FIGURES 23, 26.

Amphidesma carinata Conrad, Journ. Acad. Nat. Sci. Phila., vi., p. 229, pl. 9, fig. 23, 1830; Fos. Medial Tert., p. 37, pl. 19, fig. 7, 1838.

Sinodesmia carinata Tuomey and Holmes, Pleioc. Fos. S. Car., p. 93, pl. 23, fig. 2, 1856.

Abra Holmesii Conrad, in App. Kerr, Geol. Rep. N. Car., p. 19, pl. 3, fig. 8, 1875.

Abra carinata Conrad, Proc. Acad. Nat. Sci. Phila., xiv., p. 574, 1863.

Uppermost Oligocene of Oak Grove, Santa Rosa County, and Shoal River, Walton County, Florida (var. *compacta*); Miocene of St. Mary's County, Maryland, of the Natural Well and Magnolia, Duplin County, North Carolina, of Darlington District, South Carolina; Pliocene of the Waccamaw River, South Carolina, at Mrs. Purdy's marl bed; C. W. Johnson.

This species is of moderate size, rather compressed, with concentric waves separated by equal or wider interspaces; the waves vary from sharp edged to flattened; there is fine concentric and radial striation, feebler on a marked posterior fold and somewhat compressed, well-sculptured beaks. Conrad's *Abra Holmesii* was founded on Tuomey and Holmes's figure, but I am unable to see any discriminating characters either in specimens or figures. The figured specimen in the present work is from Oak Grove, and is characterized by a somewhat more elongated form and more uniform and close-set sculpture, especially over the posterior dorsal area. The size of those collected is also smaller than that of the full-grown Miocene specimens. It may perhaps be separated from the type as a variety *compacta*.

Besides the above, the following species are known from the Miocene and later horizons.

Semele Burnsii Whitfield.

Amphidesma Burnsii Whitfield, Mio. Moll. N. J., p. 79, pl. xiv., figs. 16-18, 1894.
Abra æqualis Whitfield, *op. cit.*, p. 80, pl. xiv., figs. 11-15, 1894; not of Say.

Miocene marl of Cumberland County, New Jersey, at Shiloh and Jericho; Burns.

This is a small, nearly smooth species, with irregular incremental lines. It has a rather inflated shell. An examination of Whitfield's types in the National Museum shows that his *Amphidesma Burnsii* was founded on an imperfect specimen of the same species as that which he had identified as *Abra æqualis* Say, but which is not Say's shell, nor an *Abra*. The other specific name must therefore be retained for this shell, which is clearly distinct from the other Miocene Semeles.

Semele alumensis n. sp.

Plate 43, Figure 4.

Miocene of the upper bed at Alum Bluff, Calhoun County, Florida; Dall and Burns.

Shell small, moderately convex, but more compressed near the posterior end; anterior end slightly longer, rounded; posterior end sloping above, with a well-marked radial fold, especially in the left valve, subtruncate obliquely, near the base, behind; sculpture of ten or twelve prominent, rounded concentric riblets separated by equal or wider interspaces, not very regularly disposed; the ribs tend to be especially prominent in the middle of the disk and to be obsolete behind the posterior fold; the surface is also concentrically striated; hinge strong, normal; beaks not prominent; pallial sinus short, rounded, ascending towards the umbo and not extending behind a vertical therefrom. Alt. 6.5, lat. 8.0, diam. 3.5 mm.

This stout, strongly sculptured little shell recalls the young of *carinata,* but is much more inflated, solid, and more coarsely sculptured.

Semele subovata Say.

Amphidesma subovata Say, Journ. Acad. Nat. Sci. Phila., iv., p. 152, pl. 10, fig. 10, 1824; Conrad, Fos. Medial Tert., p. 36, 1840.

Syndosmya subobliqua Conrad, Proc. Acad. Nat. Sci. Phila., vii., p. 29, 1854 (lapsus for *subovata*).

Abra ovalis Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 288, 1863.

Miocene of the Choptank River, Maryland; of Petersburg, Virginia; of the Yorktown beds along the York River, Virginia; and of the artesian well at Galveston, Texas, between two thousand five hundred and fifty-two and two thousand six hundred feet below the surface.

This is a common species of the Virginia Miocene, separable from the *S. carinata,* which is almost equally common, by its more oval and thinner shell, and finer, sharper, and closer concentric sculpture. The posterior dorsal area is usually conspicuously sculptured, while in *S. carinata* the tendency of the sculpture on this area is to become obsolete.

Semele bella Conrad.

Abra bella Conrad, Kerr, Geol. N. Car., App., p. 19, pl. 3, figs. 4, 6, 1875.

Miocene of North Carolina at Wilmington, and in Duplin County, at and near the Natural Well; Conrad and Burns.

This species exhibits much such a series of mutations as *S. mutica* of the Oligocene. It is nearly the shape of *S. subovata* and may be separated into three principal varieties by its sculpture:

Variety *duplinensis* Dall. This form has close set, elevated, concentric, sharp lamellæ, with no radial sculpture. Duplin County, North Carolina.

Variety *appressa* Dall. In this the concentric lamellæ are appressed to the surface, forming narrow, flattish waves, much as in *S. carinata* var. *compacta,* but more distinct, narrow, and clear cut. Duplin County, also in the Waccamaw beds, South Carolina.

Variety *bella* Conrad, s. s. In this, which (though not common, compared with the other varieties) was the form figured by Conrad, to the other sculpture is added more or less distinct radial striation or threading, as in *S. mutica* var. *scintillata*, but finer and less distinct. The concentric sculpture is sharper and more elevated than in var. *appressa*, but not lamellose, as in var. *duplinensis*, and the radial sculpture is confined almost entirely to the interspaces. This type was described from Wilmington, but occurs occasionally with the others with which it intergrades. The reticulation is feebler than in *S. bellastriata* Conr., to which it bears some resemblance.

Semele proficua Pulteney.

?*Tellina reticulata* Linné, Syst. Nat., ed. xii., p. 1119, 1767.

Tellina proficua Pulteney, Hutch. Dorset., p. 29, pl. v., fig. 4, 1799; Mont. Test. Brit., p. 66, 1803.

Tellina decussata Wood, Gen. Conch., p. 190, pl. 43, figs. 2, 3, 1815.

Amphidesma orbiculata Say, Journ. Acad. Nat. Sci. Phila., ii., p. 307, 1822; Tuomey and Holmes, Pleioc. Fos. S. Car., p. 94, pl. 23, fig. 4, 1856.

Amphidesma radiata Say, Journ. Acad. Nat. Sci. Phila., v., p. 230, 1826; Hanley, Rec. Shells, p. 342, pl. 12, fig. 8, 1856; not of Reeve, 1853.

Amphidesma jayanum C. B. Adams, Proc. Boston Soc. Nat. Hist., ii., p. 10, 1845.

Amphidesma reticulata (Chemn.) Orbigny, Moll. Cuba, ii., p. 240, 1846; Reeve, Conch. Icon. *Amphidesma*, pl. v., fig. 29, 1853.

Amphidesma subtruncatum (Sby.) Reeve, Conch. Icon. *Amphidesma*, fig. 11, 1853; Sowerby, Spec. Conch., pt. 2, *Amphidesma*, fig. 3, 1855.

Amphidesma decussata Reeve, Conch. Icon. *Amphidesma*, pl. iv., fig. 23, 1853.

Semele orbiculata Holmes, Post-Pl. Fos. S. Car., p. 51, pl. viii., fig. 9, 1858.

? *Semele radiata* Holmes, Post-Pl. Fos. S. Car., pl. viii., fig. 11, 1858; young shell.

Semele carolinensis Conrad, Am. Journ. Conch., iii., p. 14, 1867.

Semele reticulata Arango, Moll. Cubana, p. 247, 1880.

Pliocene of the Caloosahatchie River, Florida, and of the Waccamaw beds, South Carolina; Pleistocene of Simmons Bluff, South Carolina; living on the coast of the eastern United States south to the Antilles and Brazil.

This is the species which was referred to the Linnæan *Tellina reticulata* by Spengler, Schumacher, Wood, and other early writers. Linné, however, states that his species was brought from India by Tesdorf, and refers to a figure of an Amboyna species in Rumphius to illustrate it. In the absence of definite types, which do not exist, we must therefore regard Linné's species as Oriental. The next name in point of date is that of Pulteney and Montagu, who erroneously supposed the shell to be British. Say's names are later, being subsequent to that of Wood. Conrad named the figures of Tuomey and Holmes which represent the pit of the resilium as unusually large. This is a somewhat variable character in this group, and in the large series of recent specimens in the National Collection there are several undoubted examples of this species in which the pit is nearly as large as figured by Holmes. The color is also variable and northern specimens, as usual, are less brilliant and have a thicker periostracum. Quite young specimens are more transverse than those which are older, and the adults differ somewhat in outline among themselves.

Semele perlamellosa Heilprin.

PLATE 37, FIGURES 4, 5.

Semele perlamellosa Heilprin, Trans. Wagner Inst., i., pp. 92, 102, pl. 11, fig. 23, 1887.

Pliocene of the Caloosahatchie and Shell Creek, Florida; Willcox and Heilprin.

The original figure of this elegant species was taken from an imperfect specimen, and at Mr. Willcox's suggestion it has been refigured here from a more perfect example. The dimensions of a well-preserved pair are: alt. 40, lon. 55, diam. 14 mm.

Semele Leana n. sp.

PLATE 37, FIGURES 1, 2.

Pliocene of the Caloosahatchie River and Shell Creek, Florida; Dall and Willcox.

Shell large, moderately inflated, somewhat inequilateral, the anterior end longer, nearly equivalve; anterior end evenly rounded, base evenly arcuate, posterior end blunt, subtruncate, short; lunule narrow, longer on the left valve, the right valve-margin encroaching on the hinge-line in the lunular region; sculpture of feeble, flattened, small radial threads and numerous evenly distributed, rather high, concentric lamellæ, those on the posterior dorsal areas lower and forming an obtuse angle where they pass on to the disk; the edges of the lamellæ are more or less minutely crenulated by the radial sculpture; hinge normal, pit rather large, pallial sinus large, rounded, ascending, free from the pallial line except at junction. Lon. of average specimen 54, alt. 44, diam. 18 mm. An exceptionally large valve measures lon. 63, alt. 52, diam. (double) 22 mm.

This extremely fine shell is of the same general type as *S. perlamellosa,* but of different outline and proportions, as the figures show very well. It is one of the most characteristic shells of the Florida Pliocene and is not exactly represented by any of the recent species of the coast so far discovered. It is named in honor of the late Dr. Isaac Lea, one of the earliest, most careful and thorough workers on our Tertiary Paleontology.

Semele purpurascens Gmelin.

Venus purpurascens Gmelin, Syst. Nat., vi., p. 3288, No. 91, 1792; Mörch, Cat. Yoldi, ii., p. 16, 1853 (after Lister, pl. 303-304, figs. 144, 145, and Klein, Tent. Ostr., p. 157, pl. ii., fig. 57).

Tellina obliqua Wood, Gen. Conch., p. 152, pl. 41, figs. 4, 5, 1815; Dillwyn, Descr. Cat. Rec. Shells, i., p. 78, 1817.

Amphidesma variegata Lamarck, An. s. Vert., v., p. 490, 1818; Sowerby, Gen. Sh., pt. 9, fig. 1, 1821; Orbigny, Moll. Cuba, ii., p. 239, 1853.

Amphidesma obliqua Reeve, Conch. Icon. *Amphidesma*, pl. i., figs. 5 *a, b,* 1853.

Semele purpurascens Mörch, Cat. Yoldi, ii., p. 16, 1853; Krebs, Cat., p. 106, 1864; Arango, Moll. Cuba, p. 246, 1878; Mörch, Poulsen Cat. W. I. Shells, p. 14, 1878; Krebs, Cat., p. 106, 1864; not of Sowerby, Reeve, or Lamarck.

Semele ornata Gould, Otia Conch., p. 239, 1862; Tryon, Am. Mar. Conch., p. 155, 1874 (young shell).

? Semele formosum Krebs (as of Sowerby), Cat., p. 106, 1864; not of Sowerby.

Pliocene of the Caloosahatchie beds, Florida, Dall; of Costa Rica, Gabb; Pleistocene of Santo Domingo, Gabb; living in the Western Atlantic from North Carolina to Rio Janeiro.

This fine species has had a variety of names, but Mörch's identification of it with Gmelin's *Venus purpurascens* appears to be correct. The *Amphidesma purpurascens* of Lamarck, however, was founded on *Ervilia nitens* and the species so named by Reeve in the Iconica is distinct from the present one.

Semele bellastriata Conrad.

Amphidesma bellastriata Conrad, Journ. Acad. Nat. Sci. Phila., vii., p. 239, pl. xx., fig. 4, 1837; Bull. Nat. Inst., ii., p. 192, 1842.

Amphidesma cancellata Orbigny, Moll. Cuba., ii., p. 241, pl. 25, figs. 42-44, 1853 (? not of Sowerby, 1853).

Semele nexilis Gould, Otia Conch., p. 238, 1862; Tryon, Am. Mar. Conch., p. 155, 1874; Dall, Proc. U. S. Nat. Mus., vi., p. 338, 1883.

Semele cancellata Dall, Bull. No. 37, U. S. Nat. Mus., p. 62, 1889.

Semele lata Adams, Bush, Trans. Conn. Acad., vi., part 2, p. 476, 1885.

Pliocene of the Caloosahatchie River and Shell Creek, Florida, Dall and Willcox; living in the Western Atlantic and Antillean region from Cape Hatteras, North Carolina, south to Cape San Roque, Brazil, in moderate depths of water.

This elegant little shell was described by Conrad among Nuttall's Californian shells, and consequently the name has been overlooked. A careful comparison of Pliocene and recent specimens shows a practical identity of character, the only difference observable being that the recent shells would average slightly heavier. The latter are very variable in color and sculpture. There does not seem to be any *Semele lata* of Adams, and the name used by Miss Bush for this species is apparently an error of labelling.

Section *Semelina* Dall.

Semele nuculoidea Conrad.

Amphidesma nuculoides Conr., Am. Journ. Sci., vol. xli., p. 347, Oct., 1841; Fos. Medial Tert., p. 73, pl. 41, fig. 6, 1845.

Abra nuculoides Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 574, 1863; Meek, S. I. Checkl. Mio. Fos. N. Am., p. 11, 1864.

Semele nuculoides Dall, Bull. 37, U. S. Nat. Mus., p. 62, 1889.

Oligocene of Oak Grove, Santa Rosa County, Florida, Burns; also in the Miocene of North Carolina at Wilmington, and at Magnolia and the Natural Well, Duplin County; of Virginia in the Yorktown beds of the York River; Pliocene of the Caloosahatchie beds, Florida; living from North Carolina, near Cape Hatteras, southward to the West Indies and west to Pensacola, Florida.

The variety *striulata* Dall, from the uppermost Oligocene of Oak Grove, Florida, differs from the typical Miocene phase of this species by its finer and closer striation, and in most of the specimens by its more parallel-sided and elongated shell. The variety *lirulata* Dall, which is chiefly found among the recent specimens, has faint radial striation distally. The recent shells are usually whitish, but the color varies and may be yellow, red, or rayed with red; the variations of the outline are proportionately about the same as in the larger species of the genus. The remark that the lateral teeth of the hinge are obsolete shows that Conrad had only a left valve to study, as in the right valve they are strong. The pit for the reception of the resilium is not conspicuous and in slightly worn specimens it is difficult to make out. The concentric striation is somewhat sharper, and the interspaces are more elevated over the posterior dorsal slope, as usual in the genus. The largest of the Duplin County specimens measures 7 mm. long by 5 mm. high; no recent specimens have come to hand as large as this.

Semele cythereoidea n. sp.

PLATE 44, FIGURE 5.

Upper Oligocene of the Chipola River, Calhoun County, Florida; Dall.

This species, which is abundant in the Chipola marl, is much like the preceding, from which it differs by its shorter and more triangular form, like a miniature *Cytherea,* and by its very fine, close, concentric striation. In the latter feature it surpasses the Oak Grove *S. nuculoidea* var. *striulata,* which in its turn is more finely sculptured than the Miocene type, but the *striulata* is not intermediate in form, being more elongated and parallel-sided than either its ancestor or its descendant, if we may so term the Chipola and Duplin species respectively. The *S. cythereoidea* is also on the whole a smaller species than either of the others mentioned, the largest specimens among a large number measuring five millimetres long by 3.75 high and having a diameter of 1.7 mm. These differential characters with the figure will serve better to define the present species than a more elaborate description, which would merely recapitulate for the most part the characters of *S. nuculoidea.*

The *Syndosmya nuculoides* of Whitfield (Mon. Mio. N. J., p. 81, pl. xv., figs. 7-9, 1894) is not Conrad's species, nor does it belong to this genus; the specimen is an undoubted *Sportella* of the section *Fabella* Conrad..

The *Amphidesma transversa* of Say (Am. Conch., iii., 28, 1831) is not an American shell, the species being based on a specimen of *Scrobicularia piperita* which Mr. Say had been led to suppose indigenous. What the species described by Holmes under the same name (Post-Pl. Fos. S. Car., p. 52, pl. viii., fig. 10) may be, neither his description nor his figure is sufficient to determine. The *Amphidesma lepida* Say is a *Lepton* and his *A. punctata* is a *Diplodonta. A. constricta* Conrad is a *Fabella,* as is his *A. protexta. A. inequale* "Say" Conrad (Journ. Acad. Nat. Sci. Phila., vii., 153, 1834) is a lapsus for *A.* (*Abra*) *æqualis* Say.

On the Pacific coast *Semele decisa* Conrad, and *S. pulchra* Sowerby, are reported by Gabb from the Pleistocene of California (Pal. Cal., ii., p. 94, 1869).

Genus **ABRA** (Leach) Lamarck.

Abra (Leach MS.) Lam., An. s. Vert., v., p. 492 (in synonymy), 1818. First species *Mactra tenuis* Mont.

Amphidesma (sp.) Lam., *op. cit.,* p. 492, 1818; Leach, Moll. Gt. Brit., p. 278, 1852.

Ligula (sp.) Montagu, Test. Brit., Suppl., p. 96, 1808; not of Humphrey, 1797, nor Bloch, 1782.

Abra Gray, Ann. Mag. N. Hist., xx., p. 272, 1847.

Syndosmya Récluz, Rev. Zool., 1843, pp. 292, 359. Type *Amphidesma Boysii* Lam., = *Mactra alba* Wood.

Syndesmia (corr.) Chenu, Agassiz, 1846.

Orixa Leach, Moll. Gt. Brit., p. 280, 1852. Type *Mactra tenuis* Montagu; Fischer, Man. de Conchyl., p. 1152, 1887.

Dorvillea Leach, Moll. Gt. Brit., p. 286, 1852; sole ex. *D. anglica* Leach, *loc. cit.;* Jeffreys, Brit. Conch., ii., p. 444, 1863.

Scrobicularia (pars) Jeffreys, Brit. Conch., ii., p. 435, 1863.

Lutricularia Monterosato, Nom. Conch. Med., p. 28, 1884; *Erycina ovata* Phil., and *Mactra tenuis* Montagu, are cited.

Abra Risso, Hist., p. 370, 1826; *A. fragilis* and *sinuosa* Risso, cited; Monterosato, Nom. Conch., Med., p. 29, 1884.

Syndesmya Fischer, Man., p. 1151, 1887 (*S. alba* Wood).

Iacra H. and A. Adams, Gen. Rec. Moll., ii., p. 409, 1856; sole ex. *I. seychellarum* A. Adams.

Erycina (sp.) Lam., Ann. du Mus., vi., 1804; Philippi, Moll. Sicil., i., p. 12, 1836.

Shell tellinoid, with an external ligament and stronger internal resilium; one or two, often bifid, cardinal teeth in each valve, and feebly developed lateral laminæ in the right valve, sometimes obsolete; surface usually smooth, and with the periostracum often faintly iridescent, as in some Tellinas; pallial sinus discrepant in the two valves. The teeth are feeble, often more or less variable in the same species; in the trigonal species the laterals are frequently, but not always, obsolete. There seems to be insufficient ground for more than one sectional division of the genus, as follows:

Abra s. s. Type *A. tenuis* (Mtg.). Exterior smooth or faintly concentrically sculptured.

Iacra Adams. Type *A. seychellarum* Adams. Surface divaricately sculptured.

Strigillina Dunker, Mal. Bl. viii., p. 43, 1861, of which the type is *S. lactea* Dunker (*loc. cit.*) is identical with and must be regarded as an exact synonym of *Iacra*. Externally this group closely resembles *Strigilla*.

Abra nitens Lea.

Egeria nitens Lea, Contr. Geol., p. 51, pl. 1, fig. 19, 1833.

Mysia nitens Conrad, in Mort. Syn. Org. Rem., App., p. 7, 1834.

Amphidesma tellinula Conrad, Am. Journ. Sci., N. S., i., p. 397, pl. 4, fig. 5, 1846; Harris Reprint, Fos. Tert., p. 115, pl. 19, fig. 12, 1893.

Abra nitens Conrad, Am. Journ. Conch., i., p. 5, 1865; Checkl. Eoc. Olig. Foss., p. 7, 1866; Harris, Bull. Pal., i., p. 30.

Abra tellinula Conrad, Am. Journ. Conch., i., p. 5, 1865; Checkl. Eoc. Olig. Foss., p. 7, 1866.

Tellina nitens Gregorio, Mon. Claib., p. 223 (*ex parte*), pl. 35, fig. 17, 1890.

Syndesmya tellinula Cossmann, Notes Compl., p. 8, pl. 1, figs. 7-8, 1894.

Claiborne sands, at Claiborne, Alabama; Burns and others.

This little shell is a typical *Abra*, with which Conrad's *Amphidesma tellinula* is synonymous. A small species of *Tellina* of almost identical form is figured by de Gregorio under this name (pl. 35, figs. 13-16) and Cossmann has supposed that this might have been Lea's species. Lea's specimens, however, are of the *Abra,* and the *Tellina,* requiring a new name, might be called *T. Cossmanni.* Gregorio's figures erroneously represent the pallial line as entire. Conrad's second figure of his *tellinula* in Harris's reprint (pl. 19, fig. 12) is different from his original figure and is either very bad or represents some other shell.

A. nitens is the only Eocene species yet made known from the eastern United States. From the Oligocene of Vicksburg, Mississippi, Conrad has described *A. perovata* and *A. protexta.* Two others referred by him to the same genus are probably referable to *Semele* (*A. mississippiensis* and *A. staminea* Conrad); both are Vicksburgian. The following species is derived from the Upper Oligocene:

Abra triangulata n. sp.

Plate 49, Figure 4.

Oligocene marl of Bowden, Jamaica; Henderson and Simpson (rare).

Shell small, thin, polished, subtrigonal, nearly equilateral, wider than high, moderately inflated; beaks pointed, not much elevated, the dorsal margins straight, diverging at the umbo in an angle of somewhat over ninety degrees; base arcuate; anterior end slightly longer, rounded; posterior end shorter, more pointed; exterior polished; anterior dorsal margin in the right valve with a lateral tooth at some distance from the hinge-plate; on the posterior margin is a short fold not elevated to become a tooth; the left valve shows no laterals. Alt. 5.5, lat. 6.25, diam. 3.0 mm.

This species is not unlike *A. lioica* Dall, of the recent fauna, but of a more evenly trigonal outline and with the anterior part less produced.

Abra subreflexa Conrad.

Amphidesma subreflexa Conrad, Journ. Acad. Nat. Sci. Phila., vii., p. 133, 1834; Fos. Med. Tert., p. 37, pl. 19 (1st ed.), fig. 6, 1845.

Abra subreflexa Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 574, 1863.

Miocene of the York River, Virginia, Conrad and Harris; Petersburg, Virginia, Burns.

This is an elongated species, with feeble lateral teeth.

Abra æqualis Say.

Amphidesma æqualis Say, Journ. Acad. Nat. Sci., ii., p. 307, 1822; Am. Conch., iii., pl. 28, 1831; Conrad, Fos. Med. Tert., p. 76, pl. 43, fig. 9, 1845; Tuomey and Holmes, Pleioc. Fos. S. Car., p. 93, pl. 23, fig. 3, 1856.

Abra æqualis Holmes, Post-Pl. Fos. S. Car., p. 50, pl. 8, fig. 7, 1859; Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 574, 1863.

Abra nuculiformis Conrad, Am. Journ. Conch., iii., p. 14, 1867.

Not *Abra æqualis* Whitfield, Mio. Moll. N. J., p. 80, pl. 14, figs. 11-15, 1894; = *Semele* sp.

Miocene of North Carolina, near Wilmington, Stanton; of South Carolina at Goose Creek and Smith's, Tuomey; Pliocene of the Waccamaw district, South Carolina, and of the Caloosahatchie River, Florida. Living from Cape Hatteras, North Carolina, to the Gulf of Mexico in moderate depths of water.

This species varies a good deal in outline in the same locality, but southern specimens of the recent shells, especially those from Florida, have the anterior dorsal slope less rounded and the umbonal angle smaller than those from more northern localities. The fossils are generally of this type rather than like the more rounded northern recent specimens. From *A. angulata* Holmes, of the Post Pliocene of the Carolinas, *A. æqualis* is separated by the same characteristics, only more pronounced. This would indicate that the larger rounded form is correlated with water of a lower temperature. From *A. lioica* Dall, of the recent fauna, *A. æqualis* is distinguished by its less transverse and quadrate form, and also by having on the anterior right dorsal margin a long groove continuous with the hinge-plate, bordered by a ridge below, while *A. lioica* has a short, developed lateral tooth separated by a wide gap from the hinge-plate.

Abra or *Amphidesma subobliqua* Conrad (Proc. Acad. Nat. Sci. Phila., vii., p. 29) is apparently an undescribed form, or a *lapsus pennæ*. Other species in the literature which have been referred to *Abra*, especially those of Conrad (1863 and 1865), will be found treated of under the genera to which they really belong, such as *Semele, Aligena,* and *Fabella* or *Sportella.*

Genus **CUMINGIA** Sowerby.

Cumingia Sowerby, P. Z. S., 1833, p. 34. Type *C. mutica* Sby.

Mactra (sp.) Conrad, 1831.

Anatina (sp.) H. C. Lea, 1845.

Harpax Gistel, Naturg. Thierr., p. viii., 1848; not of Parkinson, 1811.

Lavignon (sp.) Orbigny, 1846, and Tuomey and Holmes, 1856.

Mikrola O. Meyer, Proc. Acad. Nat. Sci. Phila. for 1887, p. 53.

This is a well characterized genus, though intimately related to *Scrobicu-*

laria, which it seems to represent on the American coasts. It differs from the type of *Scrobicularia,* which lives in sandy places, by being found as a nestler; though never excavating burrows in hard substances, it often occupies those made by true borers, and in this way exhibits a great diversity of outline within the species, as usual with nestlers. The surface is usually fine, radially striate or sagrinate, with concentric sculpture which may be in one and the same species mere lineation or elevated lamellæ, the different mutations of sculpture frequently occurring, at different stages of growth, on the same specimen. The right valve exhibits two strong lateral teeth, the anterior one distally being often subspinose, the dorsal margins of the left valve are extended to fit in the channels above the laterals of the opposite valve, the outer surface of these extensions forming a lunule and escutcheon almost wholly confined to the left valve. There is an external ligament and strong internal, posteriorly directed resilium. The pallial sinus is deep and well marked, the siphons separate and naked, the gills as in *Scrobicularia.* The genus has its emporium on the two coasts of middle America and extends in the Pacific to Simoda, Japan. A subgenus, *Thyella* H. Adams, 1865 (not R. Desvoidy, 1863), is represented by its type, *T. elegans* Sby., in the Philippines, and a fine species, *T. Stimpsoni* Dall, in the Loochoo Islands. It differs from *Cumingia* in the absence of lateral teeth in the right valve. The genus *Montrouzieria* Souverbie has somewhat analogous hinge characters, but is not a nestler and may not be closely related to *Cumingia.* It is represented by a single species in New Caledonia. The number of species of *Cumingia* has been overestimated, owing to the variability of its characters due to the nestling habit. In the northern range of the common species of the United States on both the Pacific and Atlantic we find the shells larger and the sculpture less sparse and irregular. As we follow the species south the shells seem to diminish in average size and the lamellation becomes relatively more prominent. Thus, south of Florida the specimens never attain the size of those of the Carolinas and Massachusetts, and on the Pacific the northern specimens of *C. californica* are twice as large as those of the Gulf of California and Panama. Though the change is gradual, and I am inclined to believe all the mutations should be referred to one species, I have kept them separate here for convenience, as the extremes differ considerably.

Cumingia medialis Conrad.

Cumingia tellinoides Conrad, Fos. Med. Tert., p. 28, pl. 15, fig. 4, 1838; not of Conrad, 1831.

Anatina tellinoides H. C. Lea, Trans. Am. Phil. Soc., 3d Ser., ix., p. 237, pl. 34, fig. 12, 1845.
Lavignon tellinoides Orbigny, Prodr. Pal., iii., p. 101, 1852.
Lavignon tellinoides Tuomey and Holmes, Pleioc. Fos. S. Car., p. 92, pl. 23, fig. 1, 1856.
Cumingia medialis Conrad, Am. Journ. Conch., ii., p. 106, 1866.

Miocene of the James River, Virginia, Conrad; Petersburg, Virginia, H. C. Lea; York River, Virginia, Harris; of Duplin County, North Carolina, at the Natural Well and Magnolia, Burns; of South Carolina on the Peedee River, Tuomey.

This species is very similar to some varieties of the recent *C. tellinoides,* but differs in general in its larger size, more conspicuous socket for the resilium, less elongation and less prominent surface sculpture. The genus is said to go back to the Cretaceous, but in the American beds the only species older than the *C. medialis* is a small shell described from the Red Bluff Eocene of Mississippi by Otto Meyer (Proc. Acad. Nat. Sci. Phila. for 1887, p. 53, pl. iii., figs. 16, *a-b*) under the name of *Mikrola mississippiensis.* An examination of the type specimens of this species led to the discovery that, contrary to Dr. Meyer's diagnosis, there are well developed lateral teeth in the right valve on each side of the fossette; and the appearance of the shell confirmed the opinion that it is only a very young specimen of a species of *Cumingia* which would therefore carry the specific name of *mississippiensis.*

Cumingia tellinoides Conrad.

Mactra tellinoides Conrad, Journ. Acad. Nat. Sci. Phila., vi., p. 258, pl. xi., figs. 2-3, 1831; Am. Mar. Conch., pl. 14, fig. 2, 1831; not of Conrad, 1838, ex Miocene.
Cumingia borealis Conrad, Am. Journ. Conch., ii., p. 76, 1866.
Cumingia tellinoides Holmes, Post-Pl. Fos. S. Car., p. 53, pl. 8, fig. 12, 1859; Verrill, Am. Journ. Sci., 3d Ser., x., p. 371, 1875; Dall, Bull. U. S. Nat. Mus., No. 37, p. 62, pl. 56, fig. 14, 1889.

Pleistocene of Sankoty Head, Massachusetts, Verrill, and of Simmons Bluff, South Carolina, Holmes and Burns. Recent from Prince Edward Island south to Florida and, if the following form be regarded as conspecific, to Northern Brazil.

Cumingia coarctata Sowerby.

Cumingia coarctata Sby., P. Z. S., 1833, p. 34 (not of Cpr.).
Lavignon antillarum Orbigny, Moll. Cubana, ii., p. 236, pl. 25, figs. 36-38, 1846.
Lavignon Petitiana Orbigny, *op. cit.,* p. 236, pl. 25, figs. 33-35.
Cumingia antillarum A. Adams, P. Z. S., 1850, p. 24.
Cumingia fragilis A. Adams, P. Z. S., 1850, p. 25, pl. 8, fig. 7.

Cumingia sinuosa A. Adams, P. Z. S., 1850, p. 25, pl. 8, fig. 6 (*sinuata* in legend to plate).
Cumingia tenuis H. and A. Adams, Gen. Rec. Moll., ii., p. 412, 1854.

Pliocene of the Caloosahatchie beds, Florida; Dall. Recent from the Florida Keys throughout the Antilles to the Bay of Caraccas, and probably to northern Brazil.

This form appears to grade into *C. tellinoides,* from some of the young of which it cannot be distinguished by shell characters. It is also essentially like the Pacific coast *C. lamellosa* Sby., with which Carpenter even united it. *C. lamellosa* bears to *C. californica* Conr. the same relation which *C. coarctata* does to *C. tellinoides.* The fact remains, however, that, notwithstanding the northern specimens of *coarctata* appear to merge into the southern type of *tellinoides,* no specimens of typical *tellinoides* have been seen from the West Indian region; just as on the Pacific side no specimens of typical *C. californica* are known from the region east and south of Cape St. Lucas. The two forms in each case are perhaps to be regarded as subspecies of a common descent, modified by differences of temperature and food, or, as we formerly expressed it, "geographical races."

Cumingia californica Conrad.

Cumingia californica Conrad, Journ. Acad. Nat. Sci. Phila., vii., p. 234, pl. 17, fig. 12, 1837.
Cumingia similis A. Adams, P. Z. S., 1850, p. 24, pl. viii., fig. 4; Sby. in Reeve, Conch. Icon. *Cumingia,* pl. 2, fig. 13, 1873.

Pliocene of San Diego (?); Hemphill. Pleistocene of California at Santa Barbara and San Diego. Recent from Crescent City, California, south to Cape St. Lucas. Also received from Simoda, Japan, collected by W. Stimpson.

Cumingia lamellosa Sowerby.

Cumingia lamellosa Sby., P. Z. S., 1833, p. 34.
Cumingia trigonularis Sby., P. Z. S., 1833, p. 34.
Cumingia coarctata Cpr., P. Z. S., 1863, p. 367; not of Sby.

Pleistocene of Lower California, at Todos Santos Bay. Recent, from the Gulf of California south to Payta, Peru.

The other west coast species of Cumingia which are recognizable as such are: *C. mutica* Sby. (1833, + *C. grandis* Desh. 1856, + *C. ventricosa* Sby., 1873), the largest species and type of the genus, from Chile and Peru; *C. Cleryi* A. Adams (1850), a species said to be smooth and polished, from Chile; and *C. striata* A. Adams (1850, + *C. Adamsi* Cpr., 1863), from Chile to the Gulf of California, a small, arcuate species with fine, crowded sculpture.

Family TELLINIDÆ.

Having eliminated *Sanguinolaria* and its allies from this family, and omitting a discussion of the ill-known groups referred here by Conrad from among his Cretaceous types, the remainder forms a very compact and natural group, in which the following genera may be recognized:

A. WITH LATERAL TEETH.

Genus *Tellina* (Linné) Lamarck, 1799. Type *T. virgata* Linné.

Genus *Tellidora* (Mörch MS.) H. and A. Adams, 1856. Type *T. Burneti* Broderip and Sowerby.

Genus *Strigilla* Turton, 1822. Type *T. carnaria* Linné.

Genus *Metis* H. and A. Adams, 1858. Type *T. Meyeri* Dunker.

B. WITHOUT LATERAL TEETH.

Genus *Gastrana* Schumacher, 1817. Type *T. fragilis* Linné.

Genus *Macoma* Leach, 1819. Type (*M. tenera* Leach, =) *T. calcarea* Gmelin.

All the above have two cardinal teeth in each valve when perfect. The posterior left cardinal in *Phylloda, Tellidora,* and *Strigilla* is an extremely thin lamina, attached to the anterior face of the nymphal callosity, above which it rises. In opening the valves the free part of this lamina—which fits into an extremely narrow chink in the right valve between the large bifid cardinal and the nymph—is in *Strigilla* usually broken off even with the top of the callosity, leaving no traces of its existence except a slight roughness which disappears entirely in slightly worn valves. By careful search I have never failed to find it. In *Metis* (*alta* Conr.), usually described as without laterals, I have found a minute distant posterior left lateral, though in most of the species there is no trace of this lamina, unless in the young shells.

With a view of testing the constancy of the various characters which have been used as a basis for sectional divisions in the *Tellinidæ,* I went over all the recent species in the Museum and tabulated the features of each species as regards lateral teeth, coalescence or freedom of the ventral part of the pallial sinus, thickened radii internally, etc. The only differences found throughout the family in the cardinal teeth, of which the number is invariable, were those of size and in the grooving of the central cardinals. A very few species after careful inspection showed no grooving, but in nearly all cases unworn specimens indicate a perceptible groove. I have been forced to the conclusion that the amount or absence of coalescence with the pallial line of the ventral part of the pallial sinus is a character of minor value. Even within the species it is not absolutely constant, though mainly so. Physiologically, as I have already pointed out, it has very little significance. In general the tendency to coalescence increases with the progress of geological time, but even in the Eocene there are species with wholly coalescent scars. In a general way species which would be placed together on other grounds have similar sinus characters, but there are so many exceptions to this that no rule can be said to be established.

In this group, as in the gastropods, singular as it may appear, the characters of the external sculpture seem to be among the most permanent features in an evolutionary series from the Eocene to recent times. All of the groups approach each other closely, through peripheral species, in this as in other features.

A careful examination of the hinges of a large number of species indicates that the lateral laminæ are prone to become obsolete in all the forms where they are not actively functional. The right anterior lateral when adjacent to the cardinals is invariably functional, which may account for its exceptional constancy. In species where a lateral is represented only by an almost microscopic ridge or pustule it becomes difficult to decide on its diagnostic use. One cannot say the species has no laterals, although they are obsolete, and it sometimes happens that species, closely allied by other characters, differ in the state of the laminæ, so that if these organs were functional the discrepancy is such as ordinarily would be taken to be of sectional or subgeneric value.

In my diagnoses of groups I have described as carefully as I could the characters of the type species, but it will frequently happen that the forms which it seems necessary to associate with the type do not correspond in all minor details with the diagnosis. I cannot bring myself to think that a named subdivision for each of these fluctuations would correspond to any important series of facts or be of real service to students; indeed, I have found the multiplication of ill-defined and insufficiently compared subgenera, sections, etc., in much of the later literature a real impediment to study.

Realizing the difficulties, and that I can hardly hope to surmount all of them to the satisfaction of everybody, I have tried at least to make my statements correspond with what I have seen in the specimens, and have not troubled myself overmuch as to whether this agreed with antecedent literature or not; except that, when I found a disagreement, I have taken the precaution to review my work at intervals and again compare with the specimens. If any reader feels disposed to criticise the result, my only request is that before formulating his dissent he should carefully investigate, not manuals and text-books, but a good series of correctly identified specimens.

I may add that while certain Tellinas have all their lateral laminæ nearly or quite obsolete, they do not thereby become Macomas. *Macoma* seems to be a very natural group in which there never were any laterals developed, and not one which has possessed and subsequently lost them.

Genus **TELLINA** (Linné) Lamarck.

< *Tellina* Linné, Syst. Nat., ed. x., p. 674, 1758; ed. xii., p. 1116, 1767; Gmelin, Syst. Nat., p. 3228, 1792; Cuvier, Tabl. élém., p. 426, 1798.

Tellina Lamarck, Prodrome, p. 84, 1799; *Tellina virgata* L.; Syst. An. s. Vert., p. 124, 1801; *T. radiata* L.

< *Angulus* Muhlfeldt, Mag. d. Ges. Naturf. freunde zu Berlin, v., p. 47, 1811; *T. lanceolata* L. and *T. virgata* L.

> *Tellinella* "Gray, 1852," Mörch, Yoldi Cat., ii., p. 13, 1853; H. and A. Adams, Gen. Rec. Moll., ii., p. 394, 1856; Stoliczka, Cret. Pel. India, p. 116, 1871.

> *Musculus* Mörch, Yoldi Cat., ii., p. 13, 1853; not Raf., 1818.

> *Liotellina* Fischer, Man. de Conchyl., p. 1147, 1887; *T. radiata* L.

> *Peronæoderma* Mörch, Yoldi Cat., ii., p. 12, 1853; not of Poli, 1795; *T. polita* Poli.

Eutellina Fischer, Man. de Conchyl., p. 1147, 1887.

> *Arcopagia* Leach, in Brown, Ill. Conch. Gt. Brit., p. ii., pl. 16, fig. 8, 1827; *Tellina crassa* Mont.

> *Cydippe* Leach, Moll. Gt. Brit., p. 314, 1852; *Tellina crassa* Mont.

> *Omala* Schumacher, Essai, p. 128, 1817; *Tellina hyalina* Gmelin.

> *Homala* Agassiz, Nomenclator, Index, p. 744, 1848; Mörch, Cat. Yoldi, ii., p. 11, 1853; *Tellina triangularis* Dillwyn.

> *Phylloda* Schumacher, Essai, p. 148, 1817; *Tellina foliacea* Linné.

> *Tellinides* Lamarck, An. s. Vert., v., p. 535, 1818; *Tellina timorensis* Lam.

> *Eurytellina* Fischer, Man. de Conchyl., p. 1147, 1887; *T. punicea* Born.

> *Homalina* Stoliczka, Cret. Pelec. India, p. 118, 1871; *Tellina triangularis* Dillwyn; Cossmann, Cat. Illustr. Eoc. Paris, p. 74, 1886.

> *Quadrans* Bertin, Nouv. Arch. du Mus., 2me Sér., i., pp. 229, 266, 1878; *Tellina gargadia* Linné.

> *Peronæa* Stoliczka, Cret. Pelec. India, p. 119, 1871; *Tellina planata* (Linné) Poli; not *Peronæa* Poli, 1791, = *Psammotella* Lamarck.

> *Palæomoera* Stoliczka, Cret. Pelec. India, p. 116, 1870; *Tellina strigata* Goldfuss.

> *Fabulina* Gray, Brit. Moll. and Brach., p. 40, 1851; *Tellina fabula* Gron.

> *Moera* H. and A. Adams, Gen. Rec. Moll., ii., p. 396, 1856 (= *Donacilla* Gray, 1851; not of Lam., 1812, or Philippi, 1836); not *Moera* Leach, Crust., 1815.

?*Lincaria* Conrad, Journ. Acad. Nat. Sci. Phila., iv., p. 279, 1860; *L. metastriata* Conr.

> *Moerella* Fischer, Man. Conchyl., p. 1147, 1887; *T. donacina* Linné.

> *Homala* Fischer, Man. Conchyl., p. 1148, 1887; *T. hyalina* Gmel. (= *Omala* Schum.); not *Homala* Mörch, 1853.

> *Pseudarcopagia* Bertin, Nouv. Arch. du Mus., Paris, 2me Sér., i., pp. 229, 264, 1878; *Tellina decussata* Lamarck.

?*Liothyris* Conrad in Kerr, Geol. Rep. N. Car., App., p. 9, 1873, not of Douvillé, 1880.

> *Donacilla* Gray, List Brit. An., Moll., p. 39, 1851; *Tellina donacina* Linné; not *Donacilla* (Lam.) Philippi, 1836.

> *Maera* H. and A. Adams, Gen. Rec. Moll., i., index, p. xxvii., 1856; not *Maera* Leach, *Crust.*, 1813.

> *Elliptotellina* Cossmann, Cat. Illustr. Eoc. Paris, p. 58, 1886. Type *Tellina tellinella* Lamarck.

> *Macaliopsis* Cossmann, Cat. Illustr. Eoc. Paris, p. 63, 1886; *Tellina Barrandei* Desh.

> *Cyclotellina* Cossmann, Cat. Illustr. Eoc. Paris, p. 67, 1886; *Tellina lunulata* Lamarck.

> *Arcopagiopsis* Cossmann, Cat. Illustr. Eoc. Paris, p. 69, 1886; *Tellina pustula* Deshayes.

> *Oudardia* Monterosato, Nom. Conch. Medit., p. 22, 1884; *T. compressa* Brocchi; Cossmann, Cat. Ill., p. 75, 1886.

> *Tellinula* Auct., Bucquoy, Dautz, et Dollf. Moll. Mar. Roussillon, ii., p. 654, 1898. Type *Tellina fabula* Gronovius.

In discussing the synonymy of this genus it is first of all necessary to eliminate from consideration the authors who were not consistently Linnean in their nomenclature, such as Chemnitz, who was frankly polynomial, and Poli, who organized for himself a unique quadrinomial system in which the shell and animal had each a separate generic and specific name. Thus simplified, the genus *Tellina* of Linné is recognizable as obviously heterogeneous according to modern ideas. The first author to name a type for it was Lamarck in 1799. The species selected by him was *T. virgata* Linné. The first author to subdivide the genus was Megerle von Mühlfeldt, in 1811, who divided the Linnean Tellens into two groups, one containing all the elongated and rostrate species, and the other the suborbicular species. His genus *Angulus,* proposed for the former group, is thus synonymous with the group indicated as typical *Tellina* by Lamarck. Megerle's first species was a peculiar compressed and acute form, *T. lanceolata,* for which, with its allies, his name has been retained in an amended and restricted sense. In 1817 Schumacher proposed *Omala, Phylloda,* and *Gastrana* for peculiar forms of *Tellina,* and Lamarck proposed *Tellinides* in the following year for a form with a single adjacent lateral which he took for a third cardinal tooth. Leach followed with *Arcopagia* and *Macoma,* and subsequent authors have proposed numerous subdivisions, chiefly on characters of very small physiological importance. A favorite basis has been the coalescence of the siphonal retractor scars with the basal part of the pallial impression. Such characters, convenient for sections when constant, in a genus containing numerous species, should not be taken too seriously; as the moving of the ventral part of the retractile apparatus a fraction of an inch with respect to the points of attachment of the pallial margins is surely not of much weight. A matter which has greatly added to the difficulty of clearing up the synonymy is the reckless manner in which authors who in other respects have done excellent work have disregarded all rules of nomenclature and have altered, consolidated, and proposed new names with apparently no consideration of the mischief they were doing or the difficulties created for other workers by such conduct.

The hinge of *Tellina* in the broad sense, when developed to the fullest extent, comprises on each valve an anterior and posterior lateral and two cardinals, of which one is grooved or bifid on its distal edge. When the valves are closed the two bifid teeth are central and the simple teeth are respectively anterior and posterior to them. Normally the teeth of the right valve close in in advance of the teeth of the left valve, and in the obsolescence of the laterals those of the left valve disappear first. The simple cardinal of the left valve is often very close to and hardly distinguishable from the anterior part of the nymphal callosity, and, owing to its fragility, is often broken off at the base, leaving hardly a trace, from which circumstances proceed the erroneous diagnoses so common in the literature which ascribe a single left cardinal to sundry species or groups of Tellinas. No *Tellina* is without two cardinal teeth in each valve and at least one (anterior) lateral tooth in the right valve, unless it has been deprived of these parts by erosion, fracture, senility, or abnormal growth.

It occasionally happens that the hinge of an individual will be reversed with respect to the valves of normal specimens, but I have found no species in which the hinge is habitually reversed. The laterals are stated by Bernard to appear independently of and later than the cardinals, and in those species where the laterals are distant from the cardinals they do not develop from the shank of a ⌐-shaped nepionic tooth, as do the laterals of many Teleodont bivalves. I am inclined to believe, however, that the so-called "adjacent" laterals may arise in the above-mentioned manner, as they often appear to retain some connection with the anterior cardinal, and, in fact, have been described by several authors as cardinals. In the subgenus *Omala* the adjacent lateral is so close to the cardinals and so like them that it is not surprising that it has been taken to belong to the cardinal series.

The distant laterals, as in *Cardium* and *Lucina,* arise independently and later. They are often not functional and naturally become obscure and sometimes obsolete. It is often difficult to say whether the projecting callosity at the distal end of a nymph should be regarded as a lateral or not, and it often happens in inequivalve species that the functions of a lateral lamina are performed by an evenly callous projecting portion of the valve margin, not differentiated into a recognizable lamina. I have regarded such hinge margins as not constituting laminæ in making up my formulæ. It often happens that the non-functional laminæ are reduced to very small dimensions only visible on close study and easily overlooked, whence such cases arise as in the genus *Metis,* of which some species still retain (as in *M. alta* Conr.) a minute obsolete lateral under the nymph, while others (*M. interstriata* Say) have entirely lost it. I have not found in the literature a single case where the diagnostic characters given for the various groups are uniformly correct in describing the hinges. The teeth are subject to differences correlated with age. To obtain an accurate idea of the cardinals it is often necessary to examine specimens in the adolescent stages, as the teeth become in some cases crude and irregular in adults, besides suffering from erosion. The bifid teeth are not, as Noëtling has apparently assumed, due to the coalescence of two originally distinct lamellæ, but the accretions to the teeth, being deposited by distinct proliferations of the dorsal mantle-border, are naturally less profuse along the line where two adjacent proliferations meet each other, and a groove results. The lateral laminæ, on the other hand, are usually better developed in the older individuals and sometimes wanting in the young.

The ligament varies from extremely long and narrow, as in *Phylloda,* to short and high, as in some species of *Angulus.* The nymphs are usually larger and more prominent in thin shells with short ligaments; subcircular species always have a short ligament. The resilium is usually enclosed in the hemicylindric ligament. In some forms, however, as *Metis* and *Tellidora,* the resilium is much shorter than the ligament and evinces a tendency to become internal, as in the *Semelidæ.* In such instances it is notably thicker, especially towards the beaks. There is in a few forms, like *Macalia,* a tendency towards an amphidetic area, and over this is frequently concentrated a certain amount of dark periostracum, presenting an appearance as if the ligament proper extended in front of the beaks. Mr. E. A. Smith called attention to this in his report on the Challenger *Pelecypoda,* instancing *T. donacina* as an example. I have not, however, been able to satisfy myself in any instance that any portion of the true ligament extends forward of the beaks in *Tellina,* except in cases where erosion has set up a diseased condition, nor that the resilium has become separated from the ligament to form an internal and distinct bond between the valves, as in *Semele* or *Abra.*

The valves of many species, especially compressed and thin forms, are often strengthened by a deposit of shell-material in radial lines, which generally pass from the beaks towards the margin behind the anterior adductor scars, and less frequently in front of the posterior scars. In the cases I have noted of the latter kind there is a tendency to form two adjacent small rays (as in *T. fabula* Gronovius), while the anterior radii are usually single and stronger (*T. compressa* Brocchi). The radii are sometimes well defined (as in the species last mentioned), but quite frequently they have only one well-defined margin. All stages intermediate may be observed in a large collection of species.

The posterior adductor scars in *Tellina* are generally rounded, the anterior ones longer and narrower. The scar of the mantle attachment is usually parallel to the margin of the valves. The scar of the sinus or impression of the siphonal retractors is quite variable. In some species the sinus is quite free, ventrally, from the pallial line; in the majority the two are more or less coalescent, and in still others the dorsal portion of the line extends from one adductor scar to the other. These may have the ventral portion absolutely coalescent with the pallial line throughout, as in *Strigilla* (*sincera,* Hanl.), or from the adductor scar the siphonal line may run downward and backward, enclosing a small triangular space between the pallial and siphonal lines and the scar of the anterior adductor. Still another state occurs in which the sinus may not reach forward, even near to the adductor, but from the latter to the anterior part of the bight of the sinus a line of attachment extends (as in *T. scobinata* L.), leaving a distinct scar. This is probably connected with some reinforcement of the retractor muscles of the siphons. It is not common to all the species of *Arcopagia,* does not occur in *T. crassa,* for instance, which is much the same shape as *T. scobinata,* nor is it confined to rounded species, since the elongated *T. Antoni* Phil. exhibits it. I have called this a case where the sinus is "linked" to the adductor.

I have not found the details of the disposition of the scar of the sinus very constantly correlated with the other characters of the shell, and in the Macomas a notable amount of variation may occur within the species. As I have elsewhere observed, its physiological importance cannot be very great and caution should be used in basing systematic subdivisions on this character alone.

The exterior sculpture of the Tellinas is emphatically concentric. Though fine radial sculpture often exists, it does not, except in the section *Pseudarcopagia,* rival the concentric sculpture in strength. There is no known species with only radial sculpture. Oblique or angular sculpture is rare. The posterior end of the shell is usually flexed to the right and exhibits one or more folds of greater or less prominence. Occasional marked inequality of the valves is observable, and the culmination of the surface sculpture as it passes over the ridges which radiate from the beaks towards the end of the valves sometimes results in elegant lamelliform prominences.

The characteristics of the soft parts have been already mentioned (p. 553), the foot is sometimes (*Psammacoma*) modified to serve as a stilt or anchor, much as in Yoldia, and the siphonal tubes are long and naked. The supposition of Fischer, that in *Macoma* the branchial siphon is much shorter than the anal one, is incorrect. Deshayes has indeed figured a species with this character (which was perhaps due to mutilation), but the common typical Macomas do not show any such feature; in them, as in most bivalves, the anal siphon is shorter. If we symbolize the left valve by L, the right by R, the laterals by l, the simple cardinals by 1, the bifid cardinals by ½, the resilium by c, and indicate distance from or adjacency to the cardinals by the signs — and + respectively, the normal formula for the hinge of a fully developed *Tellina* will be $\frac{\mathrm{L}\ l - 10\frac{1}{2}0 - l}{\mathrm{R}\ l - 0\frac{1}{2}01 - l}$, the ciphers standing for the gaps into which the teeth enter when the valves are closed. In the subgenus *Angulus,* which has a single adjacent lateral in the right valve, possibly of different origin from the distant laterals of typical *Tellina,* the formula will be $\frac{\mathrm{L}\ \ 10\frac{1}{2}0}{\mathrm{R}\ \ 0\frac{1}{2}01 + l}$, the right hand end of the formula in all cases corresponding to the anterior end of the hinge. I insert the symbol for the resilium only when it is subinternal.

The following subdivisions are recognizable in the genus *Tellina:*

A. With two lateral laminæ in each valve, those in the left valve always less strong.

Subgenus *Tellina* (Lam.) s. s. Type *T. virgata* Linné.

Valves sculptured externally, the concentric sculpture stronger; somewhat compressed, ovate trigonal, subequivalve, with a more or less distinct ridge from the beaks towards the lower posterior angle; subequilateral, porcellanous, often elegantly colored, the periostracum hardly visible; the umbonal radii internally inconspicuous or absent, the shell margin entire, the siphonal sinus more or less coalescent below with the pallial line.

Angulus Megerle, 1811, *Tellinella* "Gray" Mörch, 1852, and *Eutellina* Fischer, 1887, are synonymous. The group is a denizen of the warmer seas. The following groups may for convenience be regarded as of sectional rank:

Section *Liotellina* Fischer, 1887 (*Musculus* Mörch, 1853, non Rafinesque, 1818). Type *T. radiata* Linné.

Valves externally smooth, elongated, and convex, the left lateral laminæ feeble or obsolete. Tropical.

Section *Macaliopsis* Cossmann, 1886. Type *T. Barrandei* Desh. of the Parisian Eocene.

Shell resembling *Tellina* proper, but usually smaller, more compressed, and not brightly painted, most of the species being nearly white, with no color pattern, but only a delicate suffusion, when colored at all; hinge and sinus as in *Tellina;* external sculpture concentric, frequently sharp and with a fine radial striation. Eocene to recent seas, especially of the warm temperate region.

This group presents little in the way of salient diagnostic characters, but is a very natural one, ancient geologically and widespread. Species with rounded form and obsolete fold form the section *Arcopagiopsis* Cossmann.

Section *Arcopagella* Meek, 1871. Type *A. mactroides* Meek, Upper Cretaceous of Dakota.

This form has the form and sculpture of *Moerella,* and the sinus of *Arcopagia.*

Section *Herouvalia* Cossmann, 1892. Type *H. semitexta* Cossmann. Parisian Eocene.

Shell small, subequilateral, moderately convex, with a posterior truncation but no fold; hinge as in *Tellina;* sinus squarish in front, partly confluent below; the nymphs short and the bifid cardinals rather long and thin; the lunule and escutcheon very narrow, well marked, and deeply impressed; the external sculpture is mainly concentric with rays towards the ends which reticulate the former.

This little shell is very close to *Linearia,* a subgenus of *Tellinidæ* described by Conrad from the Upper Cretaceous in 1875. The type of *Linearia* externally resembles *Semele cancellata,* the hinge has a well-marked nymph, and its chief peculiarity is in the lengthening of the bifid cardinals. The present section differs by its greater convexity, more marked posterior truncation, and shorter cardinals. *Herouvalia* is also very close to *Elliptotellina,* which has less developed laterals and an evenly rounded posterior end. I may add that *Liothyris* Conrad (not Douvillé), described as a subgenus of *Linearia,* is quite distinct, and its connection with any of the *Tellinidæ* is very doubtful.

B. With two lateral laminæ in the right valve, one or both of those of the left valve absent or obsolete.

Subgenus *Elliptotellina* Cossmann, 1886. Type *Tellina tellinella* Lamarck.

Shell small, subequilateral, convex, with the extremities rounded, the posterior not compressed or folded; hinge with a moderate nymph and ligament, two laterals in the right valve, none in the left; sinus free, short, rising obliquely from the pallial line; external sculpture concentric with a tendency to reticulation near the ends by radii from the umbones. Lower Eocene of Paris to recent fauna.

This remarkable little shell resembles an *Ervilia* externally, and is quite destitute of some of the most characteristic features of *Tellina,* to which it is linked by *Herouvalia,* which has a more fully developed hinge and posterior truncation. Recent species occur in the warm temperate waters of both coasts of North America.

Subgenus *Pseudarcopagia* Bertin, 1878. Type *Tellina decussata* Lamarck.

Shell subequilateral, moderately convex or somewhat compressed; the extremities rounded, with no flexure; hinge with two right but no left laterals; valves rounded or ovate; sinus high, partly confluent below; external sculpture reticulate. Tropical, especially Austral seas.

These forms make a strong contrast with the other Tellinas, owing to their conspicuously reticulate sculpture, in which the radial element is not markedly feebler than the concentric and may be even stronger. Such species as *T. pretiosa* Deshayes recall Conrad's *Linearia,* from which they differ in their normal cardinals.

Subgenus *Arcopagia* (Leach), 1827 (+ *Cydippe* Leach, 1852), 1827. Type *Tellina crassa* Pennant.

Shell large, solid, rounded, moderately convex, the flexure obsolete; posterior left lateral absent, and the anterior obsolete, other teeth normal; sinus free, ascending obliquely; internal radii thick and strong but ill defined; sculpture concentric, usually smoothish or not sharply lamellate, sometimes reduced to incremental lines. Warm, temperate, and tropical seas.

The chief feature of this group is the free sinus, but this in species otherwise closely allied becomes more or less confluent.

Section *Cyclotellina* Cossmann, 1886. Type *Tellina lunulata* Deshayes.

Shell with the shape and sculpture of *Arcopagia,* the anterior left lateral sometimes present (as in the type), the sinus more or less confluent below, anterior and posterior radii more or less developed. Lower Parisian Eocene to recent in the warmer seas.

This group may perhaps be extended to include most of the large rotund species which have erroneously been referred to *Arcopagia,* such as *T. fausta, remies,* and *discus,* which have a partially confluent sinus, often linked to the anterior adductor scar by a linear scar, but in other respects agreeing with *Arcopagia. Arcopagiopsis* Cossmann has the fully developed hinge of *Tellina* and sharp sculpture, allying it more closely to the section *Macaliopsis,* from which it can hardly be separated.

Section *Merisca* Dall, 1900.

This group comprises more or less trigonal, usually rather convex shells, of small or moderate size, with lamellose concentric sculpture, and often fine radial striæ in the interspaces; there is a narrow but sharp posterior flexure; the laterals of the right valve are strongly developed, but the left valve is without lateral teeth, its margin fitting above the laterals of the opposite valve; the pallial sinus is ample, frequently wholly confluent below, and always largely confluent, the dorsal portion often represented only by a line connecting the adductors.

These shells are related to *Macaliopsis,* from which they differ by the absence of lateral teeth in the left valve; to *Moerella,* from which their sculpture and posterior fold separate them; and to *Pseudarcopagia,* which is not rostrate and has no fold, while its radial sculpture is more conspicuous. The recent species are usually pale, without color markings, or white, and inhabit the warmer seas.

Section *Phyllodina* Dall, 1900. Type *Tellina squamifera* Deshayes.

Shell elongate, inequivalve, with a sharp concentric sculpture rising into leaflets along the dorsal border; fold conspicuous; hinge with well-marked right laterals and a feeble anterior left lateral, distant from the cardinals; sinus short, ascending, blunt behind and free below from the pallial line as in *Arcopagia;* interior without thickened radii. Oligocene to recent.

This elegant shell, described from a single specimen of unknown habitat, has erroneously been referred to Chinese seas, but is now known to be American. Its characters recall *Phylloda* and it can hardly find a place in other sections, especially as it has several fossil representatives.

Section *Eurytellina* Fischer, 1887 (*Peronæoderma* Mörch, 1853, non Poli, 1795). Type *T. punicea* Born.

Valves compressed, flexure obsolete or absent, the surface feebly concentrically sculptured, a radial rib behind the anterior adductor scars, the left posterior lateral lamina obsolete or absent, the anterior laterals adjacent, the pallial sinus close to or touching the anterior adductor scar and (in the type) wholly coalescent below with the pallial line. Tropical and warm temperate seas.

Section *Scrobiculina* Dall, 1900. Type *Scrobicularia viridotincta* Carpenter.

Valves thin, flexuous behind, feebly sculptured; hinge with the anterior right lateral subapproximate, the other laterals feebly developed; resilium short, deep, internal on the excavated hinge-plate; radii feeble or absent, the sinus moderate, confluent below.

Differs from *Metis* by its regular Tellinoid shape and better developed hinge.

Section *Quadrans* Bertin, 1878. Type *T. gargadia* Linné.

Valves as in *Eurytellina*, but bluntly truncate behind, externally sculptured with oblique grooving; sinus as in *Eurytellina*, hinge with the left laterals both obsolete. Recent warmer seas.

Section *Tellinides* Lamarck, 1818. Type *T. timorensis* Lamarck.

Shell compressed, equivalve, with no flexure or sharp truncation, a single approximate anterior lateral, no internal thickened radii, the sinus coalescent below, the external sculpture feeble.

This group was proposed with generic rank by Lamarck owing to his misinterpreting the adjacent small lateral as a third cardinal tooth. It differs from *Quadrans* by the absence of the posterior right lateral and of the external oblique grooving. Recent warm seas.

Subgenus *Phylloda* Schumacher, 1817. Type *Tellina foliacea* Linné.

Shell large, compressed, with a very long ligament, the nepionic valves undulate, the adults delicately, chiefly concentrically, sculptured; posterior dorsal margin convex and more or less dentate; hinge with the laterals very small or obsolete; a minute right anterior and usually a feeble left anterior may be traced close to the cardinals; sinus, more than half free from the pallial line below, linked by a lineal scar to the anterior adductor scar. Tropical.

Subgenus *Moerella* Fischer, 1887. (+ *Moera* Adams, 1856, non Leach, 1815; + *Maera* Adams, 1856, non Leach, 1813; + *Donacilla* Gray, 1851, non Lamarck, 1812). Type *Tellina donacina* Linné.

Shell small, compressed, hardly folded, acute behind, rounded in front, with feeble concentric sculpture; left laterals obsolete; no interior radii; the sinus long, coalescent with the pallial line below. Eocene to recent seas.

This little group is closely related to the smaller forms of *Angulus,* but has the laterals better developed and is without internal radii. It forms the transition from the forms previously considered towards *Angulus.* There is a distinct posterior lateral in the right valve, and an obsolete anterior lateral may sometimes be detected in the left valve.

C. Hinge with a strong right anterior lateral, closely adjacent to the cardinals, the left laterals absent, the posterior right lateral obsolete.

Subgenus *Angulus* Megerle (em.), 1811. (+ *Fabulina* Gray, 1851, + *Tellinula* (sp.) auct.). Type *Tellina lanceolata* Linné.

Shells elongated, variable in size but chiefly small, compressed, with the posterior end angularly pointed and not twisted, the surface smooth or with fine concentric sculpture; nymphs short and prominent, the ligament short; hinge with a single adjacent lateral well developed in the right valve anteriorly; internally a thickened ray passes from the umbo just behind the anterior adductor scars and one or two narrower similar rays in front of the posterior adductors, often stronger in the left valve, the posterior rays sometimes obsolete; sinus largely or wholly coalescent with the pallial line below. Eocene to recent.

Section *Angulus* s. s. Surface smooth or finely concentrically striated, internal radii ill defined.

Section *Scissula* Dall, 1900. Surface with fine oblique grooving, not in harmony with the incremental lines. Type *Tellina decora* Say.

These forms constitute a well-defined and perfectly recognizable group.

Section *Oudardia* Monterosato, 1885. Type *Tellina compressa* Brocchi.

This group differs from *Angulus* s. s. only in having the anterior radii internally, strong and well defined. The type has oblique external grooving which is wanting in other species.

Section *Peronidia* Dall, 1900 (*Peronæa* Mörch, 1853; not *Peronea* Curtis, 1824, nor *Peronia* Blainville, 1824). Type *Tellina albicans* Gmelin (*nitida* auct.).

Shell without laterals, having the internal characters of *Angulus* s. s. and the external appearance of *Eurytellina*. Tertiary and recent.

Subgenus *Omala* Schumacher, 1817 (+ *Homala* Agassiz, 1848, and Fischer, 1887; non Mörch, 1853). Type *Tellina hyalina* Gmelin.

Shell mesodesmatiform, inequilateral, compressed, with narrow and pronounced lunule and escutcheon. Anterior laterals small and approximate, posterior laterals absent; no internal radii, sinus short, coalescent with the pallial line below; surface smooth or feebly concentrically sculptured. Eocene to recent.

The inequilaterality and compression of these species give them a very characteristic look, but the distinctions are not very important.

Section *Homalina* Stoliczka, 1871 (+ *Homala* Mörch, 1853; not Agassiz, 1848). Type *Tellina triangularis* Dillwyn.

Shell resembling *Omala,* but (according to the literature) without any lateral teeth. Recent. This species requires further examination and may prove to belong to *Omala* proper. It is smaller than *T. hyalina,* and the laterals if present may have been overlooked. Stoliczka separated this form from Omala under a mistaken impression as to the type of that group, but if there is a real difference the name can be retained, as he specifies *T. triangularis* as the type of *Homalina.* The Parisian Eocene form, *T. Lamarckii* Deshayes, belongs to *Omala* in the strict sense, at least if one may judge from figures and descriptions.

The following Eocene species have been described from the region under consideration; the sections under which they would probably rank are inserted in parentheses: *T.* (*Arcopagia?*) *Spillmani* Dall = *T. albaria* Conrad, Am. Journ. Conch., i., p. 138, pl. xi., fig. 7, 1865; not *T. albaria* Conrad, Geology Wilkes Expl. Exp., p. 725, App., pl. 18, fig. 5, 1849, which is probably an *Angulus. T. Spillmani* is from the Jacksonian of Mississippi; *T.* (*Arcopagia*) *alta* Conrad, 1833, Claibornian, not *T.* (*Metis*) *alta* Conrad, 1837; *T.* (*Arcopagia*) *eburneopsis* Conrad, 1865, Jacksonian; *T.* (*Moerella*) *Greggi* Harris, 1896 (+ *T. lignitica* Harris, 1896, but not *virginiana* Clark, 1895), Chickasawan; *Tellina linifera* Conrad, 1865, Jacksonian; "*T.*" *nitens* Lea, 1833 (= *Abra nitens* Conrad, not *T. nitens* Gregorio, which is founded on *Diplodonta ungulina* in a very young state), Claibornian; *T.* (*Moerella*) *ovalis* Lea, 1833 (= *T. Leana* Dall, not *T. ovalis* Sowerby, 1825), Claibornian; *T.* (*Peronidia?*) *papyria* Conrad, 1833 (+ *T. mooreana* Gabb, 1860), Lower

Claibornian; *T.* (*Angulus*) *plana* Lea, 1833 (+*Donax plana* Gregorio). The numbers of the figures of this species and *T. ovalis*, both in text and on the plate, in Lea's "Contributions to Geology" *are reversed; Egeria plana* is represented by figure 24, and *E. ovalis* by figure 25, as clearly denoted by their respective descriptions. As there was already a *Tellina plana*, d'Orbigny changed this specific name to *subplana* in 1850, Claibornian; *T.* (*Arcopagia*) *Raveneli* Conrad, 1846 (a fine and typical *Arcopagia*, externally recalling *Semele linosa;* Conrad refers to a figure on Plate v., but I have never found a copy of this plate, though the description is quite recognizable), Claibornian; *Macoma scandula* Conrad, 1834, Claibornian; *T.* (*Metis?*) *Sillimani* Conrad, 1846, Claibornian; *T.* (*Angulus*) *subtriangularis* Aldrich, June, 1895 (not *T. Williamsi* Clark), Chickasawan; *T.* (*Arcopagia*) *tallicheti* Harris, 1895 (compare *T. papyria* Conr.), Claibornian; *T.* (*Arcopagia*) *Trumani* Harris, 1897, Chickasawan; *T.* (*Peronidia?*) *Williamsi* Clark, 1895, Maryland; and *T.* (*Angulus*) *virginiana* Clark, 1895 (not identical with *subtriangularis* Aldrich), Maryland; *T. subequalis* Conrad, 1848, unfigured and described from a cast, is unrecognizable. To this list a few species can now be added from the collections of the United States Geological Survey.

Tellina (Angulus) entaenia n. sp.

Plate 46, Figure 2.

Eocene of the Claiborne sands at Claiborne, Alabama; Frank Burns.

Shell small, rather compressed, solid, elongate, very inequilateral; beaks low, surface polished, sculptured with faint, little elevated, somewhat irregular concentric lines, which at about the posterior third become suddenly stronger and more prominent, and on the posterior dorsal slope become about half as numerous, somewhat irregular, and still more elevated; hinge normal, nymph for the ligament short and prominent; pallial sinus short, rounded in front, reaching a little before the middle of the valve and below about half confluent with the pallial line; a faint ray behind the anterior adductor scar. Lon. 9, alt. 4, semidiam. 0.8 mm.

Nothing like this interesting little shell has been described from this horizon. Two left valves were obtained. The prominence of the nymph is a general characteristic of the subgenus *Angulus*, though I note in several European publications this feature does not appear to be understood, and there has been a tendency to refer such forms to *Psammobia*, apparently on this character alone.

Tellina cynoglossa n. sp.

PLATE 46, FIGURE 27.

Chickasawan Eocene of Wood's Bluff, Alabama; Choctaw Corners and near Meridian, Mississippi; Burns and Johnson.

Shell small, moderately convex, subovate, slightly inequilateral, with a moderate posterior fold; beaks little elevated; surface polished, sculptured with numerous even, regular concentric riblets with narrower interspaces, flattish in the middle of the disk, sharper and more elevated towards the ends of the valve, especially over the fold; lunule smooth, depressed, long, and narrow; hinge normal, right laterals distant, strong; left laterals obscure; pallial sinus small, oblong, obliquely ascending, confluent for a short distance below with the pallial line; interior with a few obscure radii. Lon. 16.5, alt. 10.5, diam. 4.8 mm.

This species is quite abundant at Wood's Bluff and has very much the external characters of *T. linifera* Conrad, which is larger, more elongated, and more pointed behind.

The species from the Pacific coast described at an early date by Conrad, and referred by him first to the Miocene and later to the Eocene, will be considered under the head of the Oligocene, though it is probable that some of them may be Miocene. Most of the types are in the National Museum.

Tellina (Moerella?) Aldrichi n. sp.

PLATE 46, FIGURE 9.

Chickasawan Eocene of Lisbon, Alabama; Aldrich. Also of Bell's and Gregg's Landings, Alabama.

Shell large for a *Moerella,* elongate, with very straight dorsal slopes, rounded in front, arcuate below, and bluntly pointed behind; beaks incurved, pointed, not prominent, posterior end hardly folded; surface smooth, with obsolete concentric undulations and rare radial striulations; lunular region deeply impressed; hinge normal. Lon. 20, alt. 10, semidiam. 2.5 mm.

A single left valve, with the interior inaccessible except the hinge, was sent by Aldrich with specimens of *T. papyria,* from which it differs by its elongated slender form, smaller size, and less convex valves. Better specimens from Bell's Landing show a nearly normal hinge with long, low laterals, and an ovate pallial sinus about half confluent below. It is perhaps nearest to *T. Greggi* Harris, but that species seems to be smaller, more rounded behind, with the pallial sinus free from the pallial line below.

Comparatively few species have been described from the Oligocene, though it is well supplied with *Tellinidæ*. Gabb cites *T. cuneata* Orbigny, 1853 (= *Moerella Gouldii* Hanley, 1847, not *Tellina cuneata* Chemnitz or *T.* (*Macoma*) *cuneata* Sowerby, 1867), from Santo Domingo, an identification which needs to be confirmed; *T.* (*Peronidia?*) *dariena* Conrad (+ *T. semilævis* Gabb, 1861) is from the Oligocene sandstones of the Isthmus of Darien above the Eocene shales; *T.* (*Eurytellina?*) *serica* Conrad (+ *T. euryterma* Gabb), Vicksburgian; *T.* (*Moerella*) *minuta* Gabb, 1873, Santo Domingo; *T.* (*Elliptotellina?*) *perovata* Conrad, 1848, Vicksburgian; *T.* (*Moerella*) *pectorosa* Conrad, 1848, Vicksburgian; *Macoma sublintea* Conrad, 1871, a doubtful species from the Vicksburgian, and *T.* (*Moerella*) *vicksburgensis* Conrad, 1848, Vicksburgian, are all the east American species I have found recorded. From the Pacific coast there are a few species, poorly described and figured, but of which the types in some cases exist, from the Astoria region in Oregon, but it is uncertain whether the horizon be Oligocene or Miocene, the fauna of these shales having been but little investigated with reference to their stratigraphy. The species are *T.* (*Peronidia?*) *emacerata* Conrad; *T.* (*Moerella?*) *obruta* Conrad; *T.* (*Peronidia?*) *oregonensis* Conrad, and two indeterminate forms, *T. bitruncata* and *subnasuta* Conrad, described in the geological report of the Wilkes Exploring Expedition in 1849. None of them appears to be definitely identifiable with any recent species.

Tellina chipolana n. sp.

PLATE 47, FIGURE 6.

Oligocene of the Chipola beds at Alum Bluff and on the Chipola River, Florida; Burns.

Shell solid, ovate, inequilateral, the anterior side longer, beaks low, pointed; anterior end rounded, rather plump, posterior end more compressed, rostrate, strongly folded, dorsal area with two radial ridges, each with a shallow sulcus above it, posterior angle obliquely truncate; surface with obscure, fine radial striation, sculptured with strong, low, sharp, regular, elevated, concentric lamellæ; hinge normal, left laterals obscure, lunule impressed, narrow, smooth; interior with an obscure thickened ray behind the anterior adductor scar; pallial sinus low, ovate, about half confluent below. Lon. 38, alt. 23, diam. 11 mm.

The left valve is very sharply pointed and flexed behind. This form may be regarded as a precursor of such types as *T. interrupta* Wood, of the recent fauna.

Tellina strophia n. sp.

PLATE 47, FIGURE 11.

Oligocene of the Chipola River, at Macdonald's farm, Calhoun County, Florida; Burns.

Shell elongate, subequilateral, slender, with inconspicuous beaks, rostrate, and sharply sculptured, with low, elevated, close-set concentric lamellæ, which become sparser and more prominent on the posterior part of the shell, especially on the rostrum; posterior dorsal area with two radial folds separated by a shallow sulcus, the upper fold obscure; lunule very narrow, moderately impressed; rostrum of the left valve ending in a narrow sharp point; teeth normal, small; in the left valve obscure; pallial sinus elongate, two-thirds confluent below, rounded behind. Lon. 27, alt. 11, diam. 5 mm., but probably reaching a size one-third greater, judging by fragments collected.

This shell recalls *T. cumingii*, though smaller and more delicate.

Tellina segregata n. sp.

PLATE 37, FIGURES 7, 8.

Oligocene of the silex beds at Ballast Point, Tampa Bay, Florida; Dall.

Shell small, subovate, subequilateral, beaks low; anterior end rounded, base evenly arched, posterior end feebly rostrate, obliquely truncate with two radial folds separated by a sulcus; lunule extremely narrow, impressed, smooth, the escutcheon slightly larger, similar but represented only on the left valve; disk almost compressed, surface finely radially striated, the concentric sculpture of fine, elevated threads, which on the anterior half have a tendency to segregate themselves in groups of four, separated by wider interspaces; near the base, however, the threads become crowded; as the threads pass backward one after another in each group fails, and the posterior half therefore shows much sparser threading and wider interspaces, while the persistent threads tend to become lamellose; the interior of the silicified type of this species is inaccessible. Lon. 17, alt. 10, diam. 4 mm.

This species appears to belong to the same group as *T. chipolana*, but the character of the sculpture is quite different.

Tellina (Macaliopsis?) merula n. sp.

PLATE 46, FIGURE 4.

Oligocene of the Tampa silex beds at Ballast Point.

Shell small, plump, subovate, anterior end longer, evenly rounded, base convexly arcuate, posterior end slightly flexed, hardly folded; obliquely bluntly pointed; beaks inconspicuous, lunule obscure; surface nearly smooth, with irregular concentric striation at intervals and sparse elevated concentric threads or lamellæ, usually worn off, and when present low and delicate; hinge normal, in the left valve feeble; pallial sinus large, subovate, largely confluent below. Lon. 16, alt. 12.2, diam. 8 mm.

Shell recalling *T. mera* Say but of different form.

Tellina (Macaliopsis) cloneta n. sp.

PLATE 46, FIGURE 8.

Oligocene of the Chipola River, Calhoun County, Florida.

Shell small, thin, inequilateral, anterior end longer, more convex, and evenly rounded; posterior end shorter, rather suddenly pointed, and slightly flexed; beaks pointed, smooth, prominent; lunule and escutcheon obsolete; disk without radial striæ, but with very thin, regular, rather distant concentric, elevated lamellæ, easily worn off, the posterior end with an obsolete radial fold; hinge normal, pallial sinus large, gibbous, nearly reaching the anterior adductor scar, more than half confluent below. Lon. 13.5, alt. 8.5, diam. 4 mm.

Much more delicate and of a different form from the preceding species.

Tellina (Merisca) æquistriata Say.

Tellina æquistriata Say, Journ. Acad. Nat. Sci. Phila., iv., p. 145, pl. x., fig. 7, 1824; Harris, Bull. Am. Pal., i., p. 321, pl. 29, fig. 7, 1896.

Oligocene of Alum Bluff, Calhoun County, Florida; of the Bowden marl, Jamaica; Miocene of Maryland and the York River, Virginia; Pliocene of the Croatan and Waccamaw beds, North and South Carolina; recent, from North Carolina to Brazil, in moderate depths of water.

This species is closely related to the recent *T. lintea* Conrad, 1837, but when adult is more triangular and equilateral. The fossil specimens reach a size considerably in excess of any that I have hitherto examined among recent shells. Between those of equal size I have not observed any differences which might serve as a basis for even a varietal name, but the differences of the adults, above noted, probably render it desirable to keep the two forms separate until more is known about them. A single valve of the recent type was found in the Caloosahatchie marl.

Tellina (Merisca?) acrocosmia n. sp.

PLATE 46, FIGURE 10.

Oligocene of the Bowden beds of Jamaica, West Indies.

Shell small, rounded, triangular, with nearly central, inconspicuous beaks, and hardly pointed, slightly flexed, posterior end, the anterior end evenly rounded, base convexly arched; lunule obsolete; disk covered with a fine radial threading, more or less concealed by fine, elevated, concentric sharp lamellæ; hinge normal, teeth large and strong for the size of the shell; pallial sinus large, nearly reaching the anterior adductor scar, largely confluent below; above rising above the level of the posterior adductor. Lon. 7, alt. 5.5, diam. 3 mm.

This very compact and sharply sculptured little shell is very distinct from any of the other local or any American species.

Tellina (**Merisca?**) **halidona** n. sp.

PLATE 38, FIGURES 3, *3a*.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall.

Shell small, solid, inflated, very inequilateral, elongate and rounded in front, obliquely subtruncate in front; beaks full, low, not conspicuous, base convexly arcuate; lunule and escutcheon obsolete; surface smooth or with incremental lines, not polished; hinge normal, pallial sinus high, short, mostly confluent below. Lon. 14.5, alt. 11.5, diam. 6.5 mm.

This species rests upon a single left valve of which a very perfect silicious pseudomorph was collected, consequently the hinge characters of the right valve are unknown. It seems highly probable, however, that it is referable to *Merisca*. *T.* (*Macaliopsis*) *merula* Dall is the most similar species of this horizon, but has a better developed hinge and different outline.

Tellina (**Merisca**) **sclera** n. sp.

PLATE 49, FIGURE 5.

Oligocene of the Bowden marls, Jamaica, West Indies.

Shell minute, short, plump, with low inflated beaks, rounded in front and below, shorter and blunt behind; slightly flexed, not rostrate, but with an obsolete posterior radial sulcus in the right valve; sculpture of elevated crowded concentric threads, becoming alternately obsolete towards the ends of the shell where the persistent threads are more elevated and tend to become lamellose; hinge normal, strong for the size of the shell; pallial sinus short, round, confluent below. Lon. 4.2, alt. 3.2, diam. 2 mm.

This little shell is not unlike *T. acrocosmia* Dall, but smaller and without the strong radial sculpture.

Tellina (Merisca) hypolispa n. sp.

PLATE 46, FIGURE 23.

Oligocene of the Chipola horizon at Alum Bluff and on the Chipola River, Calhoun County, Florida, and of the Oak Grove sands at Oak Grove, Santa Rosa County, Florida.

Shell small, inequivalve, inequilateral, plump, polished, the right valve flatter; anterior end longer, rounded, the posterior rather roundly pointed; base arcuate, near the posterior end a little concave; beaks small, pointed; posterior end obscurely rayed, slightly flexed; surface smooth or with incremental lines but no radial sculpture; anteriorly near the base are usually a few sparse, concentric, elevated threads with irregular but wider interspaces; the posterior dorsal area, contrary to the usual rule, is smooth and shows no traces of lamellation; hinge normal, rather feeble; a narrow impressed lunule; interior with some obscure radii; pallial sinus as in *Angulus*. Lon. 13.5, alt. 8.5, diam. 5 mm.

This species is on the border line between *Angulus*, *Moerella*, and *Merisca*. The right valve seems flatter, less arcuate below, and higher than the left when considered separately.

Tellina (Phyllodina) lepidota n. sp.

PLATE 46, FIGURE 18.

Shell nearly flat, elongated, subequilateral; beak small, low, pustular; nepionic shell distinct, smooth, polished; profile of the dorsal slopes near the beaks rectilinear; anterior end rounded, posterior subrostrate, with, in the right valve, a single elevated ray extending to the posterior basal angle from the umbo; an extremely narrow lunule deeply impressed; margin of dorsal slopes close-set with oblique scales; surface of the disk with low, distant, concentric lamellæ with much wider, slightly excavated interspaces showing microscopic concentric striæ; interior showing the reflection of the surface undulations, polished; laterals long and slender, cardinals very small; pallial sinus obliquely ascending, narrow, free. Lon. 7.5, alt. 4 mm., taken from lines of growth on fragment 8.5 mm. long.

This fragment is from the Oligocene sandstones above the Eocene shales of Gatun on the line of the Panama Canal, and is so remarkable that I have thought it best to include it, since the species may turn up at any time in the equivalent beds of the Antilles or the Gulf States. The figure does not show the scales with sufficient distinctness.

Tellina (Phyllodina) halistrepta n. sp.

PLATE 47, FIGURE 17.

Oligocene of the Bowden marl on the island of Jamaica; Henderson and Simpson.

Shell compressed, flattish, subequilateral, longer than high; beak small, low, resembling a pustule on the summit of the broad, smooth nepionic shell; surface marked anteriorly with rather close, low, elevated, concentric threads with about equal interspaces; near the posterior third of the disk these threads become less numerous by the cessation of alternate threads, making the interspaces wider, while the persistent threads become lamellose; in the type, which is a young shell, the dorsal margin is not coronate, but in an adult there are probably dorsal scales corresponding to the later lamellæ; hinge normal for the section, pallial line obscure. Lon. 9, alt. 5.5, diam. 1.2 mm.

Although this specimen is young, it is sufficiently characteristic and distinct to be recognized, though the adult very likely reaches twice or thrice the size of the one described.

Tellina (Phyllodina) dodona Dall.

PLATE 30, FIGURE 7.

Tellina dodona Dall, this work, part iv., p. 925, pl. 30, fig. 7, 1898.

Oligocene sands of Oak Grove, Santa Rosa County, Florida; Burns.

Shell elongate, rather rude, solid, subequilateral, inequivalve, the right valve flatter; beaks low, compressed, with pustular apex and small, smooth nepionic shell; anterior part produced and rounded, passing evenly into the curve of the base; posterior end slightly rostrate, with a straight dorsal slope, the end nearly vertically truncate, the posterior basal angle in the left valve, pointed and produced; surface marked with rather irregular incremental lines, a conspicuous sulcus from the umbo radiating to a point just above the posterior basal angle; disk with a succession (up to ten) of low, rather obscure, concentric waves, obsolete distally but indicated by a sparse series of small triangular foliations on the posterior dorsal border, the anterior border being only obscurely waved; lunule long and very narrow; hinge normal, pallial sinus short, free, obliquely ascending; sculpture of the right valve similar but sharper, more emphatic, and the foliations more conspicuous. Lon. 34, alt. 21, diam. 6 mm. Lon. of figured specimen, 16 mm.

Since the young valve was figured, a considerably larger left valve has come to light, from which, and from fragments of the right valve, the above description has been drawn.

Tellina (Eurytellina) sp.

Oligocene of the Bowden marl, Jamaica, West Indies.

Fragments of quite a distinct species of *Eurytellina* were found in the marl, but I prefer to merely announce its presence until material fit for figuring is obtained.

Tellina (Eurytellina) roburina n.sp.

Plate 47, Figure 9.

Oligocene of the Oak Grove sands, Santa Rosa County, Florida; Burns.

Shell solid, subequilateral, rather elongate-trigonal, compressed; anterior end evenly rounded, posterior end pointed with a small truncation near the tip; beaks inconspicuous, pointed; lunule short and nearly linear; dorsal slopes nearly rectilinear; surface of the disk polished, closely, evenly, concentrically grooved, sublamellose on the posterior dorsal area, which exhibits an obsolete fold and slight flexuosity; hinge as in *Angulus,* teeth well developed; valve thickened on the inner margin of the adductor scars; pallial sinus elongate, low, squarish at the anterior end where its distal angle nearly touches the adductor scar, wholly confluent below. Lon. 39, alt. 22.5, diam. 8 mm.

This is a fine species, a precursor of *T. angulosa* Gmelin, *T. rubescens* Hanley, and similar recent forms.

Tellina (Moerella) Simpsoni n. sp.

Plate 46, Figure 12.

Oligocene of the Bowden marl of Jamaica; Henderson and Simpson.

Shell small, inflated, equivalve, very inequilateral, polished; anterior dorsal slope rectilinear, anterior end rounded, base convexly arcuate; posterior end very short with a sudden constriction, slightly flexed, with the extremity bluntly pointed; beaks low, somewhat opisthogyrous, with a perceptible lunule; hinge normal, pallial sinus extending nearly to the anterior adductor scar, mostly confluent below. Lon. 7, alt. 5, diam. 4 mm.

This form is what Gabb identified as *T. cuneata* d'Orbigny, but the latter is less inflated and less flexuous behind. *T. Simpsoni* sometimes appears perfectly smooth, but other specimens show incremental sculpture.

Tellina (Moerella) Hendersoni n. sp.

Plate 46, Figure 5.

Oligocene of the Bowden marl of Jamaica; Henderson and Simpson.

Shell small, moderately convex, very inequilateral; form resembling the preceding species but less inflated, more regular, with the posterior end not constricted or markedly flexed; surface polished, with, except near the beaks, fine, rather distant, concentric threads, which on the basal half of the posterior end rise into extremely delicate low lamellæ; hinge normal, strong; pallial sinus connecting the adductor scars and confluent below; there is a slightly impressed narrow lunule. Lon. 7.5, alt. 5, diam. 3 mm.

This species differs in sculpture, form of the pallial sinus, and other details from the other allied forms.

Tellina (Moerella) acloneta n. sp.

Plate 46, Figure 16.

Oligocene beds of the Chipola River, Calhoun County, Florida; Burns.

Shell minute, elongate, very inequilateral, moderately inflated; anterior end rounded, posterior end somewhat produced, flexed, the right valve showing a shallow sulcus extending from the umbo to the base behind the posterior basal angle; surface polished, smooth except for incremental lines; hinge normal, beaks low, almost pustular; lunule present, slightly impressed; pallial sinus rounded, short, reaching two-thirds of the way from the posterior to the anterior adductor scar; below mostly confluent. Lon. 4.7, alt. 3.0, diam. 1.5 mm.

This form is near *T. Simpsoni,* but is smaller, and when compared with specimens of that species of the same size appears more compressed and more elongated.

Tellina (Angulus) pharcida n. sp.

Plate 46, Figure 7.

Oligocene of Bowden, Jamaica; Henderson and Simpson.

Shell small, elongate, very inequilateral, moderately convex; anterior end produced, rounded; posterior end short, roundly pointed, with a slight flexure; beaks in the posterior third; surface covered with extremely fine close-set grooves; sculpture as usual a little stronger near the posterior end; beaks low, pointed; lunule obsolete; hinge normal, pallial sinus obscure in the polish of the interior but probably normal; no thickened rays. Lon. 5.5, alt. 3, diam. 1.5 mm.

This small form recalls *T. sybaritica* Dall, which is a larger, more solid, and more flexuous shell. It may not be fully adult, but is not the young of any of the other species which were obtained from the Bowden marl at the same time.

Tellina (Moerella) nucinella n. sp.

PLATE 46, FIGURE 19.

Oligocene sands of Oak Grove, Santa Rosa County, Florida.

Shell minute, ovate, equivalve, very inequilateral; beaks pointed, low; anterior end produced, rounded; posterior end much shorter, wider, and bluntly rounded; sculpture of uniform, close-set, rounded threads which in the posterior third become alternately higher and here cross minute close radial striæ; lunule and escutcheon absent; hinge normal, strong, ligament very short; pallial sinus obliquely ascending, rounded, short, free from the pallial line below. Lon. 3.5, alt. 2.3, diam. 1.0 mm.

A single right valve of this little species was obtained from the marl. It recalls *T. ovalis* Lea from the Claibornian, but is proportionately shorter.

Tellina (Angulus) pressa n. sp.

PLATE 47, FIGURE 5.

Oligocene marl of Bowden, Jamaica, and of the Chipola River, Calhoun County, Florida.

Shell thin, compressed, inequilateral; beaks low, hardly interrupting the dorsal profile, but sharp and almost pustular; ligament rather long, hinge delicate but normal; surface polished, with rather distant, fine, concentric impressed lines; the posterior dorsal slope with sparse, sharp, little elevated concentric lamellæ; near the beaks the shell is smooth; interior with a faint anterior elevated ray which separates the adductor scar from the anterior part of the long, high pallial sinus, which is wholly confluent below; the interior more or less obscurely radially striate. Lon. 12.5, alt. 7.5, diam. 2 mm.

A thin and delicate species with no observable flexure or ridge on the posterior end, and whose especial characteristic is the high dorsal profile behind the beaks.

Tellina (Angulus) acosmita n. sp.

PLATE 46, FIGURE 1.

Oligocene of the Chipola beds, Chipola River, Calhoun County, Florida; Dall and Burns.

Shell small, thin, elongate, inequilateral, rounded in front, produced and pointed behind; beaks small, pointed, low; disk with usually an obscure constriction mesially; surface polished, concentrically feebly striated, near the margins with regularly spaced concentric grooving; on the posterior dorsal slope fine, close, low imbrications; hinge delicate, normal; interior thickened ray anteriorly not prominent, touched by the anterior end of the high pallial sinus, which is wholly confluent below. Lon. 10.5, alt. 5, diam. 2.5 mm.

The most common of the Chipola *Tellinidæ*. The young are proportionately longer and perceptibly flexed and rostrate behind, characters which lose their prominence in the adults. From the following species this is distinguished especially by its rather sparse concentric sculpture, giving the effect of *T. alternata* Say in miniature.

Tellina (Angulus) agria n. sp.

PLATE 46, FIGURE 11.

Oligocene sands of Oak Grove, Santa Rosa County, Florida; Burns.

Shell resembling the preceding species, but more slender and evenly covered with close-set regular concentric threading; beaks small, the minute protoconch distinct, giving a pustular effect; hinge normal, interior normal, the thickened ray present but ill defined, the pallial sinus as in *T. acosmita*. Lon. 6.7, alt. 3.5, diam. 2 mm.

By its fine close striation this species recalls the recent *T. sybaritica* Dall, which is a larger, more solid, and much more flexuous shell.

Tellina (Angulus) acalypta n. sp.

PLATE 47, FIGURE 12.

Oligocene of the Chipola horizon at Alum Bluff, Calhoun County, and in Walton County, Florida; also in the Oak Grove sands, Santa Rosa County, Florida; Burns.

Shell small, polished, slightly inequivalve, inequilateral; anterior end longer, rounded, posterior end produced, attenuated, obliquely truncate, obtusely pointed; beaks small, low, the disk near them smooth, polished; surface of the valve towards the margins with fine, regular, rather distant concentric grooves, the posterior dorsal area with fine concentric wrinkles or smooth, the shell showing traces of darker and lighter zones and obscure slightly depressed rays; valves moderately convex, the right slightly less so than the left; hinge normal, extremely fine and delicate; interior polished, thickened ray in left valve present but feeble; pallial sinus high, long, reaching the ray, and wholly confluent below. Lon. 10.5, lat. 5.5, diam. 2.5 mm.

This form is not unlike *T. polita* Say, but is a constantly less elevated shell.

Tellina (Scissula) scitula n. sp.

PLATE 47, FIGURE 15.

Oligocene of Santo Domingo and of Bowden, Jamaica.

Shell small, thin, elongate-ovate, polished, inequilateral; rounded in front, moderately pointed behind; beaks low; surface with fine, regular, rather close striæ extending obliquely backward towards the base, with more or less evident microscopic radial striulation; posterior dorsal areas minutely concentrically waved; interior with no thickened rays; hinge normal, very delicate; pallial sinus long, high, normal. Lon. 8, alt. 4.2, diam. 1.5 mm.

From the young of *T. iris* Say of the same size it is at once distinguishable by the much finer and closer and more oblique striation and the more pointed posterior end.

Tellina (Scissula) lampra n. sp.

PLATE 46, FIGURE 14.

Oligocene of the Chipola horizon at Alum Bluff, and on the Chipola River, Calhoun County, Florida.

Shell solid, polished, moderately convex, subequilateral; anterior part slightly longer, rounded, posterior attenuated, rather bluntly pointed; beaks low, posterior dorsal area with delicate imbricated sculpture; disk with fine, close, sharp striations descending obliquely backward from the anterior dorsal margin towards the base; hinge normal, delicate; internal thickened rays in the right valve, the anterior touched by the anterior end of the pallial sinus, which is wholly confluent below. Lon. 8.6, alt. 7.3, diam. 4 mm.

This recalls *T. decora* Say, which is more inequilateral and has a blunter and differently shaped posterior end. The oblique sculpture also is differently disposed and more close set.

This completes the list of species belonging to the various subdivisions of the genus *Tellina* known from the Oligocene of North America and the West Indies. The Eocene and Oligocene of middle America, judging by material in my possession, will eventually add very largely to this number. Omitting those species of doubtful horizon from Oregon and California which have already been referred to, we may now conveniently consider the Neocene species in one list, not forgetting that some of them which reach the Oligocene have already been referred to. *Tellina* (*Eurytellina*) *appressa* Gabb, 1881, from the Pliocene of Costa Rica, is unfigured, but is said to resemble *T. rufescens* Chemnitz; *T.* (*Peronidia?*) *arctata* Conrad, 1843 (not *T. arctata* Conrad, Wilkes Exped., 1849, from Oregon = *Macoma arctata* Dall), from the Upper Miocene of North Carolina; *T. abrupta* Conrad (in Meek's Miocene Checklist, 1864), from the Miocene of Oregon, seems to be a mere list name, as I have been unable to find any other reference to it; *T.* (*Peronidia*) *bodegensis* Hinds, 1844 (not the same as *emacerata* Conrad, 1849, as suspected by Gabb), is abundant in the Pleistocene of San Diego and San Pedro, California; the specimens cited under this name from lower horizons require further examination; *T.* (*Angulus*) *capillifera* Conrad, 1866 (+ *T. shilohensis* Heilprin, 1887, list name), Lower Miocene of Shiloh, New Jersey; *T.* (*Angulus*) *declivis* Conrad, 1834, Lower Miocene of Shiloh, New Jersey, of Plum Point and Jones Wharf, Maryland, of Petersburg, Virginia, Upper Miocene of York River and Suffolk, Virginia, Pliocene of Shell Creek, Florida, and Pleistocene of North Creek, Osprey, Florida; this species is very close to *T.* (*Angulus*) *polita* Say, of the recent fauna, but the latter is a more ventricose shell and the right anterior lateral is longer than in the fossil; *T.* (*Peronidia?*) *egena* Conrad, 1834, Miocene of James River, Virginia; *T.* (*Merisca*) *lintea* Conrad, 1837 (not *T. lintea* Conrad, Vicksburgian, 1848, which is a *Psammobia*), Upper Miocene or Pliocene of New Berne, North Carolina, a species very near *T. æquistriata* but larger and more produced; *T.* (*Angulus?*) *peracuta* Conrad, 1866, a somewhat dubious species from the Lower Miocene marls of Cumberland County, New Jersey; *T.* (*Angulus*) *producta* Conrad, 1840, Miocene of Plum Point and Blake's Cliffs, Maryland, of Petersburg, Virginia, and the Pliocene or transition beds at the northern end of the Dismal Swamp, Virginia. For other species refer to the genus *Macoma* and the following descriptions.

Tellina (**Eurytellina**) **alternata** Say.

Tellina alternata Say, Journ. Acad. Nat. Sci. Phila., iv., p. 275, 1822; Tuomey and Holmes, Pleioc. Fos. S. Car., p. 89, pl. 22, fig. 4, 1857; Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 573, 1863; Gabb, Geol. St. Domingo, p. 248, 1873; Plioc. Fos. Costa Rica, p. 371, 1881.

Pliocene of the Caloosahatchie beds, on Shell Creek and the Caloosahatchie River, Florida; of South Carolina (Haldeman); of the Croatan beds and the Neuse River below New Berne, North Carolina; Pleistocene of Simmons Bluff, South Carolina; and recent from Cape Hatteras, North Carolina, south to Belize and St. Domingo.

I have not found any satisfactory evidence of the presence of this species in beds earlier than the Pliocene, the references to the Miocene being due to a confusion of Miocene and Pliocene deposits or misidentification with other species. It is certain at least that the assertion that it is found in Miocene beds requires confirmation. This species is said by Dunker and Krebs to be synonymous with *Tellina subradiata* Schumacher, but I have been unable to find the place of publication of Schumacher's name, if it has been published.

An allied species, *T.* (*Eurytellina*) *rubescens* Hanley, now living in West Mexican waters, occurs in the Pleistocene of San Pedro, California.

Tellina (Eurytellina) scapha n. sp.

Plate 47, Figure 16.

Upper Miocene at Lee's wharf, Nansemond River, near Suffolk, Virginia; Burns.

Shell thin, light, moderately convex, inequilateral, the anterior end longer, higher, evenly rounded; the posterior end short, attenuated, with an obsolete fold, vertically rounded-truncate; beaks low, lunule and escutcheon obsolete; surface smooth or marked only with incremental lines a little stronger on the posterior dorsal area; hinge normal, hinge-line thin, pallial impressions obscure, the sinus probably falling short of the anterior adductor scar. Lon. 30, alt. 16.5, diam. 7 mm.

A single left valve was obtained by Burns which has the aspect of a *Eurytellina.* In form it resembles Conrad's dubious *Tellina arctata,* but wants the broad hinge-plate and concentric elevated lines.

Tellina (Merisca) caloosana n. sp.

Plate 47, Figure 2.

Pliocene marls of the Caloosahatchie River, Florida, near the site of Fort Thompson; Dall.

Shell small, plump, ovate, slightly inequivalve, nearly equilateral, slightly flexuous behind, but hardly rostrate, posterior dorsal area marked by a shallow sulcus; beaks pointed, conspicuous, a well-marked lunular impression in front of and escutcheon behind them; surface covered with small, sharp, regularly spaced elevated concentric lamellæ; upper part of the pallial sinus connecting the adductor scars, the lower part wholly confluent with the pallial line. Lon. 8, alt. 6, diam. 3 mm.

This little shell differs from the young of *æquistriata* by its inflation; from *T. martinicensis* d'Orbigny, its nearest ally, by its more crowded surface lamellation and the form of the pallial sinus, the latter in the recent shell failing to reach the anterior adductor scar and running for some distance, after turning, nearly parallel with the pallial line below, before becoming confluent with it.

With it was found a single valve which could only be referred, after careful comparisons, to the recent *T. mera* Say, still abundant in the Antillean region, Bermuda, and on our southern coast.

Tellina (Merisca) dinomera n. sp.

Plate 47, Figure 19.

Pliocene marls of the Caloosahatchie River, Florida; Dall.

Shell solid, rotund, rather convex, nearly equilateral; beaks pointed, with a small narrow lunule impressed before them; surface faintly concentrically striate with no radial lines, and with numerous, regularly spaced, elevated, concentric lamellæ; a well-marked radial fold borders the dorsal area below; hinge normal, strong, sinus gibbous, not attaining the anterior adductor and about half confluent below. Lon. 18, alt. 15, diam. 8 mm.

This differs from the closely allied *T. mera* Say, also found in the same marls, by being much heavier and more strongly sculptured and with the dorsal slope more abruptly descending behind; *T. promera* Dall, also very similar, has the lateral teeth nearer the cardinals and a larger and more gibbous pallial sinus, free from the adductors in both valves.

Tellina (Cyclotellina) fausta Donovan.

Tellina fausta Donovan, Nat. Hist. Brit. Shells, iii., pl. 98, 1801; Dillwyn, Descr. Cat. Rec. Shells, i., p. 94, 1817; Wood, Gen. Conch., p. 185, 1815; Pulteney, Dorset Cat., p. 29; Montagu, Test. Brit., i., p. 64, 1803.

Tellina remies Born, Mus. Test. Vind., p. 36, pl. 2, fig. 11, 1780; not of Linné, 1768.

Tellina lævis Wood, Gen. Conch., p. 181, pl. 37, fig. 1, 1815.

A single young valve, agreeing perfectly with the young of the recent shell now inhabiting the same region, was found in the Pliocene marl of the Caloosahatchie. This species was originally described as British from adventitious specimens, but is an inhabitant of south Florida and the Antilles.

Tellina (Moerella) suberis n. sp.

Plate 46, Figure 25.

Pliocene of the Caloosahatchie marls.

Shell small, solid, inflated, polished, very inequilateral, produced and rounded in front; short, distinctly folded, and slightly flexed behind; beaks small, high, with a deeply impressed lunule in front of them; hinge normal, teeth strong; surface mostly smooth or showing faint incremental lines, but towards the basal margin and on the posterior dorsal area exhibiting a few distant rather irregular elevated lines; interior with the upper part of the pallial sinus connecting the adductors and wholly confluent in the pallial line below. Lon. 7, alt. 5, diam. 3 mm.

This little shell differs from *T. Gouldii* Hanley by its flexuous posterior end and less regular form. From *T. martinicensis* d'Orbigny, which is nearly allied, *T. suberis* differs by its blunter posterior end, less sculptured surface, and wholly confluent pallial sinus below.

The species associated under the name of *Angulus* in our later Tertiary are very puzzling. There are about as many forms in the Miocene and Pliocene as there are in the recent fauna of the coast, and in most cases it may be surmised that the recent forms are the descendants of the fossil ones. The resemblance in many cases is so close that a hasty examination would result in their being united under one name, as I myself did when making provisional identification of part of the material here treated. More thorough study has shown that a certain amount of constant difference separates a number of the older forms from their recent representatives, and these have been consequently regarded as distinct in the final arrangement.

Tellina (Angulus) dupliniana n. sp.

PLATE 46, FIGURE 17.

Miocene of Wilmington, of the Natural Well and Magnolia, Duplin County, North Carolina; of Plum Point, Maryland; and of York River, Virginia; Pliocene of the Waccamaw beds at Mrs. Guion's marl pit, Waccamaw River, South Carolina; Burns, Harris, and C. W. Johnson.

Shell small, solid, rather convex, inequilateral, dorsal margins rectilinear, diverging at an angle of about one hundred and eight degrees, anterior end longer, rounded evenly into the base, which is nearly parallel with the anterior dorsal margin; posterior end much shorter, pointed, the terminal angle slightly decumbent and the basal margin in front of it slightly incurved; beaks inconspicuous, hinge normal, the right adjacent lateral short and the anterior hinge-margin in front of it grooved for the edge of the opposite valve; middle of the disk smooth, the beaks, posterior dorsal area, and the portions of the disk near the basal margin more or less concentrically striated; interior with the pallial sinus rising to a small angle under the umbo, then descending in a somewhat wavy line to a point on the pallial line considerably short of the anterior adductor scar; in the left valve the sinus is not angulated above and extends somewhat nearer the adductor; the interior is marked with some faint radiations near the adductors, but no thickened ray appears. Lon. 12.5, alt. 8, diam. 4 mm.

There is some little difference in the proportional height in different individuals, in the amount of inflation, and in the arcuation of the posterior dorsal margin; the posterior fold, or ridge bounding the posterior dorsal area, is not strongly marked. Compared with *T. tenella* Verrill, this species is a heavier and higher shell, with the posterior end more pointed and decurved. The dorsal margin of the right valve is not grooved in *T. tenella,* and the adjacent lateral is longer than in *T. dupliniana* of the same size.

Tellina (Angulus) umbra n. sp.

PLATE 46, FIGURE 13.

Upper Miocene of North Carolina, at Wilmington, and in Duplin County, at the Natural Well, and Magnolia; and of St. Mary's, Maryland; Pliocene of the Waccamaw district, South Carolina, at Mrs. Guion's marl-pit, and of the Caloosahatchie River, Florida; Pleistocene of North Creek, Osprey, Florida.

Shell small, solid, markedly flexuous, moderately convex, inequilateral, nearly equivalve; anterior end longer, rounded; posterior end shorter, attenuated, bluntly pointed; beaks inconspicuous; whole surface covered with close-set, regular, even, concentric threads; hinge normal, right anterior lateral short and stout, posterior lateral small but prominent; pallial sinus long, slightly convex above, reaching to the anterior ray (which is obviously thickened), nearly similar in both valves, and wholly confluent below. Lon. 12.5, alt. 6.5, diam. 3.5 mm.

This species is nearest to *T. sybaritica* Dall, but is a larger and less slender shell, with a less angular posterior end. It is doubtless the precursor of that species.

Tellina (Angulus) propetenella n. sp.

PLATE 46, FIGURE 6.

Upper Miocene of York River, Virginia, and Wilmington, North Carolina; Pliocene of the Caloosahatchie River, Florida, and of the Waccamaw beds at Tilly's Lake, South Carolina.

Shell small, solid, hardly convex, subequivalve, inequilateral, with rather high beaks at about the posterior third; dorsal slopes rectilinear; anterior end rounded, posterior bluntly pointed, hardly flexed, with the umbo-basal ridge hardly marked; posterior angle nearly basal with the basal margin slightly incurved in front of it; surface with irregular, feeble, concentric incremental lines; hinge normal, teeth small, hinge-margin grooved in front of and behind them; pallial sinus rather shorter than usual and more arched above; the internal ray feeble. Lon. 10, alt. 6.25, diam. 3 mm.

This species approaches *T. tenella* Verrill, but is less arcuate, blunter behind, and with the sculpture less sharp, regular, and close. The left valve is usually a little flatter than the right, and there is a notable difference in individuals in the amount of arcuation, just as in *T. tenella.*

Tellina (Angulus) macilenta n. sp.

Plate 46, Figure 20.

Miocene of the Natural Well, Duplin County, North Carolina.

Shell solid, subtrigonal, moderately convex, equivalve; inequilateral; anterior end longer, rounded, posterior roundly pointed near the base; beaks pointed, dorsal margins slightly arched; surface polished, faintly distantly concentrically striated; near the basal margin the striæ become regular and more sharp and conspicuous; posterior dorsal area nearly smooth, posterior end not folded, but slightly flexed; hinge normal, adjacent lateral short, strong, and prominent; pallial sinus somewhat arched above, long, wholly confluent below; interior more or less radially striate; in the left valve the thickened rays inside the adductor scars are obvious. Lon. 16.5, alt. 10.5, diam. 5.5 mm.

This form is not intimately related to any of the recent species, and is easily discriminated by its solid, subtrigonal valves, size, and shortness from any of the Miocene species.

Tellina (Angulus) Sayi Deshayes.

Tellina polita Say, Journ. Acad. Nat. Sci. Phila., ii., p. 276, 1822; Am. Conch., pl. lxv., fig. 2, 1834; Hanley, Thes. Conch., i., p. 282, pl. 57, fig. 60, 1847; Philippi, Abh. und Beschr., ii., p. 27, pl. 3, fig. 10, 1846.

Angulus polita (*sic*) Holmes, P.-Pl. Fos. S. Car., p. 45, pl. 8, fig. 2, 1858; H. and A. Adams, Gen. Rec. Moll., ii., p. 398, 1856.

Not *Tellina polita* Spengler, Nat. Selsk., iv., pt. 2, p. 107, No. 38, 1798; nor of Pulteney, Dorset Cat., p. 29, 1813; nor of Sowerby, Tankerville Cat., App., p. iv., 1825; nor of Poli, Risso, Blainville, etc., 1795-1825.

Tellina Sayi Desh., MS.

Pliocene of the Caloosahatchie River, Florida, of South Carolina, of the Croatan beds, North Carolina; Dall and Johnson; recent from North Carolina to Yucatan.

The well-known name of this species must be changed, as it had been used for a *Tellina* three or four times before Say so applied it, and one of the prior attempts, at least, was made on a species of *Angulus*. The name of Deshayes is suggested in one of his manuscripts in my possession.

Tellina (Angulus) propetenera n. sp.

PLATE 47, FIGURE 7.

Pliocene of the Caloosahatchie River, Florida; Dall.

Shell moderately convex, equivalve, subequilateral; beaks rather prominent, anterior end rounded, posterior dorsal slope convex, the end slightly decumbent, the basal margin in front of it slightly incurved; surface polished, with concentric striæ and somewhat irregular, sharp, elevated lines, not always in harmony with the lines of growth, and which become more numerous and crowded near the basal margin; pallial sinus high, rising to an angle above the level of the posterior adductor scar in the left valve, and then descending to the pallial line at the distal end of the anterior thickened ray, and wholly confluent with the pallial line below; hinge normal, shell moderately thick, with some internal radial lines. Lon. 16, alt. 10, diam. 4.5 mm.

This shell is nearest *T. tenera* Say, but larger and more solid, with a strong thickened internal ray, its posterior dorsal margin more arched, and the valves more nearly equilateral.

T. (*Angulus*) *mera* Say and *T.* (*Angulus*) *tampaensis* Conrad are also found in the Pliocene marls of the Caloosahatchie River.

Tellina (Scissula) similis Sowerby.

Tellina similis Sby., British Misc., pl. 75, 1806; Turton, Conch. Dict., p. 170, 1819; Hanley, Thes. Conch., p. 285, pl. 57, fig. 65, 1846; D'Orbigny, Moll. Cubana, ii., p. 249, 1853.

Tellina decora Say, Journ. Acad. Nat. Sci. Phila., v., p. 219, 1827; De Kay, Zool. N. Y., v., p. 211, 1843; Hanley, Thes. Conch., i., p. 285, pl. 56, fig. 27, 1846 (not pl. 59, fig. 127, nor pl. 66, fig. 260); Binney's Say, p. 126, 1858.

Tellina iris Philippi (non Say), Abb. und Beschr., ii., p. 25, pl. iii., fig. 5, 1845.

Tellina (*Angulus*) *decora* H. and A. Adams, Gen. Rec. Moll., ii., p. 397, 1856.

Pliocene of the Caloosahatchie River, Florida, Dall; recent from Florida and Bermuda, south to Venezuela.

There can be no reasonable doubt that Sowerby's *Tellina similis* was founded upon a large white specimen of Say's *Tellina decora,* and the latter name, familiar and appropriate as it is, will have to be dropped.

Tellina (Scissula) calliglypta n. sp.

PLATE 47, FIGURE 1.

Pliocene of Shell Creek, Florida; Willcox.

Shell small, solid, subtrigonal, moderately convex, nearly equilateral, equivalve; beaks high, dorsal slopes rapidly descending; anterior end rounded, posterior end slightly decumbent and sharply pointed, basal margin sinuous; rostrum with a feeble ridge bordering the dorsal area, hardly flexed; surface polished, with faint incremental lines, obliquely, finely, closely grooved over the entire disk from the anterior end to the borders of the posterior dorsal area, which shows only sharp concentric grooving, most obvious in the right valve; pallial sinus slightly angular above, not reaching the anterior adductor, wholly confluent below, similar in both valves; interior with a few radial striæ, the ray obsolete. Lon. 13.5, alt. 9, diam. 4.5 mm., some specimens reaching a length of 18.5 and a height of 11.5 mm.

This fine species in combination of form and sculpture is unlike any other recent or fossil known from the region.

Tellina (Oudardia) Buttoni Dall.

PLATE 47, FIGURE 18.

Angulus modestus of California collectors, not of Carpenter.
Angulus? var. *obtusus* Carpenter, Suppl. Rep. Brit. Assoc. for 1863, p. 639, 1864.
Tellina (*Angulus*) var. *obtusus* Carpenter, Proc. Acad. Nat. Sci. Phila., p. 56, 1865.
Not *Tellina obtusa* Sowerby, Min. Conch., ii., p. 175, pl. 179, fig. 4, 1818.

Pleistocene of San Diego, California, Hemphill and Stearns; recent from Lituya Bay, Alaska, south to the Gulf of California.

The specific name of this species being preoccupied in the genus, I propose that above mentioned in honor of Mr. F. L. Button, an enthusiastic student and collector of Pacific coast shells.

The species is milk white, polished, with faint incremental lines, subequivalve, and slightly flexed; the pallial sinus is angular above and behind in the right valve and elongate oval in the left, in both reaching to the anterior ray, which is well defined and strong. Below the sinus is wholly confluent with the pallial line; there are two minor posterior rays in front of the posterior adductor. Lon. 20, alt. 12, diam. 3.5 mm.

The original *T.* (*Angulus*) *modesta* Carpenter is a distinct species, as the type in the National Museum indicates.

This concludes the list of species belonging to the genus *Tellina* so far known from the Tertiary of the United States.

Genus **TELLIDORA** Mörch.

Tellidora Mörch, in Adams, Gen. Rec. Moll., ii., p. 401, 1856. Type *T. Burneti* Brod. and Sby.

Lucina (sp.) Récluz, Rév. Cuv., p. 270, 1842, Mag. de Zool., pl. 60, 1843.

Tellina (sp.) Brod. and Sby., Zool. Journ., iv., p. 362, pl. ix., fig. 2, 1839.

This fine genus is often quoted as of Mörch, "1851," but Dr. Mörch published nothing in 1851 and his publications of 1850 and 1853 contain no reference to this genus. I have not been able to find any earlier citation of it than that given in the "Genera of Recent Mollusca" cited above, though it is possible the name may have been mentioned by some correspondent of Mörch in some anterior publication which I have not discovered.

The group is linked to *Tellina* by such forms as *Phyllodina*.

Tellidora cristata Récluz.

Lucina cristata Récluz, Révue Cuvier., p. 270, 1742; Guérin, Mag. de Zool., pl. 60, 1843.

Tellina lunulata (Holmes MS.) Adams, Genera of Rec. Moll., ii., p. 401, 1856.

Tellidora lunulata H. and A. Adams, Genera Rec. Moll., ii., p. 401, 1856; Holmes, P.-Pl. Fos. S. Car., p. 47, pl. ix., fig. 7, *a-b*, 1858.

Tellidora cristata Dall, Bull. 37, U. S. Nat. Mus., p. 62, 1889.

Pliocene of the Caloosahatchie and Shell Creek, Florida; Pleistocene of the Carolinas; recent from North Carolina southward to Campeche and Trinidad Island.

This is closely related to the *T. Burneti*, but is less compressed and the flatter valve is the left one, while in *T. Burneti* it is the right.

Tellidora Burneti Broderip and Sowerby.

Tellina Burneti Brod. and Sby., Zool. Journ., iv., p. 362, pl. ix., fig. 2, 1839; Cpr. Maz. Cat., p. 39, 1857.

Tellidora Burneti H. and A. Adams, Gen. Rec. Moll., ii., pl. 104, fig. 3, p. 401, 1856; Holmes, P.-Pl. Fos. S. Car., p. 48, pl. ix., fig. 6, *a-b*, 1858.

Pleistocene of Lower California (Hemphill); recent in the Gulf of California and southward to Panama.

Carpenter states, on the authority of Woodward, that "a species of similar form is found fossil in the Palæozoic rocks, agreeing more with the Atlantic shell" (Maz. Cat., p. 39), but this must refer to some Pelecypod not congeneric, since the oldest *Tellinidæ* do not pass below the Lower Cretaceous, and *Tellidora* is not known in any beds older than the Pliocene.

Genus **STRIGILLA** Turton.

Strigilla Turton, Dithyra Brit., p. 117, 1822; *Tellina carnaria* Linné, non Pennant.
Strigella Gray, Synops. Brit. Mus., p. 91, 1842 (err. typ. for *Strigilla*).
Strigillina Stoliczka, Cret. Pel. India, p. 120, 1870; not of Dunker, 1862.
Limicola (Leach) Fischer, Man. de Conchyl., p. 1149, 1887; not of Leach, 1852.
Strigula Pfeiffer, Malacozoologische Blätter für 1861, vii., Index; not of Perry, 1811.

This genus is remarkably characteristic and is found with its full development as early as the Oligocene. It is divisible into three groups, one typified by *S. carnaria,* in which the pallial sinus is discrepant in the two valves above and wholly coalescent below, the upper line uniting the adductors, the external chiselled sculpture covering the whole shell; a second in which the external sculpture is similar to the preceding but the pallial sinus is alike in the two valves and falls short of uniting the adductor scars; lastly, a third in which the adductors are connected by the pallial line in one valve and the sinus falls short in the opposite valve, externally the oblique sculpture covers part of the shell, while over the rest it is absent or the sculpture is purely concentric, the boundary between the two areas being sharply defined by a radial line (*S. senegalensis*) ; these may be regarded as sections, viz.:

1. *Strigilla* s. s. Type *S. carnaria* Linné.
2. *Rombergia* Dall. Type *S. Rombergi* Mörch.
3. *Aeretica* Dall. Type *S. senegalensis* Hanley.

The fossils so far as yet known belong to the typical section. The oblique external sculpture, which is the most marked characteristic of this genus, is in the commoner forms convexly waved near the anterior third of the disk, and this region often has the sculpture obsolete or even absent in individual specimens; the posterior dorsal slope usually has the sculpture in chevron, the lines sometimes more or less broken up, and the sculpture of this part of the shell, as any one may convince himself by examining large series of specimens, has not the constancy in pattern of that on the disk of the shell, and therefore should not be used as a specific character within narrow limits. Ignorance of these facts is responsible for a long list of synonyms among the recent species, especially on the Pacific coast.

Strigilla pisiformis Linné.

Tellina pisiformis Linné, Syst. Naturæ, ed. x., p. 677, 1758; Hanley, Thes. Conch., *Tellina,* p. 261, pl. lvi., fig. 30, 1847.
Cardium discors Montagu, Test. Brit., p. 84, 1803.
Strigilla pisiformis H. and A. Adams, Gen. Rec. Moll., ii., p. 399, 1856.

Oligocene of Bowden, Jamaica, Henderson and Simpson; Pliocene of Trinidad, Guppy; Pleistocene of the Antillean region generally, and recent throughout the West Indies and as far north as Cape Hatteras.

Guppy cites *S. carnaria* L. from the Bowden beds, but his specimens and all the specimens I have seen from the Bowden marl are identical, so far as I can judge, with the present species.

Strigilla flexuosa Say.

Tellina flexuosa Say, Journ. Acad. Nat. Sci. Phila., ii., p. 303, 1822; Hanley, Thes. Conch., p. 261, pl. lvi., figs. 28, 29, 1847; Holmes, P.-Pl. Fos. S. Car., p. 44, pl. vii., fig. 14, 1858.

Tellina mirabilis Philippi, Arch. für Naturg., 1841, i., p. 260.

Strigilla flexuosa H. and A. Adams, Gen. Rec. Moll., ii., p. 399, 1856.

Strigilla carolinensis Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 573.

Oligocene of the lower bed at Alum Bluff, Florida; Miocene of the Natural Well and at Magnolia, Duplin County, North Carolina; Pliocene of the Caloosahatchie and Shell Creek, Florida; Post-Pliocene of North and South Carolina; and recent from Cape Hatteras, North Carolina, southward to Bermuda and the Antilles.

Holmes's figure, cited above, is poor; the artist has drawn the teeth in the reversed position, probably by inadvertence. Conrad's name is based on the figure in the "Pliocene Fossils of South Carolina," pl. xxii., fig. 7, which is an excellent representation of the recent *S. flexuosa,* though derived from the Miocene of Peedee River, South Carolina.

Strigilla prora Gabb (Am. Journ. Conch., v., p. 30, 1870), from the Tertiary of Payta, Peru, is not a *Strigilla.* The species described by Hanley under the name of *prora* and cited by Gabb is a *Eurytellina.*

Genus **METIS** H. and A. Adams.

?Capsa (sp.) Bruguière, Encycl. Méth., i., pl. 231, figs. 1 *a-c?* 1797; species undeterminable *fide* Bory St. Vincent, 1827.

Capsa Lamarck, Prodrome Nouv. Class. Coq., p. 84, 1799; sole ex. *Tellina angulata* Linné.

Caspa Bosc, Hist. Nat. Coq., p. 18, 1802 (err. typ. for *Capsa*).

Not *Capsa* Humphrey, Mus. Calon., p. 59, May, 1797 (= *Cyrena Keraudrenii fide* Mörch); nor *Capsa* Lamarck, Systeme d'un Nouv. class., p. 126, 1801 (= *Asaphis* Modeer, 1793); nor *Capsa* Lam., An. s. Vert., v., 553, 1818 (= *Iphigenia* Schum., 1817).

Tellina (sp.) Bruguière, Encycl. Méth., ii., pl. 287, fig. 3, pl. 290, fig. 14, 1797; Lamarck, An. s. Vert., v., pp. 530, 531, 1818.

Lutricola Cpr., Suppl. Rep. Brit. As., p. 639, 1863; sole ex. *L. alta* Conr. Not *Lutricola* Blainv., Man. Mal., i., p. 566, 1825 (= *Thracia* + *Scrobicularia* + *Eastonia*).
Metis H. and A. Adams, Gen. Rec. Moll., ii., p. 399 (sole ex. *T. Meyeri* Phil.) + *Capsa* H. and A. Adams, *op. cit.*, p. 409, 1856; not *Capsa* Leach, Moll. Gt. Brit., p. 298, 1852, = *Venerupis;* nor Tryon, Cat. Tell., p. 99, 1869, = *Macalia* Adams.

The generic name *Capsa* has been more ill used than almost any other in our nomenclature. The first use of it probably was by Humphrey in May, 1797, for a fresh-water shell from New South Wales said to be the *Venus erosa* of Solander in the Portland Catalogue (No. 3961). A manuscript note by Mörch in his copy of Humphrey states that this was *Cyrena Keraudreni,* but neither the species nor the genus was described in either the Calonne or the Portland Catalogue. The volume of the plates of the Encyclopédie Méthodique, in which plate 231 appears, has the date 1797 on its title-page, and no text appeared until 1827 owing to the death of Bruguière. There are no specific names on the plates, only the generic name above the neat-line of the engraving. Three types are represented on the plate labelled *Capsa.* Figure 1 may perhaps be a *Metis,* but is represented with an entire pallial line. Figure 2 is *Tellina Bruguièri* Hanley, 1846, for which H. Adams in 1860 proposed the generic name of *Macalia* (not, as indicated by Fischer, Man., p. 1150, typified by *Macoma inquinata* Desh.). Figures 3 and 4 are species of *Asaphis* (Modeer, 1793). If Humphrey's name is the earliest, it is indeterminable and must be dropped from nomenclature. If Bruguière came first, then the type of *Capsa* must be either *Tellina Bruguièri,* which was adopted by Tryon in 1869, or the indeterminable possible *Metis* at the top of the plate, since the type must, according to modern rules, be taken from among those species associated with a generic name by its author at the time of its first publication. Lamarck named *Tellina angulata* L. as his sole example of *Capsa* in the Prodrome of 1799. This is a somewhat doubtful species, but probably the shell Lamarck had in mind was *T. Bruguièri* Hanley,* and if so the same as Bruguière's Figure 2. The second attempt of Lamarck exemplified *Capsa* †

* Schumacher in 1817 (Essai, p. 130) applies the name *Capsula* to *Asaphis,* and credits its authorship to Hwass, who prepared the manuscript of the Museum Calonnianum.

† A shell extremely similar to this figure 2 of Bruguière is figured by Chemnitz, Conch. Cab., vi., p. 89, pl. 9, figs. 74-75, under the name of *Tellina angulata* of Linné, and it is entirely probable that Lamarck had this in mind, though Hanley has shown that it is probably not the original *T. angulata* of Linné. This was also Tryon's opinion.

by *Asaphis,* which is prior; and the third by *Iphigenia,* which is not among Bruguière's figures and cannot be accepted. Bosc, in adopting Lamarck's genus and type of 1799, misspelled the name "*Caspa.*" Under the circumstances it is probably best to assume that Humphrey (as is entirely probable) preceded Bruguière and expel the term *Capsa* from accepted nomenclature. H. and A. Adams, curiously enough, proposed the name *Metis* for one species of the group which they placed under *Tellina* as a subgenus, while they gathered the other species of the same group as a subgenus of *Scrobicularia,* which they called *Capsa.* In 1825 Blainville consolidated several older genera into one, and instead of utilizing the oldest name for this group, proposed a new one, *Lutricola,* in violation of the rules of nomenclature; and in 1863 Carpenter revived this rejected name for the species properly belonging under *Metis,* an inadmissible proceeding.

This group, extending, with its characteristics well developed, far back into the Tertiary, seems entitled to generic rank, on the same grounds as *Strigilla,* etc. The type is *Tellina Meyeri* Dunker (in Phil.), a recent species from the East Indies.

Metis trinitaria n. sp.

PLATE 46, FIGURE 24.

Tellina biplicata Guppy, Proc. Geol. Soc., v., 22, p. 588, 1866 (not of Conrad); Proc. Sci. Assoc. Trinidad, p. 161, 1867, etc.

Tellina sagræ Guppy, Quart. Journ. Geol. Soc. Lond., Nov., 1876, p. 530; Dall and Guppy, Proc. U. S. Nat. Mus., xix., p. 329, 1896; not of d'Orbigny.

Oligocene of the West Indies, in the "Caroni series" of Trinidad, and near Santiago de Cuba at about two hundred and fifty feet elevation on the line of the ore railway; Guppy and King.

Shell anteriorly elongated and dorso-ventrally attenuated, the anterior dorsal slope rapid, the anterior end rounded; the disk mesially constricted, the posterior end short, high, blunt, strongly folded; beaks high, surface sculptured with numerous small, sharp, slightly elevated concentric lamellæ, which are closer towards the ends of the shell; interior with the pallial sinus larger and higher in the left valve, about half confluent below, deep and rounded in front. Lon. 52, alt. 41, diam. 19 mm., but reaching twice this size.

The peculiar anterior elongation and arcuate form of this species distinguish it clearly from the other American species. Guppy erroneously identified it with a Miocene and also with a Pleistocene species, from both of which comparison shows it perfectly distinct.

Metis chipolana n. sp.

Plate 47, Figure 21.

Oligocene of the Chipola horizon, at Alum Bluff and the Chipola River, Florida; Burns.

Shell small for the genus, nearly equilateral, not quite equivalve, the left valve slightly larger, evenly rounded in front, pointed and attenuated behind; beaks low, lunule and escutcheon deeply impressed, narrow; posterior end markedly flexed, with an obvious fold or emargination of the valve just above the posterior basal angle; surface finely radially striate, with a fine concentric lamellation which is more distinct towards the base and over the fold; pallial sinus obliquely ascending, free from the pallial line below, as in *Arcopagia.* Lon. 44, alt. 36, diam. 16 mm.

This species is smoother and more regular than any of the other forms known from America, and recalls *M. Dombeyi* of the Pacific recent fauna.

Metis biplicata Conrad.

Tellina biplicata Conrad, Journ. Acad. Nat. Sci. Phila., vii., p. 152, 1834; Fos. Medial Tert., p. 36, pl. xix., fig. 4, 1840; not of Tuomey and Holmes, Guppy, or Emmons.
Metis biplicata Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 573 (in part), 1863; Am. Journ. Conch., v., p. 99, 1869.

Lower Miocene of Maryland, on the Choptank River, the Patuxent, Plum Point, etc.; Pliocene of the Caloosahatchie River, Florida (?).

The Caloosahatchie specimen is quite imperfect and requires confirmation by better material, but as far as it goes it resembles this species more than any of the others. *M. biplicata* has been confused with several other species which are discriminated in this memoir, but which seem quite recognizable. The pallial sinus is low, subequal in the two valves, and partly confluent below.

Metis magnoliana n. sp.

Plate 49, Figure 6.

Tellina biplicata Tuomey and Holmes, Pleioc. Fos. S. Car., p. 88, pl. xxii., fig. 3, 1856; Emmons, Geol. Rep. N. Car., p. 296, fig. 225, 1858; not of Conrad, 1834.

Upper Miocene of the Peedee River, South Carolina, and of the Natural Well and Magnolia, Duplin County, North Carolina; Tuomey and Burns.

Shell subquadrate, subequilateral, rounded in front, with the posterior dorsal area compressed and elevated, extending backward beyond the posterior basal angle as a rounded winglike extension of the shell; posterior end strongly folded, middle of the disk nearly smooth except for fine radial striæ and incremental lines, which towards the ends of the shell are reinforced by elevated concentric lamellation, especially strong on the wing; beaks rather low; interior with large adductor scars, the pallial sinus low, not reaching the anterior scar, but more than half confluent below; lunule and escutcheon narrow, deeply impressed. Lon. 71, alt. 60, diam. 22 mm.

This species is readily recognized by its dorsal posterior "wing," which none of the other species exhibits, and which is discernible in a young specimen less than fifteen millimetres long. It seems to be characteristic of the Upper as *M. biplicata* is of the Lower Miocene of the Atlantic coast.

Metis intastriata Say.

Tellina intastriata Say, Journ. Acad. Nat. Sci. Phila., v., p. 218, 1827; De Kay, Zool. N. York, p. 211, 1843; Binney's Say, p. 125, 1858.

Tellina Grüneri Philippi, Zeitschr. für Mal., ii., p. 150, 1845.

Tellina inornata Adams, *fide* Krebs, Cat., p. 101, 1864.

Lutricola interstriata Dall, Bull. U. S. Nat. Mus., No. 37, p. 62, 1889.

Tellina ephippium Gregory, Quart. Journ. Geol. Soc. Lond., Fifth Ser., vol. li., p. 293, 1895; not of Spengler, 1793.

Tellina sagræ Orbigny, Paleontologia Cubana, pl. iv., figs. 8, 9 (1853 ?); not of Guppy, 1876.

Pleistocene of the Antillean region; recent, from the Florida Keys and Bermuda west to Texas and south to Guadelupe in thirty fathoms or less.

This species was confounded by Holmes with *Macoma constricta,* by Gregory with an Oriental species, and by Guppy with the Oligocene type. Say's original name is probably a misprint for *interstriata,* as observed by Krebs and others. On the plates of the unpublished Cuban Paleontology of Sagra's "Natural History of Cuba," d'Orbigny has named an internal cast, probably of this species, *Tellina sagræ.* I know several sets of these plates are in circulation, and the names have been cited in the literature, but as far as I can discover no text or Atlas were ever published and the date is very uncertain, though probably about 1853.

The species can be recognized by its very sharp and narrow posterior fold, its obsolete lunule and escutcheon, its extremely strong flexure, its small adductor scars, and its exceptionally large and high pallial sinus more than half confluent below. Lon. 50, alt. 41, diam. 21.5 mm.

Metis alta Conrad.

Tellina alta Conrad, Journ. Acad. Nat. Sci. Phila., vii., p. 258, 1837 (not *Tellina alta* Conrad, Fos. Tert. Form., i., No. 4, p. 41, Oct., 1833; Claibornian).

Tellina alta Hanley, Thes. Conch., i., p. 332, pl. 62, fig. 200, 1847.

Scrobicularia biangulata Carpenter, P. Z. S., 1855, p. 230.

Lutricola alta Cpr., Suppl. Rep. Brit. Assoc., 1863, p. 639; Journ. de Conchyl., xii., p. 133, 1865; Cooper, Geogr. Cat., p. 6, 1867.

Pleistocene of San Diego and San Pedro, California. Recent from Santa Barbara south to San Diego.

This species is close to but distinguishable from *M. excavata* Sowerby of the Panamic fauna. Both of them are nearer the Upper Miocene *M. magnoliana* than they are to the recent *M. interstriata* of the present Antillean fauna. Perhaps, strictly speaking, Conrad's name should be rejected for that of Carpenter, as he had already described a *Tellina alta* (now placed in *Arcopagia*) from the Claibornian Eocene, but as the two were placed in separate genera before attention was called to this fact, I have concluded to let the name remain. This is probably the largest species of the genus, one valve from the Pleistocene of San Diego in the National Collection measures in lon. 110, alt. 100, diam. (half that of the pair?) 27 mm.

Conrad described from the Pleistocene of Santa Barbara, California, an *Arcopagia unda* (Pacific R. R. Rep., vii., p. 192, pl. iv., figs. 3, 4, 1857) which may be referable to this species but is practically unrecognizable.

A Miocene species from Monterey County, California, which is probably distinct from *M. alta,* though united with the latter by Gabb, was described by Conrad (Pacific R. R. Rep., vi., pt. 2, p. 70, pl. 2, fig. 6, 1857) under the name of *Arcopagia* (=*Metis*) *medialis. M. Dombeyi* Hanley (not Carpenter) and *M. excavata* Sowerby are recent species from the west coast of Middle America which have not yet been reported in a fossil state.

Genus **MACOMA** Leach.

Macoma Leach, App. ii., Ross's Voy., p. lxii., 1819 (*M. tenera* Leach); Journ. de Physique, lxxxviii., p. 465, 1819 (June).

Limicola Leach, Moll. Gt. Brit., p. 296, 1852; *Tellina carnaria* Penn. non Linné; not *Limicola* Koch, *Aves*, 1816; nor Fischer, Man. Conchyl., p. 1149, 1887.

> *Macalia* H. Adams, P. Z. S., 1860, p. 369; *Tellina Bruguièri* Hanley.

> *Tellinungula* Roemer, Conchyl. Cab., ed. ii., Mon. *Tellina,* p. 268, 1872; *Tellina Bruguièri* Hanley.

> *Capsa* Tryon, Cat. *Tellinidæ*, p. 99, 1869; *Tellina Bruguièri* Hanley.

Macroma Gray, Ann. Phil., xxv., p. 136, 1825; P. Z. S., 1847, p. 186; err. typ. for *Macoma* Leach.

Psammobia (sp.) Turton, Dithyra Brit., p. 95, 1822; *Tellina solidula* Mtg.; Lam., An. s. Vert., v., p. 514, 1818; Say, Journ. Acad. Nat. Sci. Phila., v., 219, 1827.

Psammotea Gray, P. Z. S., 1847, p. 186; not Turton, 1822, nor Lam.

Sanguinolaria (sp.) Conrad, Am. Mar. Conch., p. 34, 1831; Gould, Inv. Mass., p. 66, 1841.

Rexithœrus Conrad, in Tryon, Cat. Tell., p. 104, 1869; *Macoma secta* Conrad.

Shell without lateral teeth, usually subtrigonal and with a marked posterior flexure, the surface feebly sculptured concentrically or smooth; the siphons naked. Type *M. tenera* Leach (= *Tellina calcarea* Gmelin).

Subgenus *Macoma* s. s. Shell subtrigonal, the periostracum conspicuous; usually colorless, or, if colored, without a color pattern; flexure well marked; the pallial sinus coalescent with the pallial line below and often discrepant in the two valves; inhabiting the cooler seas and especially boreal waters.

Section *Macalia* Adams. Shell rounded, with a wide hinge-plate and exceptionally large teeth. Subtropical.

Section *Rexithœrus* Conrad. Shell large, inequivalve, with a smooth surface, a large and strong deep-set ligament, behind which the dorsal margin is conspicuously produced upward.

Subgenus *Psammacoma* Dall, 1900. Valves equal, produced anteriorly, bluntly truncate and hardly flexed posteriorly, with a smooth surface and inconspicuous periostracum. Tropical waters. Type *Tellina candida* (Lam.) Bertin (= *T. galathea* Hanley, Reeve).

This group by its elongated *Tagelus*-like form, its delicate, often radially hirsute, periostracum, and its habitat in the warmer seas where it replaces the Arctic type of *Macoma*, is easily separable from the latter. The pallial sinus is usually about half free instead of wholly coalescent below, as more usual in typical *Macoma*.

Section *Psammacoma* s. s. Type *T. candida* Bertin. Shell elongate, ligament and resilium slender and wholly external.

Section *Psammotreta* Dall, 1900.

Like *Psammacoma* but shorter, with the resilium internal, shorter than and partly separated from the ligament. Type *Macoma aurora* Hanley.

This section bears to *Psammacoma* the same relation that *Scrobiculina* does to *Angulus* in the genus *Tellina*.

Subgenus *Cymatoica* Dall, 1889.

Shell small, thin, concentrically undulate, strongly flexed behind and elongated and inflated anteriorly. Type *Tellina undulata* Hanley (+ *occidentalis* Dall).

This very peculiar little type appears as early as the Oligocene and has persisted in the Antillean and Middle American region until the present time.

Macoma calcarea Gmelin.

Tellina calcarea, testa ovata, etc., Chemnitz, Conch. Cab., vi., p. 140, pl. 13, fig. 136, 1782.

Tellina calcarea Gmelin, Syst. Nat., vi., p. 3236, No. 38, 1792.

Tellina lata Gmelin, Syst. Nat., vi., p. 3237, No. 48, 1792.

Tellina sabulosa Spengler, Skrift. Naturh. Selsk., iv., p. 114, 1794; Mörch, Fort., Gronl. Blod., p. 18, 1877.

Macoma tenera Leach, App. to Ross's Voy., p. 62, 1819; Journ. de Phys., vol. 88, p. 465, 1819.

Tellina proxima (Brown MS.) Sowerby, Zool. Beechey's Voy., p. 154, pl. 44, fig. 4, 1839; Smith, Wern. Mem., viii., p. 105, pl. 1, fig. 21, 1839; Hanley, Thes. Conch., *Tellina*, p. 313, pl. 66, fig. 264 and pl. 59, fig. 115, 1847; Forbes and Hanley, Brit. Moll., i., p. 307, pl. 21, fig. 1, 1850; iv., p. 251, pl. 133, fig. 3, 1853; Stimpson, Shells of N. Engl., p. 21, 1851.

Tellina sordida Couthouy, Boston Journ. Nat. Hist., ii., p. 59, pl. 3, fig. 11, 1838.

Sanguinolaria sordida Gould, Inv. Mass., p. 67, 1841.

Pleistocene of Scandinavia, Scotland, Greenland, Siberia, and Alaska; living in the Arctic and boreal seas in two to one hundred fathoms, extending southward on the Atlantic coast to Long Island Sound, and on the Pacific to the coast of Oregon and Northern Japan, in the southern part of its range only in deep water.

The National Museum possesses specimens which appear to be Macomas from the Eocene of Prairie Creek, Wilcox County, Alabama; Caton's Bluff, Conecuh River, Alabama; White Bluff, Arkansas, and elsewhere, but not in satisfactory condition for description. The genus appears to be represented also in the Oligocene sandstone of the Isthmus of Panama, near Gatun, by *M.* (*Psammacoma*) *dariena* Conrad (1855, + *Tellina semilævis* Gabb, 1861). The Oligocene and later species will be treated in the order of their place in the genus.

Macoma? calhounensis n. sp.

Plate 47, Figure 10.

Oligocene of the Chipola marl, Chipola River near Bailey's Ferry, Calhoun County, Florida; Burns.

Shell small, thin, moderately inflated, ovate trigonal with prominent pointed beaks; anterior end slightly longer, rounded, base arcuate, posterior end attenuated with a small truncation at the tip; surface polished, with rather distant, very delicate, concentric, elevated lines; interior with the pallial sinus high, long, nearly reaching the anterior adductor scar, wholly confluent with the pallial line below. Lon. 10.5, alt. 6.25, diam. 3 mm.

The single perfect specimen is a left valve and has only the cardinal teeth, but the margins on each side of them project in a way unusual in this genus, yet the associated fragments include hinges of both right and left valves of undoubted *Macoma* which appear to be the same as the complete valve. It may be a young shell of a species which reaches a considerably larger size.

Macoma irma n. sp.

PLATE 46, FIGURE 15.

Oligocene of the silex beds at Ballast Point, Tampa Bay, Florida; Dall.

Shell ovate, moderately convex, short, with a marked posterior flexure, nearly equilateral; beaks not conspicuous, anterior end broad, rounded, posterior attenuated, bluntly pointed, flexed to the right; surface marked only by rather rude incremental lines; hinge-plate strong, teeth normal; pallial sinus obscure but apparently connecting the adductor scars, and wholly confluent with the pallial line below. Lon. 28, alt. 20, diam. 10 mm.

The specimens are rather poor pseudomorphs in silica, but evidently belong to the genus *Macoma* and to a species distinct from any of the others listed from this horizon.

Macoma lenis Conrad.

Tellina lenis Conrad, Proc. Acad. Nat. Sci. Phila., i., p. 306, 1843; Fos. Medial Tert., p. 72, pl. 41, fig. 9, 1845.

Tellina lens Meek, S. I. Miocene Checklist, p. 10, 1864; err. typ. for *lenis*.

Oligocene of the Oak Grove sands, at Oak Grove, Santa Rosa County, Florida, Burns; Miocene of Calvert Cliff, Maryland, Conrad; of Jones Wharf and Plum Point Landing, Maryland Geological Survey.

The pallial sinus is rather short and wholly confluent below. The hinge-teeth are very small and feeble, but the ligament long. A strong thickened ray proceeds from the umbo radially behind the anterior adductor scar, and the shell has the anterior end markedly shorter than the posterior, which is not flexed and is lanceolately pointed, giving the shell the aspect of a *Gastrana,* but the surface sculpture is without radial striation. The presence of the species in the Oak Grove sands is one of those items which illustrate the transitional character of these sands and their faunal modification by the influx of northern species of a type belonging to colder water than that of the earlier Oligocene in Florida.

Macoma Conradi n. sp.

Plate 47, Figure 3.

Miocene of Darlington, South Carolina; of the Natural Well and Magnolia, Duplin County, North Carolina, and York River, Virginia; Burns and Harris.

Shell thin, inflated, ovate, broad and rounded in front, rapidly attenuated, roundly pointed and somewhat flexuous behind; beaks low, pointed, near the posterior third; surface smooth or marked only with fine incremental lines; hinge normal, feeble, teeth small; adductor scars large, pallial sinus short, rounded, and curved (in the right valve) well backward below before coalescing with the pallial line. Lon. 22, alt. 14, diam. 7 mm.

This is a shorter and broader and less flexuous shell than *M. virginiana* Conrad, some of the varieties of which somewhat approach it.

Macoma virginiana Conrad.

Tellina lusoria Conrad, Fos. Medial Tert., p. 35, pl. 19, fig. 3, 1840; Proc. Acad. Nat. Sci. Phila. for 1863, p. 573, 1864; Emmons, Geol. N. Car., p. 297, fig. 225*a*, 1858; Tuomey and Holmes, Pleioc. Fos. S. Car., p. 89, pl. 22, fig. 5, 1858; not of Say, 1822.

Tellina virginiana Conrad, Am. Journ. Conch., ii., p. 76, 1866; not of Clark, Bull. 141, U. S. Geol. Surv., p. 76, pl. 15, fig. 4, 1897.

Miocene of York River, Petersburg, and the Nansemond River, near Suffolk, Virginia; Pliocene of the Caloosahatchie River, Florida; of Mrs. Guion's marl-pit, Waccamaw River, South Carolina; and the north end of the Great Dismal Swamp, Virginia.

After repeated studies of the subject I have come to the conclusion that Say's *Psammobia lusoria* was probably based on a large specimen of the shell which he afterwards described under the name of *Tellina tenta*. From that species the present shell differs, as Conrad states it does from *lusoria*, by being higher, more arcuate below, and less compressed and flexuous behind; it also averages considerably larger. The pallial sinus is low, rather short, rounded in front, and about half confluent with the pallial line below. There is some doubt as to whether the shell figured by Emmons is the same, as he speaks especially of sharp, elevated lines on the surface, which I have not observed on any of the Virginia shells.

Macoma alumensis n. sp.

PLATE 47, FIGURE 8.

Miocene of Alum Bluff, Calhoun County, Florida; Burns.

Shell solid, inequivalve, inequilateral; beaks inconspicuous, pointed; left valve more convex and flexuous, right valve flatter and less flexuous; anterior end longer, the dorsal margin nearly parallel with the base in the left valve, the end evenly rounded into the base, which towards the posterior end is a little sinuated; posterior dorsal margin rapidly descending; a keel near it rises above the line of the margin to the strongly flexed point, which is near the base; surface smooth except for incremental lines; right also with a strong keel, so that the margins of the valves meet at the bottom of a deep sulcus behind the beaks when closed; hinge-teeth normal; hinge-plate solid and heavy, especially in the right valve; pallial sinus discrepant in the two valves, but in both low, rather short, rounded behind, and about half confluent with the pallial line below. Lon. 20, alt. 12, diam. 8 mm.

Macoma Lyelli Dall.

PLATE 37, FIGURES 9, 10, 11.

Macoma Lyelli Dall, Am. Journ. Sci., xlviii., p. 298, Oct., 1894.

Miocene (and Pliocene?) of Gay Head, Martha's Vineyard, Massachusetts; Dall and Woodworth.

This is the shell alluded to by Sir Charles Lyell in his account of his visit to Gay Head as "a *Tellina* resembling *T. biplicata.*" It is closely related to *Macoma obliqua* J. Sowerby, of the English Crag, but is less produced in front and more excavated on the posterior dorsal margin. It occurs only in the form of very perfect internal casts in the Miocene clay of Gay Head, where it is the most abundant molluscan fossil. In the sands unconformably superposed on the clays fragments supposed to belong to this species were collected which may perhaps be Pliocene.

Macoma tenta Say.

?Psammobia lusoria Say, Journ. Acad. Nat. Sci. Phila., ii., p. 304, 1822; not of Conrad, 1840.

Tellina tenta Say, Am. Conch., plate 65, fig. 3, 1834.

Macoma tenta Dall, Bull. 37, U. S. Nat. Mus., p. 60, pl. 56, fig. 10, 1889.

Tellina Souleyetiana Récluz, Journ. de Conchyl., iii., p. 253, pl. 10, fig. 5, 5′, 1852; not *T. Souleyeti* Hanley, 1844, P. Z. S., p. 71.

Tellina (*Peronæa*) *Récluziana* Tryon, Cat. Tell., p. 98, 1869.

Pliocene marls of the Caloosahatchie River, Florida; Dall. Recent from Cape Cod southward to Rio Janeiro.

T. Souleyetiana differs from the northern specimens of *T. tenta* only by the warmer flush of yellow or orange which suffuses the umbonal region of the valves, and perhaps in having a little smoother periostracum. As these differences are obviously such as are correlated with a more southern habitat, the forms can hardly be separated specifically. *M. virginiana* Conrad is their Miocene precursor.

Macoma constricta Bruguière.

Solen constrictus Brug., Mém. Soc. Hist. Nat., i., p. 126, No. 3, 1799.
Psammobia cayennensis Lamarck, An. s. Vert., v., p. 514, 1818.
Tellina cayennensis Deshayes, An. s. Vert., ed. ii., vi., p. 177, 1835; Hanley, Thes. Conch., p. 312, pl. 62. fig. 190, 1846.
Tellina constricta Philippi, Abb. und Beschr., i., p. 9, pl. 1, fig. 5, 1843.
Tellina lateralis Say, Journ. Acad. Nat. Sci. Phila., v., p. 218, 1827.
Tellina cayennensis Holmes, P.-Pl. Fos. S. Car., p. 47, pl. 8, fig. 4, 1859.
Macoma constricta Dall, Bull. U. S. Nat. Mus., No. 37, p. 60, 1889.

Pliocene of the Caloosahatchie River, Florida, Dall; Pleistocene of South Carolina, Holmes; recent from the coast of New Jersey south to Brazil.

This species appears to be rare in the Pliocene, as only a single valve was obtained, but it is unmistakably conspecific with the recent shell.

Macoma laxa n. sp.

PLATE 47, FIGURE 14.

Pliocene marl of the Caloosahatchie River, Florida; Dall.

Shell thin, nearly equilateral, elongate, moderately convex, with inconspicuous beaks; anterior end a little longer, higher, and rounded, posterior attenuated, compressed, pointed; not obviously flexuous; surface sculptured only with rather rude, somewhat irregular incremental lines; posterior termination near the base, posterior dorsal margin moderately arched; hinge normal, with minute feeble teeth; pallial sinus discrepant in the two valves, elongate but not quite reaching the anterior adductor, in the right valve slightly angular above under the umbo, in the left valve only slightly sinuous there, in both wholly confluent below with the pallial line; interior of the valves faintly radially striated, especially near the base. Lon. 23, alt. 13, diam. 6 mm.

This species has a peculiar outline and does not closely approach any of the other species of *Macoma* from the region.

Macoma balthica Linné.

Tellina balthica Linné, Syst. Nat., ed. x., p. 677, No. 53, 1758; Fauna Suecica, ed. ii., p. 517, 1761; Syst. Nat., ed. xii., p. 1120, 1768; Meyer and Möbius, Fauna der Kielerb., ii., p. 101, f. 14-19, 1872.

Venus fragilis O. Fabr., Fauna Grönl., p. 413, 1780; not of Linné.

Tellina gröndlandica (Beck MS.) Lyell, Geol. Trans., 2d Ser., vi., p. 137, pl. 16, f. 8, 8*a*, 1839; Mörch in Rink's Grönl., App., p. 90, 1857.

Psammobia fusca Say, Journ. Acad. Nat. Sci. Phila., v., p. 219, 1827; Binney's Say, p. 126, 1858.

Sanguinolaria fusca Conrad, Am. Mar. Conch., p. 34, pl. vii., fig. 1, 1831; Gould, Inv. Mass., p. 66, fig. 42, 1841; Mighels, Bost. Journ. N. Hist., iv., p. 317, 1843; DeKay, Nat. Hist. N. Y., v., p. 212, pl. xxxii., fig. 304, 1843.

Tellina inconspicua Brod. and Sowerby, Zool. Journ., iv., p. 363, 1829; Zool. Beechey's Voy., p. 153, pl. xli., fig. 6, 1839; Hanley, Thes. Conch., i., p. 317, pl. lix., fig. 120, 1847.

Tellina fusca Hanley, Thes. Conch., i., p. 316, pl. lix., fig. 117, 1847; Philippi, Abb. und Beschr., ii., p. 24; *Tellina*, pl. iii., fig. 3, 1845; Stimpson, Sh. of N. E., p. 20, 1851.

Tellina (*Macoma*) *tenera* Mörch, Prodr. Faun. Moll. Grönl., p. 18, 1857; Admiralty Man. Nat. Hist. Greenl., p. 131, 1875; not of Leach, 1819.

Tellina Fabricii Hanley, Thes. Conch., i., p. 318, pl. lix., fig. 112, 1847.

Tellina fragilis Möller, Ind. Moll. Grönl., p. 20, 1842; not of Linné; + *T. Molleri* Desh. MS.

Macoma fragilis Stimpson, Proc. Acad. Nat. Sci. Phila. for 1861, p. 97; H. and A. Adams, Gen. Rec. Moll., ii., p. 400, 1856; Verrill, Inv. An. Vineyard Sound, p. 676, pl. xxx., fig. 222, 1873.

Macoma Fabricii H. and A. Adams, Gen. Rec. Moll., ii., p. 400, 1856.

Macoma grönlandica Packard, Mem. Boston Soc. N. Hist., i., pp. 235, 243, etc., 1866.

Macoma fusca H. and A. Adams, Gen. Rec. Moll., ii., p. 400, 1856; Holmes, P.-Plioc. Fos. S. Car., p. 48, pl. viii., fig. 5, 1858.

Tellina moesta Deshayes, P. Z. S., 1854, p. 361.

Fossil in the Pleistocene of Northern Europe, the northeastern coast of America, and Alaska; living in all arctic and boreal seas, and, on the east coast of America, south to Georgia; in Europe to the Mediterranean.

The original *Tellina balthica* was the thin form of the brackish waters of the Baltic, and not the solid, heavy, smooth shell known as *Macoma solidula* Pulteney, which is the variety of *balthica* best known among collectors. It is probably because comparisons of the American shells have usually been made with British specimens of *balthica* var. *solidula* that American authors have been disposed to separate the two and give the American shell a different name.

Macoma Kelseyi n. sp.

PLATE 49, FIGURE 7.

Pleistocene of San Diego, California, obtained in the City Park by Dr. R. E. C. Stearns.

Shell large, solid, heavy, compressed, slightly flexed; beaks subcentral, prominent, pointed; anterior end evenly rounded into an arcuate base and dorsal margin; posterior end lanceolate, the dorsal margin nearly rectilinear; surface sculptured only by strong, rather irregular lines of growth; hinge-plate short, broad, and strong; teeth normal, elongated, large; pallial sinus discrepant in the two valves; left valve with the upper part of the sinus sinuous, extending from the posterior to the anterior adductor, behind which is a thickened obscure ray; right valve with the sinus short, gibbous, the anterior end rounded, thence the line curves backward before coalescing with the pallial line below; in the left valve the sinus is coincident with the whole of the pallial line below. Lon. 86, alt. 56, diam. 20 mm.

This fine, large species is closely related to the recent and Pleistocene *M. nasuta* Conrad, from which it differs as follows: it is larger, heavier, and flatter than any specimens of *M. nasuta* yet recorded; the ridge bounding the posterior dorsal area is less prominent, and in all the specimens of *M. nasuta* examined the line of the sinus joins the pallial line below at a right angle without previously curving backward. The most obvious external character is the comparative flatness of the posterior part of the right valve and its narrower dorsal area in *M. Kelseyi.* The latter is named in honor of Professor F. W. Kelsey of San Diego, who has given much attention to the local shell fauna.

Other species of typical *Macoma* which have been reported from the post-Eocene beds of the Pacific coast are *Macoma arctata* Conrad (1849, as *Tellina,* not *Tellina arctata* Conrad, 1843, from North Carolina) from the Miocene of Oregon; *M. congesta* Conrad (as *Tellina* in P. R. R. Rep., 1855, v., App., p. 323, pl. iii., figs. 14, 18, 21, 21*a*) from the white shales of Monterey County, California, Miocene; *T. diegoana* and *pedroana* Conrad (*op. cit.*) appear to be unrecognizable; *T. eborea* Conrad (in Meek's Miocene Checklist, 1864) seems to be merely a list name never figured or described; *T. ocoyana* Conrad (1855, P. R. R. Rep., v., p. 329, pl. viii., fig. 75) is referred to *Macoma* by Gabb, but has not been recognized since it was figured by Conrad from Blake's Ocoya Creek collection; *M. indentata* Carpenter, *M. expansa* Carpenter, and *M. nasuta* Conrad have all been cited from the Miocene of California or

Oregon, but should be carefully compared with the recent types before these identifications are accepted, since in many cases the fossils prove to be representative and not identical. Conrad described (without a figure) a *Tellina nasuta* from Oregon in the "Geology of the Wilkes Exploring Expedition" in 1849, apparently quite forgetting a recent species, to which he gave the same name, from Nuttall's Californian collection in 1837. The Pliocene species are better preserved and identified, and here *M. inquinata* Deshayes and *M. nasuta* Conrad, 1837, have been recognized. The Pleistocene has yielded *M. calcarea* Gmelin, *M. nasuta* Conrad, 1837, *M. inquinata* Deshayes, *M. balthica* Linné (+ *californica* Conrad and *inconspicua* Brod. and Sby.), and *M. yoldiformis* Carpenter, all known in the recent state from the Pacific coast.

From the Atlantic coast Pleistocene the number of names is even larger, including all or nearly all of the recent species, which I will not enumerate here, as nearly all of them have been referred to already in this work.

Macoma (Rexithaerus) secta Conrad.

Teltina secta Conrad, Journ. Acad. Nat. Sci. Phila., vii., p. 257, 1837; Hanley, Thes. Conch., p. 327, pl. 65, figs. 245, 248, 1847.

Tellina tigamentina Deshayes, Mag. de Zool., 1843, pl. 8.

Macoma secta H. and A. Adams, Gen. Rec. Moll., ii., p. 401, 1858.

Macoma var. *edulis* (Nutt. MS.) Carpenter, Rep. Brit. Assoc. for 1863, p. 639.

Macoma (*Rexithærus*) *secta* Tryon, Cat. Tellinidæ, p. 104, 1869.

Pleistocene of San Diego, California, Stearns; recent from Puget Sound to Lower California.

To the same group belongs *Macoma indentata* Cpr., which also occurs in the Pleistocene of San Diego, and recent in the adjacent region.

Macoma (Psammacoma) tracta n. sp.

PLATE 47, FIGURE 13.

Oligocene of the Chipola horizon on Shoal River, Walton County, Florida, and of the Bowden beds, Jamaica.

Shell small, thin, rather compressed, elongated, inequilateral, the anterior end longer; beaks low, not conspicuous; posterior end slightly flexed to the right; anterior end higher, rounded, posterior attenuated, bluntly terminated; surface smooth except for faint incremental lines; interior (inaccessible in the specimens). Lon. 12.7, alt. 5, diam. 2 mm.

This small species differs from the young of the next in its more attenuated posterior end and slight flexure.

Macoma (Psammacoma) olivella n. sp.

PLATE 47, FIGURE 20.

Oligocene marl of Bowden, Jamaica.

Shell large, solid, moderately convex, with rather full, conspicuous beaks, equivalve, very inequilateral; anterior dorsal slope rectilinear, anterior end rounded; posterior dorsal slope slightly concave, posterior end much shorter, rounded below, blunt terminally and subangulate at its junction with the dorsal line; an elongated lunule and escutcheon, moderately impressed and not very definitely limited, are present; surface smooth, except for lines of growth and on the ridge bounding the lunule, which is slightly undulated, especially near the beaks; hinge normal, teeth rather small, pallial sinus gibbous, short, partly free below. Lon. 23, alt. 13, diam. 5 mm.

This species recalls *M.* (*Psammacoma*) *elongata* Hanley of the recent Panama fauna.

Macoma (Psammacoma?). producta Conrad.

Tellina producta Conrad, Fos. Medial Tert., p. 36, pl. 19, fig. 5, 1840.

Tellina (*Peronæoderma*) *producta* Conrad, Proc. Acad. Nat. Sci. Phila. for 1863, p. 573, 1864.

Miocene of St. Mary's River, Maryland; Meek.

This approximates to *M. tenta* by the figure, and may not belong here.

Macoma (Psammacoma?) Holmesii n. sp.

PLATE 47, FIGURE 4.

Miocene of the Natural Well, Duplin County, North Carolina; Burns.

Shell large, solid, equivalve, inequilateral, with low beaks, moderately convex, elongated; anterior end longer, the dorsal slope rectilinear, the end rounded, the base nearly straight; the posterior end shorter, the anterior vertically subtruncate, but not angular; a feeble sulcus in the left valve extending from the umbo to the posterior end of the base; a faint, narrow escutcheon but no lunule visible; surface smooth except for incremental lines, which show a little stronger on the posterior dorsal area; hinge short, teeth small, resilium verging on *Psammotreta,* to which this species may eventually, with more material, prove to belong; pallial sinus long but not reaching the anterior adductor, sinuous above; posterior dorsal ridge of the right valve insinuated at the margin of the valve. Lon. 32, alt. 17, diam. 8 mm.

The species is named in honor of Professor J. A. Holmes, State Geologist of North Carolina.

Macoma (Psammacoma) brevifrons Say.

Tellina brevifrons Say, Am. Conch., pl. lxiv., fig. 1, 1834; Binney's Say, p. 227, 1858; Hanley, Thes. Conch., i., p. 329, 1846; Tryon, Am. Mar. Conch., p. 149, pl. 26, figs. 355-7 (bad), 1874.

?*Tellina oblonga* Gmelin, Syst. Nat., p. 3234, 1792, after Chemnitz, Conch. Cab., vi., pl. 10, fig. 87.

Pliocene of the Caloosahatchie marls, Monroe County, Florida; Dall; recent from South Carolina to Brazil.

This species, having been badly figured and the figures very erroneously colored (having appeared after Mr. Say's death), seems to have been a good deal confused. It resembles the preceding species a good deal, but is a shorter and broader shell, usually small towards the northern extreme of its range but attaining a considerable size (lon. 39, alt. 23.5, diam. 13 mm.) in the warmer waters southward and in the Pliocene. The recent specimens have usually a blush of orange color in the central and umbonal region. *T. lusoria,* which has been more or less confused with this species, I suspect to have been founded on a large specimen of *Macoma tenta.*

Macoma (Psammacoma) tageliformis n. sp.

Pleistocene of Texas coast at Corpus Christi, and recent in the same region but apparently rare.

Shell rather thin, elongate, slightly flexuous, similar to the preceding species in general form but more elongated, more rudely striated, more equilateral, and, when living, without the orange suffusion; pallial sinus discrepant in the two valves; in the left valve short, high, rounded above and behind, half confluent with the pallial line below; in *M. brevifrons* this sinus is angular above and reaches nearer to the anterior adductor in front; in the right valve the sinus rises to a blunted angle in front of the posterior adductor scar and close to it, then descends obliquely, and then returns to the pallial line, with which it is less than half confluent; this sinus is even shorter than that in the opposite valve, while the same in *brevifrons* is one-fourth longer. Lon. of shell 45, alt. 25, diam. 12.5 mm.

This species, which, by its larger size, more elongate and flexuous form, its absence of color, and its different pallial sinus, is well distinguished from *M. brevifrons,* will be figured from the recent specimens in a forthcoming report on the Mollusks of Porto Rico.

Macoma (Psammotreta) aurora Hanley.

Tellina aurora Hanley, P. Z. S., 1844, p. 147; Thes. Conch., p. 301, No. 153, pl. lviii., fig. 76, 1846.

Pleistocene of San Diego, California; Stearns (abundant); recent, from the Panamic region to the Gulf of California.

This form is in a general way similar to *M. brevifrons* Say, and probably for that reason was identified with *Tellina oblonga* Gmelin by Deshayes. As Chemnitz, upon whose figure Gmelin's species was based, distinctly says his species is not European, but from Guinea and the West Indies, it cannot be assumed to be the Panama shell when one equally near Chemnitz's figure is found in the West Indies, namely, *M. brevifrons.*

Macoma (Cymatoica) Vendryesi n. sp.

Plate 46, Figure 3.

Oligocene of the Bowden marls, Jamaica; Henderson and Simpson.

Shell minute, thin, flexuous, rostrate, inequivalve, inequilateral, gaping behind, moderately inflated; anterior end full, rounded, shorter; posterior end longer, rectilinear above, sinuous below, produced into an obliquely truncate rostrum; beaks low, pustular, left valve slightly less convex than the right and a little longer; surface concentrically irregularly undulated except on the posterior dorsal area, which is transversely striated; pallial sinus small, short, partly confluent below with the pallial line. Lon. 7, alt. 4, diam. 2 mm.

This species is considerably smaller than the recent *M. orientalis* Dall, the concentric wave-like sculpture is finer and less broken, and the shell is relatively more inflated. The teeth are quite feeble and minute.

The presence of this type so long ago as the Oligocene, with its characteristics fully developed, lends plausibility to the assumption upon which its separation from the typical Macomas was based. The genus *Strigilla,* the section *Phyllodina,* etc., are analogous cases.

The present species is named in honor of Henry Vendryes, Esquire, of Kingston, Jamaica, who has given many years to the investigation of the Tertiary and recent Mollusks of Jamaica.

Superfamily VENERACEA.

Family PETRICOLIDÆ.

Genus PETRICOLA Lamarck.

Petricola Lamarck, Syst. An. s. Vert., p. 121, 1801.

Rupellaria Fleuriau de Bellevue, Mém. s. les vers lithoph., p. 3, 1802. Type *Venus lithophaga* Retzius.

Choristodon Jonas, Zeitschr. Mal., i., p. 185; Molluskolog. Beitr., p. 1, 1844. Type *C. typicum* Jonas, *op. cit.*, p. 185; Beitr., pl. 7, fig. 3.

Naranio Gray, Ann. Mag. N. H., 2d Ser., xi., p. 38, 1853. Type *N. costata* Gray = *Venus lapicida* Gmelin; Deshayes, Biv. Shells Brit. Mus., p. 215, 1853.

Lajonkairia Deshayes, Biv. Sh. Brit. Mus., p. 217, 1854; 1st sp. *Venerupis decussata* Philippi.

Petricolaria Stoliczka, Cret. Pel. India, p. 139, 1870. Type *Petricola pholadiformis* Lam.

Claudiconcha Fischer, Man., p. 1087, 1887. Type *Venerupis monstrosa* (Chemn.) Gray.

Gastranella Verrill, Am. Journ. Sci., iii., p. 286, 1872; Rep. U. S. Fish Com., 1871-72, p. 678, 1873 (Nepionic stage). Type *G. tumida* Verr., *op. cit.*, p. 286, pl. 6, figs. 3, 3*a*.

In describing the genus *Petricola,* Lamarck mentions two described species, one of which was actually known to him from a specimen in his collection, the other he cites from a publication of Retzius. The following year Fleuriau, with the approbation of Lamarck, separated the latter as a new genus, *Rupellaria.* The type of the Lamarckian *Petricola* is therefore the *Venus lapicida* of Chemnitz and Gmelin, renamed *Petricola costata* by Lamarck, which subsequently received the name of *Naranio* from Gray. It differs from *Rupellaria* only in having a more rotund form and zigzag surface striation. *Lajonkairia* of Deshayes is close to *Rupellaria,* differing chiefly by more regular radial striation, absence of strong concentric sculpture, and rounded rather than pyriform outline. *Choristodon* Jonas is a rude *Rupellaria,* the original characters upon which it was based being pathological. Jonas supposed that the anterior cardinal in the left or the posterior in the right valve was separated from its base by a layer of cartilage, and in a certain proportion of the specimens this state of affairs really seems to exist more or less completely developed. A careful study of a large series, however, shows that this condition is not normal. The only explanation of its occurrence at all which suggests itself to me is that the tooth in question, from having a sort of pedicillate or constricted base, is very liable to fracture at that point and, if this occurs while the animal is living, the break is repaired, not by the deposition of shelly matter but by the secretion of conchioline, which serves to hold the fractured tip in place. At all events I find some specimens in which the shelly matter is perfectly continuous, others in which a circular fracture, not entirely decapitating the tooth, is filled with conchioline, and still others where the entirely detached tip is soldered to the base by a layer of conchioline cement. The anatomical characters of *Choristodon* do not differ from those of *Rupellaria* sufficiently to authorize its separation; indeed, not more than might be expected between distinct species. Certain species which burrow in sand have the shell elongated, and this elongation, varying in amount in different species, is accompanied, as usual in such cases, by an antero-posterior protraction of the soft parts. For these species Stoliczka has proposed the name *Petricolaria.* Lastly we have boring species, in which the natural inequality of the valves is exaggerated and the margin of the right valve in full-grown specimens is irregularly expanded, overlapping that of the left valve, which remains normal, and frequently forming channels in which the siphons lie or may be extruded. For these forms, erroneously referred to *Venerupis,* Fischer has proposed the subgeneric name of *Claudiconcha.* These also sometimes have broken teeth cemented. *Petricola* in the wide sense and adult state has no lateral teeth; in the left valve there are three radial cardinals, the middle one larger, higher, and bifid, or with several grooves; in the right valve there are two cardinals, the anterior simple, arcuate, and often very prominent, the posterior lower, oblique, and grooved or bifid. The resilium and ligament are coincident and external on nymphs; the lunule is absent or ill-defined; the pallial sinus small or large, the siphons separate, elongated, and naked.

From the often very similar *Venerupis* the species of this group may be separated by the hinge-teeth and generally by the absence of regular and elevated concentric lamellæ. *Venerupis* has three subequal, usually bifid teeth in each valve, and the margin of the shell is very commonly serrate or denticulate, which is not the case in *Petricola.* It should be borne in mind that in these more or less distorted borers or nestlers the hinge in fully grown shells is almost always more or less distorted and defective; only the examination of a large series, especially of the young shells, can give an adequate idea of the normal dentition.

The genus appears to be divisible into sections as follows:

Section *Petricola* Lamarck, s. s. Type *P. lapicida* (Gmelin).

Shell ovate, with a short or moderate wide pallial sinus, the radial sculpture more or less divaricate or zigzag. *Naranio* is synonymous.

Section *Rupellaria* Fleuriau. Type *P. lithophaga* (Retzius).

Shell inflated and rounded in front, attenuated and more compressed behind; sculpture chiefly radial, stronger anteriorly. *Lajonkairia* and *Choristodon* are synonymous.

Section *Claudiconcha* Fischer. Type *P. monstrosa* (Gmelin).

Margin of the right valve irregularly expanded, pallial sinus shallow, form like *Petricola.*

Section *Petricolaria* Stoliczka. Type *P. pholadiformis* Lam.

Shell elongated, pholadiform, thin; hinge-teeth protracted, slender; pallial sinus deep.

Bernard is of the opinion that the nepionic shell in this group possesses rudiments of three cardinals in both valves, but, in adolescent examples, I have not been able to discover any trace of the supposed posterior right cardinal.

Petricola centenaria Conrad is an *Asaphis; P. compressa* H. C. Lea is a *Fabella* or *Sportella.* It is stated that the *P. carditoides* Conrad of the Californian recent fauna is also found in the Californian Pleistocene, but its presence in earlier beds is yet to be established.

Petricola lapicida Gmelin.

Venus lapicida Gmelin, Syst. Nat., vi., p. 3269, 1792 (after Chemn. Conch. Cab., x., p. 356, pl. 172, figs. 1664-1665, 1788); Wood, Ind. Test., pl. 8, fig. 72, 1825.

Venus divergens Gmelin, Syst. Nat., vi., p. 3269, 1792 (after Chemn. Conch. Cab., x., p. 357, pl. 172, figs. 1665-1666).

Petricola costata Lam., Syst. An. s. Vert., p. 121, 1801; Hanley, Descr. Cat. Rec. Sh., p. 53, 1843.

Naranio costata Gray, Ann. Mag. Nat. Hist., xi., p. 38, 1853.

Naranio lapicida Deshayes, Cat. Conch. B. M., i., p. 216, 1853.

Petricola divaricata Orbigny, Moll. Cubana, ii., p. 265, 1853.

Pliocene of the Caloosahatchie beds, Florida; Dall. Recent from South Carolina southward throughout the Antilles and Caribbean region, boring in coral.

Immediately recognizable by the zigzag striation in the younger stages, to which in the adult are added, on the posterior end, coarse radial ridges.

Petricola (Rupellaria) typica Jonas.

Choristodon typicum Jonas, Zeitschr. Mal., i., p. 185; Beitr. Molluskol., p. 1, pl. 7, fig. 3, 1844.

Petricola lithophaga Arango, Moll. Cuba, p. 248, 1880; not of Retzius and Lamarck.

Choristodon robusta Dall, Bull. U. S. Nat. Mus., No. 37, p. 58, 1889; not of Sowerby.

Pliocene of the Caloosahatchie beds, Florida; Dall. Recent in the Antillean region from Cape Florida southward.

Shell radially ridged, the sculpture coarser behind.

This and the preceding species appear to be rare in the Pliocene beds.

Petricola (Rupellaria) Harrisii n. sp.

PLATE 43, FIGURE 1.

Miocene of the York River, Virginia, from the bluff at Bellefield, four and a half miles above Yorktown; G. D. Harris.

Shell solid, ovate, distorted more or less by the irregularities of its *situs;* posterior end blunt, longer; anterior end shorter, rounded; sculpture of fine, nearly uniform radial rounded threads with wider interspaces, crossed by fine, rounded, slightly elevated incremental lines; beak moderately elevated, hinge short, with, in the left valve, one strong, apically grooved cardinal between two simple narrow diverging teeth; ligamentary nymph short, strong, deeply grooved; basal margin feebly crenulated by the external sculpture; pallial sinus wide, shallow. Alt. 20, lat. 23, semidiam. 7 mm.

Only one valve of this species was obtained by Professor Harris, in whose honor it is named. This species recalls the *P. decussata* Phil. of the recent Mediterranean fauna, but has no analogue in our own present fauna.

Petricola (Petricolaria) carolinensis Conrad.

Petricola carolinensis Conrad, Proc. Acad. Nat. Sci. Phila., xiv., p. 576, 1863.

Petricola pholadiformis Tuomey and Holmes, Pleioc. Fos. S. Car., p. 87, pl. 21, fig. 5, 1856; not of Lamarck, 1818.

Upper Miocene of Magnolia, Duplin County, North Carolina, Burns; Peedee River and Goose Creek, South Carolina, Tuomey.

This shell is more equilateral, and has the radial sculpture more uniform, and consequently stronger over the posterior portion than *P. pholadiformis.* It does not seem to reach so large a size as the latter.

Petricola (Petricolaria) calvertensis n. sp.

PLATE 44, FIGURE 14.

Miocene of Calvert Cliffs, Maryland; Burns and Harris.

Shell elongate-oval, with the beaks near the anterior third, solid, closely regularly sculptured with fine radiating threads, the interspaces wider, the threads a little stronger towards the ends of the shell, concentric sculpture only of fine somewhat irregular incremental lines; beaks rather elevated; shell moderately inflated, more or less irregular from nestling among rocks, sculpture near the beaks quite faint; hinge short, a spur from the lunular region extending over and past the cardinal teeth behind the beaks; hinge normal; margins entire; pallial sinus deep and rounded. Alt. 9, lat. 17, semidiam. 3.5 mm.

A single valve of this species was obtained by Messrs. Burns and Harris. It is readily discriminated from the other American species by its *Callista*-like form and very fine, even radial sculpture.

Petricola (Petricolaria) pholadiformis Lamarck.

Petricola pholadiformis Lam., An. s. Vert., v., p. 505, 1818; Conrad, Am. Mar. Conch., p. 37, pl. 7, fig. 3, 1831; Say, Am. Conch., pl. 60, fig. 1, 1834; Gould, Inv. Mass., p. 63, 1841; Sowerby, Thes. Conch., ii., p. 771, pl. 166, fig. 1, 1854; Dall, Bull. U. S. Nat. Mus., No. 37, p. 58, pl. 59, fig. 15, pl. 64, fig. 140*a*, 1889.

Petricola fornicata Say, Journ. Acad. Nat. Sci. Phila., ii., p. 319, 1822.

Pleistocene of Simmons Bluff, South Carolina; Burns. Living from Prince Edward Island south to St. Thomas, West Indies; Greytown, Nicaragua, and other portions of the Antillean region. Var. *dactylus* Sby. Post-pliocene of South Carolina according to Holmes.

It is probable that the *P. dactylus* Sowerby, though closely related to *P. pholadiformis,* may be regarded as specifically distinct. Both forms occur together from Maine to Florida, but on the South American coast the typical *pholadiformis* does not seem to have been found, though several other varieties, some of which have been named, have been reported by observers near the southern extreme of South America in what was formerly Patagonia.

The curious little shell named in 1872 by Verrill *Gastranella tumida* is certainly a *Petricolaria,* and I suspect it to be the young of *P. dactylus,* which has when very young and fresh a purplish tinge on the umbones in some individuals. The hinge is precisely the same in both. Carpenter similarly took the nepionic young of *P. denticulata* Sowerby for a *Psephis* and described it under the specific name of *tellimyalis.* This was the more excusable since the fry are brightly colored with orange and purple, while the adult and adolescent stages of the *Petricolaria* are pure white. I have a series showing the latter with its purple umbones strongly contrasting with the white valves, but this condition lasts only a short time, the color fading entirely out in most specimens before they attain full growth.

Family COOPERELLIDÆ.

Genus **COOPERELLA** Cpr. (em).

> *Oedalia* Carpenter, Rep. Brit. Assoc. for 1863, pp. 611, 639. Type named, *Oe. subdiaphana* Cpr., p. 639, Aug., 1864; Journ. de Conchyl., xii., p. 134, Apr., 1865 (same type); Smiths. Misc. Coll., No. 252, Moll. W. N. Am., pp. 97, 125, 302, Dec., 1872.

> *Cooperella* Carpenter, Rep. Brit. Assoc. for 1863, pp. 611, 639, 1864; Proc. Cal. Acad. Sci., iii., p. 208, 1866.

> *Oedalina* Carpenter, Proc. Cal. Acad. Sci., iii., p. 208, 1866 (as a substitute for *Oedalia* Cpr., 1864; not Meig., 1830).

In 1864 Carpenter described the type of this genus and the genus itself in three lines as two species of two subgenera, both of which were regarded as new, and the types of which are in the National Museum. One of the names used was preoccupied and, as both applied to the same species, the second name must be adopted. A year later Carpenter gave full diagnoses of genus and species under the preoccupied name, and in 1866, still regarding them as distinct, he gave a full diagnosis for the supposed subgenus and substituted *Oedalina* for the preoccupied *Oedalia*. The supposed subgeneric difference was based on the assumed (but not real) absence of an internal ligament in the type and its less bifid cardinal teeth. The latter character is shown by material in the collection to differ among adult individuals and probably in the same individual at different ages. The specific name under which the species was first fully described is here adopted for the type. The characters of the genus are as follows:

Shell small, thin, smooth, or concentrically striate or undulate, equivalve, nearly equilateral, with entire margins; ligament long, feeble, profuse, amphidetic; resilium short, stout, opisthodetic, immersed behind the cardinals on an oblique thickening of the hinge-plate, not excavated to form a pit or produced into a chondrophore; hinge-plate narrow, carrying two right and three left subumbonal divaricating short cardinal teeth, of which the left central tooth is always, and the others frequently, bifid; laterals none; muscular impressions small, oval; pallial line narrow with an ample sinus; siphons long, slender, separate, the branchial fringed at its orifice; mantle margins simple, free, for about half the length of the shell, gills rather small, free, with direct and reflected inner and outer laminæ, palpi very small, foot compressed, quadrate, without any byssal groove or obvious gland.

I give the anatomical characteristics from the typical species because they have not been recorded anywhere and have an important bearing on the relationship of the genus. Excepting the large sinus the shell strongly recalls *Psathura* Deshayes.

The type *Cooperella subdiaphana* (+ *scintilliformis*) Cpr. is not uncommon, living on the Pacific coast between Vancouver Island, Monterey, and Todos Santos Bay, but owing to the extreme fragility of the shell is difficult to preserve intact. It was with peculiar interest, therefore, that I noted the existence of the following species in our Miocene, the genus not being known from Atlantic waters and hitherto represented only by its type, which occurs in the Pleistocene of San Pedro, California..

Cooperella Carpenteri n. sp.

PLATE 49, FIGURE 8.

Miocene of Petersburg, Virginia, and of the Natural Well, Duplin County, North Carolina; Pliocene(?) of the north end of the Dismal Swamp, Virginia; Burns and Shaler.

Shell smooth or slightly concentrically undulate, and with faint incremental lines; ovate, nearly equilateral, the beaks moderately elevated; hinge delicate, hinge-plate narrow, excavated; pallial sinus deep but only moderately high; base arcuate, ends rounded. Lon. 14, alt. 11.5, diam, 7.50 mm.

This species bears a very marked resemblance to *C. subdiaphana* Cpr., and differs from it chiefly in being more equilateral and with more nearly equally rounded ends, and in having the area occupied by the pallial sinus proportionately less high.

The following genus is anatomically unknown, but its hinge is remarkably like that of *Cooperella,* and the habit of the shell is much the same in spite of the almost unsinuate pallial line.

Genus CYAMIUM Philippi.

Cyamium Phil., Arch. f. Naturg., i., p. 50, 1845. Type *C. antarcticum* Phil., *loc. cit.;* not *Cyamea* Kroyer, Crustacea, 1843, nor *Cyamium* H. and A. Adams, 1857 (ii., p. 476), nor Jeffreys, Brit. Conch., ii., p. 237, 1863.

Shell small, thin, smooth, ovate, with an obsolete amphidetic ligament externally, and a short, strong, oblique internal resilium; hinge-plate narrow with, in the right valve, two subumbonal divaricating bifid cardinals, and, in the left valve, three more slender, not obviously bifid, cardinals; laterals, none in either valve; pallial line narrow except near the posterior muscular impression, where it is irregularly wider or slightly insinuated; adductor scars narrow, elongate; margin of the valves entire.

This shell is perfectly distinct from the *Turtonia* of the northern hemisphere, with which it has been most unaccountably confounded. The type of dentition and aspect of the shell are entirely different. The characters of the hinge recall *Cooperella,* which has, however, a deep pallial sinus. The exact place of this genus can only be settled when the anatomical characters are known, but the appearance of the pallial line in the adult leads me to suspect it is siphonate. The *Cyamium elevatum* "Stimpson" cited by H. and A. Adams belongs to the genus *Aligena.* Philippi's genus contains only the original type, a young specimen of which in the National Museum was labelled by Dr. Philip Carpenter *Kellia declivis* Cpr., but I do not know if this name has been published.

This genus has been mentioned under the *Leptonacea,* where it may be that it will eventually remain.

Family VENERIDÆ.

The enormous group belonging to this family will be treated later, as it has been found impracticable to prepare the discussion of it in time for the publication of this division of the volume.

Superfamily Isocardiacea.

Family ISOCARDIIDÆ.

Genus **ISOCARDIA** Lamarck.

Isocardia humana Linné.

Bucardia dalmatica Klein, Meth. Ostr., p. 140, 1753 (non-binomial).

Cardium humanum Linné, Syst. Nat., ed. x., p. 682, 1758.

Chama cordiformis Linné, Mus. Lud. Ulricæ, p. 516, 1764.

Chama cor Linné, Syst. Nat., ed. xii., p. 1137, 1767; Born, Mus. Cæs. Vindob., p. 80, 1780; Chemnitz, Conch. Cab., vii., p. 103, pl. 48, fig. 483, 1784; Gmelin, Syst. Nat., vi., p. 3299, 1792; Donovan, Brit. Shells, iv., pl. 134, 1802.

Hippopodes. H. cor Meuschen, Mus. Gevers, p. 423, 1787.

Glossus + *Glossoderma rubicundus* Poli, Test. Utr. Siciliæ, ii., p. 253, 1791 (non-binomial).

Cardita cor Bruguière, Encycl. Méth. Vers., i., p. 403, 1792; Bosc, Hist. Nat. Coq., iii., p. 87, tab. 21, fig. 4, 1802; Encycl. Méth., ii., pl. 232, 1797.

Trapezium cor Humphrey, Mus. Calonnianum, p. 50, 1797.

Cardium cor auritum Bolten, Mus. Boltenianum, p. 192, 1798; 2d ed., p. 134, 1819.

Isocardia cor Lamarck, Prodr. Nouv. Class. Coq., p. 86, 1799; An. s. Vert., vi., p. 31, 1819; Sowerby, Gen. Rec. and Fos. Sh., vii., 1822; Fischer, Man. de Conchyl., p. 1074, 1887.

Isocardia globosa Lamarck, Syst. des An. s. Vert., p. 118, 1801.

Isocardium cor Link, Beschr. Rostock Samml., 2, p. 153, 1807; Blainville, Man. Mal., ii., p. 545, pl. 69, fig. 2, 1825.

Bucardium communis Megerle v. Mühlfeldt, Entw., Neues Syst. der Schalthierhause, Mag. Ges. Naturf. Fr., v., p. 52, 1811.

Glossus cor Oken, Lehrb. der Naturg., iii., Zoologie, pt. 1, pp. viii., 235, 1815; Gray, Brit. An., vii., p. 95, 1851; Stoliczka, Cret. Pel. of India, p. 188, 1871.

Bucardia communis Schumacher, Essai, p. 146, 1817.

Cardita humana Mörch, Yoldi Cat., ii., p. 38, 1853 (not *Isocardia* Mörch, *loc. cit.*, = *Meiocardia* H. and A. Adams, 1857).

Bucardia cor H. and A. Adams, Gen. Rec. Moll., ii., p. 461, 1857.

Tychocardia cor Roemer, Conchyl. Cab., Neue Ausg., x., pt. 3, p. 5, 1869.

To make clearer the history of this genus I have prefixed the synonymy of its type species so far as it bears on the subject. The "heartshells" of the older conchologists included most of the species with conspicuously cordiform profiles, compressed or cyclodont teeth, or involute umbones. *Bucardia* of the pre-Linnean writers comprised such forms as *Cypricardia, Hippopus, Cardium, Cardita,* etc., and in the *Isocardia* of Klein we find such an assembly. In early attempts to segregate the members of this heterogeneous group it was inevitable that the first subdivisions, according to modern ideas, should still be composed of more than one generic group.

Linné placed the type of this genus first in *Cardium* and subsequently in *Chama,* and gave it three specific names before suiting himself. The oldest of these, according to the rules of nomenclature, must take the place of the latest, which is in almost universal use.

Poli seems to have been the first to separate the group from the Chamas, but his quadrinomial nomenclature forbids us to utilize his names.

Bruguière separated under the name of *Cardita* a group which included the type of *Isocardia,* as well as a large number of Carditas in the modern sense.

Humphrey under the name of *Trapezium* separated *Cypricardia* + *Isocardia* of Lamarck, and the former having been selected by Megerle to carry the generic name, the name applied by Lamarck to the latter can be retained. The plural name *Hippopodes* proposed by Meuschen for *Isocardia* and *Hippopus* is not in accordance with the Linnéan nomenclature and must be rejected, though it might fairly be claimed that it was embodied in Lamarck's *Hippopus* to an extent which left *Isocardia* free. *Isocardium* and *Bucardium* are variants of philologic trifling. Why the name *Tychocardia* of Roemer should have been proposed, as observed by Stoliczka, is incomprehensible.

So far as the Tertiary and recent fauna of North America and the Antilles are concerned the genus is divided into two groups, *Isocardia* proper, typified by *I. humana* L., and the subgenus *Meiocardia* H. and A. Adams, typified by *I. Moltkeana* Chemnitz. These groups are feebly separated in the recent fauna, and among the fossils their characters seem indefinitely interchangeable. The group of which *Callocardia* is the most conspicuous member is widely separated from *Isocardia* by anatomical characters. None of its members have yet been reported as American Tertiary fossils.

There are very few species of *Isocardia* in our Tertiary. "*Bucardia*" *veta,* described by Conrad from the Shark River, New Jersey, Eocene, is referred to the *Veneridæ* by Whitfield and regarded as a Cretaceous species. Harris (Bull. Am. Pal., i., p. 180, pl. 16, fig. 5, 1896) has described *I. mediavia* from the Midway Eocene of Alabama and Texas; *Glossus filosus* Conrad (in Wailes, Geol. Miss., p. 289, pl. 14, fig. 8, 1854) is a *Glycymeris.* The following species are all the others yet discovered:

Isocardia floridana n. sp.

Plate 46, Figures 21, 26.

Vicksburgian Oligocene of Arredondo, Florida.

Shell short, high, with strongly involute beaks, solid, strongly and sharply unicarinate; inequilateral, the anterior end shorter, hardly extending farther than the vertical of the beaks; base rounded from the anterior end to the end of the carina, which extends from the beaks to the posterior basal angle; posterior dorsal margin gently arcuate, posterior end truncate from the end of the hinge-line to the basal end of the carina; teeth of the hinge normal, much compressed, the lateral low and distant; posterior dorsal slope excavated. Lon. 30, alt. 25, diam. 30 mm.

A single cast of the inside of a right valve of this species is all that was obtained, but the characters are well exhibited, except the external sculpture, which may have been somewhat undulated. It cannot be any of the described species.

Isocardia fraterna Say.

Isocardia fraterna Say, Journ. Acad. Nat. Sci. Phila., iv., p. 143, pl. xi., fig. 1 *a-b,* 1824.

< *Isocardia rustica* Conrad, Fos. Medial Tert., p. 20, pl. xi., fig. 1, 1838; not *Venus* (= *Arctica*) *rustica* Sowerby, 1818.

Glossus rusticus Conrad, Proc. Acad. Nat. Sci. Phila., vii., p. 29, 1854.

Isocardia Conradi Orbigny, Prodr. Pal., iii., p. 121, 1852.

Glossus fraterna Meek, S. I. Miocene Checkl., p. 8, 1864.

Bucardia fraterna Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 576, 1863.

Miocene of Maryland at Plum Point (Burns, lower bed), Charlotte Hall, and St. Mary's on the Patuxent; City Point, James River, and near

Yorktown on the York River, and at Williamsburg, Virginia; also at Murfreesboro, Hartford County, North Carolina, according to Conrad.

This species was confounded with the *Venus rustica* of Sowerby, a British Crag fossil belonging to the genus *Cyprina* of Lamarck (=*Arctica* Schum.), and Orbigny, on the ground that they were not identical, and probably overlooking Say's previous description, renamed the shell *I. Conradi.* This of course is not identical with the *Isocardia Conradi* Gabb (Journ. Acad. Nat. Sci., 2d Ser., iv., p. 392, pl. 68, figs. 21, 21*a*, 1860) from the Cretaceous marl of Timber Creek, New Jersey (described and figured also by Whitfield, Mon. U. S. Geol. Surv., ix., p. 200, pl. 25, figs. 3, 4, 1885) and Prairie Bluff, Alabama. The Cretaceous species may take the name of *Isocardia Gabbi,* since the present name is untenable.

The *I. fraterna* seems to have but a limited distribution in the Miocene. The young are rather more elongated than the adult proportionately and senile specimens again become drawn out so that the outline of the shell, as well as the undulation of its surface, are exceedingly variable. The striation of the lateral tooth, mentioned by Conrad, is not a constant feature, as this tooth is often smooth. Nevertheless, it is quite a characteristic shell. An internal cast, probably of this species, was collected in the Miocene clays of Chilmark, Martha's Vineyard, Massachusetts, by J. B. Woodworth.

This species has been united with the *Isocardia humana* of Europe by Deshayes, Hoernes, and others, but this appears to me quite inadmissible.

Isocardia Markoei Conrad.

Isocardia Markoei Conrad, Bull. Nat. Inst., ii., p. 193, pl. 2, fig. 1, 1842.

Glossus Markoei Conrad, Proc. Acad. Nat. Sci. Phila., vii., p. 29, 1854; Meek, Mioc. Checkl., p. 8, 1864.

Bucardia Markoei Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 576, 1863.

Miocene of Calvert Cliffs, Maryland, Markoe, Foreman, and O'Brien; Plum Point, Maryland, Burns (upper bed).

This well-characterized and compact species has not been, so far as I have heard, discovered anywhere outside of Maryland.

Isocardia carolina n. sp.

PLATE 46, FIGURE 22.

Miocene of Edgecombe County, North Carolina, J. E. Bridges; Grove Wharf, James River, Virginia, Burns.

Shell large, solid, rotund, rather thin for its size, with involute beaks, inflated and inequilateral valves; anterior end short, subangular above, rounding evenly into the base below; hinge-line forming a segment of a circle, and except the anterior angle the outline of the valve is nearly suborbicular; near the umbo behind are traces of two radial ridges separated by a shallow sulcus, but these rapidly become obsolete, and the surface of the valves smooth except for incremental lines, which become stronger and more disposed in undulations near the anterior base in senile specimens; hinge normal, strong, the lateral smooth and well developed, the left cardinal duplex, compressed, with a small deep pit for the opposite cardinal below the junction; anterior adductor scar small, impressed, posterior scar much larger. Lon. 95, alt. 92, diam. 74 mm.

This species is represented by two left valves in the National Collection, obtained from North Carolina and Virginia. It forms a marked contrast to *I. fraterna* in its nearly smooth subglobular form and greater size. It may be that to specimens of this species Conrad referred when in his description of *I. rustica* (= *fraterna*) he said that it "attains in North Carolina a larger size than the *I. cor* with which Deshayes considers it identical." If Deshayes had specimens of this sort his conclusion would not seem so unreasonable as it does when one compares a good series of *I. fraterna* with *I. cor* (= *humana*). The present species, though very much less ponderous than *I. fraterna,* is thicker than *I. humana* and has its hinge less compressed, especially the cardinals, of which the profile forms a broad M with a conical pit below it; the lateral is also stronger and proportionately more distant from the cardinals; the posterior adductor scar is larger than in *humana* of the same dimensions, while the umbo of *I. carolina* is smaller, more pointed, less involute, and is distant 6.5 millimetres from the hinge margin, while, in a specimen of *I. humana,* slightly larger than that of *I. carolina,* the umbo of the same valve is eighteen millimetres from the margin. Correlatively, the excavation in front of the beaks is considerably smaller in *I. carolina.* The largest senile specimens of *I. humana* are higher and less orbicular than the types of *I. carolina,* which are evidently senile specimens also.

On the whole, in spite of the fact that the material is scanty, there seems to be reason to think that in the Upper Miocene there is a type of *Isocardia* leading from the older Miocene forms of Maryland in the direction of the *I. humana* of the European fauna. The form figured by Hoernes from the Vienna Miocene under the name of *Isocardia cor* (Moll., Wiener Beckens, pl. 20, fig. 2 *a-d,* 1870) is in my opinion distinct from the recent shell, from which it differs by its more produced and involute beaks, its much greater transverse diameter as compared with its height, its broader and heavier hinge-plate, and its less angular or rather totally rounded anterior end. I give the dimensions for comparison:

I. humana L.,	alt. 70, lon. 76, diam.	55.0 mm.
Hoernes's figure,	" 70, " 70, "	71.5 mm.
Height from hinge-line to base,	*I. humana*, ...	65 mm.
" " "	" " Hoernes's figure, . .	60 mm.
" " "	top of beaks, *I. humana*, . .	5 mm.
" " "	" " Hoernes's figure,	10 mm.

Hoernes states, and his figures support the statement, that the Vienna shell is more ponderous than the recent one, and I may say that the comparison of a large series of the latter from various localities shows nothing comparable with the characters of the former. I would therefore propose the name of *Isocardia Hoernesi* for the type from Gainfahren, Vienna Miocene.

Superfamily CARDIACEA.

Family CARDIIDÆ.

Genus CARDIUM Linné.

< *Cardium* Linné, Syst. Nat., ed. x., p. 678, No. 272, 1758; Mus. Lud. Ulricæ, p. 483, 1764; Syst. Nat., ed. xii., p. 1121, 1767. First species *C. costatum* L.

Cordiformes Da Costa, Elem. Conch., pp. 267-68, 1776; ex. fig'd. *C. unedo* L. (work not strictly binomial in nomenclature).

Cardium Muller, Zool. Dan. Prodr., p. 246, 1776; *C. echinatum et edule* L.; Humphrey, Mus. Calonnianum, p. 49, 1797; Bolten, Mus. Boltenianum, ed. i., p. 189, 1798; ed. ii., pp. 132-34, 1819; Bruguière, Encycl. Méth., i., pp. 203-235, 1789; Lamarck, Prodrome, p. 86, 1799; sole ex. *Cardium aculeatum* L.

The genus Cardium as originally proposed by Linné was nearly homogeneous. He named no type, and Bruguière was the first to eliminate *Isocardia* (which he placed with *Cardita*), but he also contented himself with saying that the spiny species were originally typical, and named none of them as an exemplar. Hwass (in Humphrey) seems to have followed Bruguière, and Bolten was the first to make a formal division of the genus. He separated the species into three genera, *Corculum*, containing shells of the *C. cardissa* type; *Fragum*, with the "strawberry heartcockles" like *C. unedo;* and *Cardium* proper, which was also divided into lamellate, costate, imbricate, dentate, or spiny, and glabrous groups, the latter being equivalent to *Isocardia.* The following year Lamarck, in his Prodromus, selected *C. aculeatum* Linné as an exemplar of the genus.

From that time the work of systematists has been confined chiefly to naming minor groups characterized by peculiarities of sculpture, many of which are of little structural importance and chiefly convenient as a means of assorting a rather uncomfortably numerous assembly of species.

The genus *Cardium* in the wider sense is very homogeneous compared with most large groups. The differences are of comparatively minor importance if judged by the standard of many other analogous groups.

The sculpture is predominantly radial, only in very exceptional cases does concentric or oblique sculpture or marked reticulation appear.

The hinge throughout the typical portion of the group is very uniform, comprising lateral lamellæ in both valves and two cardinals in each valve, of which, when interlocked, the inner pair are more robust and the outer pair feeble, so as to be liable to be overlooked or to become obsolete in worn or senile specimens. A more important character is that brought about by "torsion," or a process of twisting, which results in many species in bringing the two cardinals of one valve one above another, vertically, while in the opposite valve the cardinals will follow each other in a horizontal line. The teeth often, especially in thin species, seem to spring from the umbonal cavity rather than from a hinge-plate, a feature which I have tried to indicate by the term Cyclodont. Another feature, perhaps connected with the apparent rotation of the cardinals, is the tendency of the dorsal margin, just in front of the umbones, to be pouted and thickened.

In all the typical Cardiums there is neither lunule nor escutcheon, though a space between the terminal ribs and the shell margin may be smoother and simulate a lunular area. The lateral teeth are present in all groups except the subgenus *Lophocardium.* In *Serripes* alone the cardinals are obsolete. All the species, especially those of tropical waters, tend to have the ends of the shell, especially the posterior end, slightly different in sculpture from the middle of the disk. Thus in *Lævicardium* the ends are smooth and the disk obsoletely radially grooved, in *Serripes* the exact reverse is the case. Whether the surface be smooth or not, there is always some serration of the internal basal margins. In *Protocardia* a strongly differentiated posterior area is developed, the sculpture of which is doubtless correlated with the structure of the mantle edge around the siphonal apertures. In *Tropidocardium* there are several channels (corresponding, not to elevations of sculpture, but to the interspaces of the ribs externally) internally radiating from near the umbones, where at their terminations they are, as it were, roofed over; these channels are differently colored from the rest of the interior. Somewhat analogous is the case of *Ethmocardium,* an Upper Cretaceous type, in which the region within the pallial line is deeply pitted, the apices of the conical pits being covered with an extremely thin layer of shelly matter, so that the least exfoliation or erosion results in the appearance of a row of perforations in the channels between the external ribs over a large part of the disk. In most *Cardiacea* the pallial line is more distant from the distal margin of the valves than is usual in Pelecypoda, and it is frequently subtruncate behind. In *Leptocardia,* a small Cretaceous type, there is a double sinuation of the posterior part of the pallial line, almost suggesting a pallial sinus, and in *Serripes* it is truncate.

The periostracum in most species is thin and obscure, but in the boreal species, except *Serripes,* it becomes more conspicuous, coarse, and even tufted. A few tropical forms, notably *C. latum* Reeve, also show a pubescent periostracum.

The ligament, which encloses an obscure resilium, is usually short, strong, and seated in a deep groove, forming short, often thickened, nymphs. I have not found any species with an amphidetic ligament or any tendency to a sinking in of the ligament. The activity of these animals is such that the valves must be pretty flexible in their motions not to put their owner to a disadvantage among its kind, and this condition is correlated with the feebleness of the cardinals, the strong, short ligament, and the constant presence of serrations to hold the valves in place when closed.

Nearly all Cardia have two forms, one more equilateral and globose, the other more oblique and elongated, but whether these differences can be correlated with sex is at present unknown.

The shell of *Cardium,* especially the tropical species, is frequently furnished with an external shelly layer from which most of the spinose, nodose, or other superficial sculpture is wholly formed. This layer is very feebly attached to the next inward layer of shell and may be easily scaled off, taking with it the sculpture. The surface below it is usually polished, and in fossils, especially of the subgenus *Fragum,* the ribs will then appear polished and perhaps flat, when they were originally keeled or nodose, and show no evidences of erosion. This deceptive habit should be borne in mind by workers on this group.

The distribution of the genus in time among our Tertiaries has some points of interest. The Eocene forms are much more like European recent species, as regards the sections of the genus to which they belong, than later American forms. There are at present no species of typical *Cardium* in the American fauna, but in the Eocene and up to the end of the Oligocene such forms were not uncommon.

The curious subgenus *Ethmocardium* of the Cretaceous, the section *Dinocardium* from the Oligocene to the present fauna, and the elegantly sculptured *Trigoniocardia* are of strictly American distribution both recent and fossil as far as I have been able to ascertain.* *Cardium* and *Trachycardium* are represented in America only as fossils. We have no representatives of *Tropidocardium, Hemicardium, Fulvia, Discors, Corculum, Ctenocardia, Lunulicardia,* or *Avicularium. Cerastoderma* and *Serripes* are circumboreal; *Ringicardium, Fragum, Papyridea, Lævicardium,* and *Protocardia* are circumtropical. Unless the internal cast from the (Eocene?) Puget group of Washington, figured by White (U. S. Geol. Surv., Bull. No. 51, plate ix., fig. 4, 1889), be an exception, we have on this side of the world no examples of that curious group of modified fluviatile cockles, typified by *Adacna,* so abundant in the brackish water beds of southeastern Europe and the Caspian.

The synonymy and subdivisions of this group are as follows:

Genus **CARDIUM** (L.) Lamarck.

Cardium Lam., Prodr., p. 86, 1799; Poli, Test. Utr. Sicil., iii., pp. 50, 258, 1795; Megerle, Entw., p. 53, 1811.

Cerastes + *Cerastoderma* Poli, *op. cit.,* p. 258, 1795; not *Cerastes* Laur., 1768 (*Reptilia*).

Acanthocardia Gray, List of Brit. An., p. 23, 1851; H. and A. Adams, Gen. Rec. Moll., ii., p. 455, 1857.

Acanthocardium Roemer, Conch. Cab. (*Cardium*), ed. ii., p. 17, 1869; Monterosato, Conch. Medit., p. 18, 1884.

Cardea Conrad (MS.) Whitfield, Lam. Raritan Clays, p. 134, 1885 (*C. dumosum* Conrad).

Criocardium Conrad, Am. Journ. Conch., vi., p. 75, 1870 (*C. dumosum* Conrad).

Eucardium Fischer, Man. Conch., p. 1037, 1887.

Plagiocardium Cossmann, Cat. Illustr., p. 156, 1887.

Shell variably sculptured, usually with predominantly radial ornamentation, usually closed or gaping but slightly, with no lunule or escutcheon; foot

* Since this was written I find *Cardium alternatum* Orbigny, from the Turonian of Sainte Maure, is an *Ethmocardium.*

geniculate, smooth, the pallial line rather distant from the margin of the valves. Hinge $\frac{\text{L. 010.0101.010}}{\text{R. 101.1010.101}}$.

Subgenus CARDIUM s.s.

Shell rotund, closed, with spinose ribs and granulose or cross-striated channels; left cardinals anterior when interlocked.

Subgenus TRACHYCARDIUM Mörch.

Trachycardium Mörch, Yoldi Cat., ii., p. 34, 1853 (*C. isocardia* L.).
Granocardium Gabb, Pal. Cala., ii., p. 266, 1868 (*C. sabulosum* Gabb).

Shell like *Cardium* s. s., but with the ribs imbricate or granulose; the channels also sometimes granulose.

Section *Acrosterigma* Dall, 1900.

Shell with an elevated mesial rib internally, radiating from the umbonal cavity. Type *Cardium Dalli* Heilprin.

Subgenus RINGICARDIUM Fisher.

Ringicardium Fischer, Man. Conch., p. 1037, 1887 (*C. ringens* Gmelin).
Bucardium Gray, Ann. Mag. N. Hist., 1853, p. 40 (*ex parte,* not of Megerle, Entw., p. 52, 1811).
Pectunculus (*Adanson*) Mörch, Yoldi Cat., ii., p. 33, 1853 (not of Lamarck, 1799).

Shell rotund, gaping, with flat ribs and channels, the posterior area with granulose channels; posterior margin sharply spinose, the spines crossing each other over the gape; left cardinals when interlocked posterior to the right ones.

Subgenus CERASTODERMA Mörch.

Cerastoderma Mörch, Cat. Yoldi, ii., p. 34, 1853; Roemer, Conch. Cab., 2d ed. (*Cardium*), p. 40, 1868; Meek, Pal. Upper Missouri, p. 166, 1876; *C. edule* L.
Cardium Gray, List Brit. An., p. 25, 1851; not of Lamarck.
Parvicardium Monterosato, Sin. Conch. Medit., p. 19, 1884.

Shell rotund or obovate, closed; with strong ribs obsoletely granulose or imbricate or smooth; no posterior or anterior area, channels simple; hinge normal.

Section *Cerastoderma* s. s.

Shell white, with coarse or tufted periostracum, the ribs similar, and usually obscurely nodulose; inhabiting boreal seas or comparatively deep water.

Section *Dinocardium* Dall, 1900.

Shell with more or less coloration, periostracum thin, polished, and inconspicuous; ribs with, anteriorly, arcuate hardly raised imbrications; mesially, flattened and nearly smooth; posteriorly, depressed and polished. Type *Cardium magnum* Born, = *C. ventricosum* Brug.

This group is notable for its elegant sculpture, from which spines, pustules, and elevated scales are absent. It replaces in warmer waters of America the Cerastodermas of the North, and goes back in geological time, with its characters well marked, as far as the Oligocene.

Subgenus ETHMOCARDIUM White.

Ethmocardium White, Proc. U. S. Nat. Mus., ii., p. 291, 1880. Type *Cardium speciosum* Meek and Hayden, Proc. Acad. Nat. Sci. Phila. for 1856, p. 274, 1857; not *Cardium speciosum* Adams and Reeve, Voy. Samarang, p. 77, pl. 22, fig. 9, 1850.

Shell ovate, closed, usually with plain ribs and channels, internally with the pallial area deeply pitted in lines corresponding to the external channels, the pits nearly reaching the external surface.

This type is believed to be characteristic of the Upper Cretaceous. The specific name of the typical species is preoccupied and I would propose for it the new name of *Cardium* (*Ethmocardium*) *Whitei*.

Subgenus TROPIDOCARDIUM Roemer.

Tropidocardium Roemer, Conch. Cab., 2d ed. (*Cardium*), p. 13, 1869 (*C. costatum* L.); Meek, Pal. Upper Missouri, p. 166, 1876.

Shell with a straight hinge-line, subauriculate, inflated, rotund, gaping behind, with ribs bearing hollow keels or spines; interior with excavated radial channels behind the middle line; hinge normal.

Subgenus FRAGUM Bolten.

Fragum Bolten, Mus. Boltenianum, p. 189, 1798; ed. ii., p. 131, 1819 (*C. unedo* L.); Mörch, Cat. Yoldi, ii., p. 35, 1853.

Isocardia Oken, Lehrb. Naturg., pp. viii., 234, 1815 (*ex parte*, not of Lamarck, 1799).

Hemicardium Swainson, Mal., p. 373, 1840; Roemer, Conch. Cab., 2d ed., p. 100, 1869; Cuvier, Regne An., ii., p. 479, 1817, *ex parte*.
Bucardium Gray, Ann. Mag. Nat. Hist., 1853, p. 40; not of Megerle, Entw., p. 52, 1811.
Loxocardium Cossmann, Cat. Illustr., p. 160, 1887.

Shell subtruncate behind, inflated, with strong ribs, no lunule or escutcheon, the channels simple, hinge normal, pallial line nearer the basal margin than in most Cardia.

Section *Fragum* s.s.

Valves obtusely angular in front of the truncation, ribs numerous, strong, pustular, or imbricate throughout. Type *C. unedo* L.

Section *Hemicardium* (Cuvier em.) Dall.

Valves more or less keeled behind the truncation, ribs comparatively few, low, flattish, only those near the middle of the shell pustular; channels concentrically sculptured. Type *C. hemicardium* L.

Section *Trigoniocardia* Dall.

Shell small, few ribbed, medial ribs very strong; posterior end subtruncate with smaller closer ribs; channels strongly concentrically sculptured; shell colorless, periostracum smooth. Type *Cardium graniferum* Sowerby.

Section *Ctenocardia* H. and A. Adams.

Ctenocardia H. and A. Adams, Gen. Rec. Moll., ii., p. 459, 1857; Fischer, Man. Conch., p. 1139, 1887. Type *C. hystrix* Reeve.

Like *Fragum* s. s., but the ribs profusely spinose, the truncated area destitute of spines, or with much smaller ones.

Subgenus **PAPYRIDEA** Swainson.

Papyridea Swainson, Mal., p. 374, 1840 (*C. soleniforme* Brug. = *C. spinosum* Meuschen).

Valves elongate oval, gaping, with numerous narrow ribs more or less tuberculose or spiny.

Section *Papyridea* s.s.

Shell thin, gaping at both ends, subcompressed, the posterior margin around the gape deeply serrate; periostracum inconspicuous.

Section *Fulvia* Gray.

Fulvia Gray, Ann. Mag. N. Hist., 1853, p. 40. Type *C. apertum* Bruguière; not *Fulvia* H. and A. Adams, Fischer, etc.

Shell globose, very thin, gaping behind, with fine radial threading; anterior part of shell minutely pustulate; the right anterior laterals start from the umbonal cavity, not from the hinge-plate, and the left cardinals, as in *Papyridea,* are posterior to the right ones when interlocked; the margin of the gape is not serrate.

The type of this section has been erroneously cited as *C. bullatum* L., causing confusion.

Subgenus LÆVICARDIUM Swainson.

Lævicardium Swainson, Mal., p. 373, 1840; H. and A. Adams, Gen. Rec. Moll., ii., p. 457, 1857; Roemer, Conch. Cab., 2d ed. (*Cardium*), p. 80, 1869.

Liocardium Mörch, Yoldi Cat., ii., p. 35, 1853. Type *Cardium norvegicum* Spengler.

Shell thin, oval, closed, middle of the valves smooth or feebly radially sculptured, ends with a smooth area, hinge normal, but with the anterior laterals springing from the umbonal cavity; periostracum smooth.

Section *Pachycardium* Conrad.

Pachycardium Conrad, Am. Journ. Conch., v., p. 96, 1870. Type *C. Spillmani* Conrad.

Shell resembling *Lævicardium* but very ponderous and with obsolete radial sculpture on the posterior fourth of the shell, visible chiefly as serrations on that part of the margin; the remainder of the shell smooth, or in certain abnormal specimens with irregular concentric wrinkles on the anterior aspect. Cretaceous.

Another Cretaceous form from Texas (Tucumcari) has the posterior end of the shell truncate and somewhat impressed, as in *Fragum medium* L., but shows the other characteristics of *Pachycardium.*

Subgenus DISCORS Deshayes.

Discors Deshayes, An. s. Vert. basin de Paris, i., pp. 553, 569, 1858. Type *C. subdiscors* Orbigny.

Lyrocardium Meek, Pal. Upper Missouri, p. 173, 1876. Type *C. lyratum* Sowerby.

Amphicardium von Martens, 1880, *fide* Fischer.

Divaricardium Dollfus and Dautzenberg, Feuille des Jeunes Nat., p. 95, 1886; *C. discrepans* Basterot.

Shell like *Lævicardium* but with the anterior half finely radially striate, over which pass sharp, elevated, oblique lamellations; posterior half with sharp, elevated, radial ribs.

Genus **SERRIPES** Beck.

Serripes (Beck MS.) Gould, Inv. Mass., p. 93, 1841; *C. grönlandicum* Gmelin.

Aphrodite Lea, Trans. Am. Phil. Soc., v., p. 111, 1834; obs. genus *Unio,* i., p. 223; sole ex. *A. columba* Lea, *op. cit.;* not *Aphrodite* Hübner, 1816 (Lepidoptera).

Acardo Swainson, Mal., p. 374, 1840; *C. edentulum* auct.; not *Acardo* Bruguière, or Lamarck, 1799, or Oken, 1815.

Valves smooth mesially, radially striate towards the ends, cardinal teeth obsolete; pallial line truncate behind; foot geniculate, compressed, serrate on the edge below.

This genus is confined to boreal seas and includes only two species in the present fauna.

Genus **CORCULUM** Bolten.

Corculum Bolten, Mus. Boltenianum, p. 188, 1798; ed. ii., p. 131, 1819. *Cardium cardissa* L. Roemer, Conch. Cab., 2d ed. (*Cardium*), p. 113, 1869.

Cardissa Megerle von Muhlfeldt, Entw., p. 52, No. 19, 1811; Swainson, Mal., p. 373, 1840; Gray, Ann. Mag. N. Hist., 1853, p. 41 (not of Oken, Lehrb. d. Naturg., pp. viii., 232, 234, 1815, = *Venericardia* Lam.).

Isocardia Oken, Lehrb. d. Naturg., pp. viii., 234, 1815 (not of Lamarck, 1799).

< *Hemicardes* Cuvier, Regne An., ii., p. 479, 1817.

Hemicardium Fèrussac, Fabl. Syst., p. xliii., 1822; Gistel, Naturg., p. 172, 1848.

Hemicardia Mörch, Yoldi Cat., ii., p. 36, 1853; H. and A. Adams, Gen. Rec. Moll., ii., p. 458, 1857.

Shell antero-posteriorly compressed, mesially keeled, closed, with a moderately impressed escutcheon but no lunule, feeble radial sculpture and normal hinge. In adults of the larger forms of this genus the umbones pass by each other like the blades of a pair of scissors and the ligament is very short.

Genus **LUNULICARDIA** Gray.

Lunulicardia Gray, Ann. Mag. N. Hist., 1853, p. 41 (*C. retusum* L.); H. and A. Adams, Gen. Rec. Moll., ii., p. 459, 1857; Roemer, Conch. Cab., 2d ed. (*Cardium*), p. 116, 1869; not *Lunulicardium* Münster, 1840.

Opisocardium Bayle, Journ. de Conchyl., xxvii., p. 35, 1879.

Shell truncate in front with a deeply impressed lunule, but no escutcheon, the flap of the dorsal anterior margin projecting into the cavity of the lunule, hinge pressed out of shape by the lunular depression but otherwise normal; sculpture feeble.

Genus AVICULARIUM Gray.

Avicularium Gray, Ann. Mag. N. Hist., xi., p. 41, 1853. Type *Cardium aviculare* Lam.
Lithocardium Woodward, Man. Rec. and Fossil Shells, p. 291, 1854.

Shell keeled laterally, subtrigonal, the hinge-line long, straight, mostly in front of the umbones, and the hinge produced anteriorly.

Section *Avicularium* s. s.

Valves closed.

Section *Byssocardium* Munier Chalmas, 1882.

Valves with a byssal foramen on the anterior margin. Type *Cardium emarginatum* Deshayes.

Pterocardia (Agassiz) Bayan, 1874, founded on *C. striatum* Buvignier, Mém. Soc. phil. de Verdun, ii., p. 5, pl. 3, figs. 20-21, 1843 (*C. Buvignieri* Deshayes), I have not seen, but from Fischer's description it must be allied to *Avicularium* if not identical.

Goniocardium Vasseur, Journ. de Conchyl., xxviii., p. 182, 1880, has not been well figured and is founded on *G. Heberti* Vasseur and *Cardium rhachitis* of Deshayes. Cossmann refers it to *Fragum*, but from the description given by Vasseur it would seem to resemble *Avicularium*.

Genus PROTOCARDIA Beyrich.

Protocardia Beyrich, Zeitschr. für Malak., p. 17, 1845. Type *Cardium hillanum* Sowerby. Cretaceous.
Protocardium Meek and Hayden, Proc. Acad. Nat. Sci. Phila., xii., p. 418, 1860; Cossmann, Cat. Illustr., p. 163, 1887.
Nemocardium Meek, Pal. Upper Missouri, p. 172, 1876; *C. semiasperum* Deshayes.

Shell globose with a posterior area sharply distinguished by sculpture from the rest of the surface; closed; hinge normal, with no lunule or escutcheon.

Section *Protocardia* s.s.

Posterior area sculptured with smooth radial ribs, the remainder of the surface with concentric striation.

Section *Nemocardium* Meek.

The posterior area spinose or tuberculate, the remainder of the surface finely radially striate, or finely reticulate; the anterior laterals springing from the umbonal cavity.

Section *Leptocardia* Meek.

Leptocardia Meek, Pal. Upper Missouri, p. 172, 1876; *C. subquadratum* Evans and Shumard. Cretaceous.

Shell small, thin, with the form of *Protocardia* s. s. with the sculpture obsolete, and the pallial line doubly sinuous near the anterior adductor scar.

I have cited the above sections indicated by Meek, though I am very doubtful of their value. I find the minute tuberculations, which sometimes are seated on the ribs and sometimes spring from the channels, are extremely fugitive, and it is often difficult to decide even in recent specimens whether they have been provided with tubercles or not. Consequently I am disposed to unite *Nemocardium* with *Protocardia* s. s. Moreover, I find, in examining many specimens of recent *Protocardia*, that in a large proportion of them an irregular sinuosity appears in the posterior part of the pallial line, as figured by Meek for *Leptocardia*, but it is not constant in the same species, and is probably one of those individual irregularities which have no systematic value. Therefore I should let *Leptocardia* share the fate of *Nemocardium*. All the Protocardias have on the anterior part of the shell both concentric and radial sculpture, though, as in *Lævicardium*, it may be almost imperceptible. The slight variations which will result in radial, concentric, or reticulate sculpture on this part of the shell can therefore be held to have hardly more than specific importance. The anterior laterals in *Protocardia* invariably spring from the umbonal cavity; in many forms the posterior laterals, especially in the left valve, show signs of obsolescence; and the dorsal margin of the right valve exhibits a tendency to overlap the corresponding margin of the opposite valve, as often occurs in *Chlamys*. *Pachycardium* should be transferred to the vicinity of *Lævicardium*. The spinules next the anterior border of the posterior area in *Protocardia* often fuse together to form a low crest or keel, much as in *Lophocardium*, but this formation is so excessively fragile that even in living specimens it is only represented by fragmentary portions of the original.

Subgenus **LOPHOCARDIUM** (Fischer).

Lophocardium Fischer (as section of *Papyridea*), Man. de Conchyl., p. 1038, 1887; *C. Cumingi* Broderip.

Lophocardium Dall, Nautilus, June, 1889, p. 13; Proc. U. S. Nat. Mus., xii., No. 773, p. 264, 1889.

Shell resembling *Protocardia* but gaping behind, with the keel bordering the posterior area more prominent and less fugacious, and with the lateral teeth entirely obsolete. An examination of a recent specimen shows marked anatomical differences also.

The species of typical *Cardium* in our Tertiaries are few and do not survive the Oligocene. *C. hatchetigbeënse* Aldrich, 1886, from the Lower Claibornian and *C. Tuomeyi* Aldrich, 1886, from the Chickasawan are the only well-established species in the literature. Gabb described a *C. multiradiatum* (1860, not *C. multiradiatum* Sowerby, 1846) which Whitfield identifies with a fossil from the Raritan clays of New Jersey, which is a *Cardium* s. s., but its name must be changed, as it has been used in the genus before. *C. vicksburgense* Conrad, from the Vicksburgian, may belong to this section or to *Cerastoderma,* I have not examined it. The "*Cardium*" *aleuticum* of Girard, 1850, from the Alaskan Eocene, is perhaps an internal cast of a *Glycymeris.* "*C.*" *subtentum* Conrad, 1849, from Oregon, appears to be a *Venericardia. Cardium globosum* Conrad (1848, printed *glebosum* by a typographical error afterwards corrected by Conrad, but not *Cardium globosum* Bean, 1839, from the Cornbrash of Scarborough, England; nor *C. globosum* d'Orbigny, 1849), from the Jacksonian and Red Bluff beds, is perhaps to be placed in this section, though its Λ-shaped spines recall *Trachycardium.* As *glebosum* is a Latin word, it may best be retained as the name of the species, though in no wise appropriate to the shell in question.

Cardium propeciliare n. sp.

PLATE 48, FIGURE 12.

Oligocene marl of the Chipola River, Calhoun County, Florida; Burns.

Shell small, thin, inflated, slightly oblique and inequilateral, with high, well-rounded beaks, anterior end slightly shorter, general outline suborbicular; sculptured with nineteen elevated ribs of triangular section separated by narrow, cross-striated channelled interspaces, each rib surmounted by a low keel the edge of which is periodically produced into short spines each ending in a knob, sides of the ribs finely concentrically striate; near the posterior end the whole surface shows a microscopic granulation; internal margins deeply fluted; hinge normal, delicate. Alt. 20, lon. 20, diam. 15.5 mm.

This elegant little shell is close to the young of the *C. echinatum* L. of Europe, in which, however, the ribs are lower, the interspaces wider and less sharply cross-striated, the keel less elevated and continuous, and the spines long and sharp. The European shell is more equilateral, with a longer hinge-line and not oblique. However, they are so similar as to be very interesting. According to Turton and Hanley, the young *C. echinatum* is probably the *C. ciliare* of Linné.

Cardium ctenolium n. sp.

Plate 40, Figure 13.

Oligocene sands of Oak Grove, Santa Rosa County, Florida; Burns.

Shell rounded, a little produced behind, with inflated beaks, subequilateral; sculptured with eighteen broad, rounded ribs separated by narrower flat interspaces sharply defined; there are posteriorly some fine radial striations and over the whole shell fine concentric sculpture which seems stronger where it passes over the ribs, especially distally, and in some places approaches imbrication; there is a small smooth area above the outermost anterior rib, but none behind the beaks; internal margins deeply fluted and radially striate; hinge normal. Lon. 19.5, alt. 18.5, diam. 14 mm.

Although not spiny I have placed this species in the typical section, as in all other characters this seems closely related to the true *Cardia*, and the latest representative of that group known from our Tertiaries.

Cardium acrocome n. sp.

Plate 48, Figure 2.

Oligocene marl of the Chipola River, Calhoun County, Florida; Burns.

Shell small, rotund, plump, nearly equilateral, with moderately full umbones; sculpture of about forty-five close-set, low, nearly flat radial ribs separated by very narrow channelled interspaces; the alternate ribs anteriorly surmounted with prominent hollow spines usually truncate at the ends, their alternates showing low Λ-shaped spines; behind the middle of the shell the long-spined ribs are less numerous and on the posterior area nearly all the ribs have low spines; there is no smooth area near the hinge-margin; internally the margins are fluted or serrate minutely, and the shell radially sulcate near the margin; hinge normal, delicate. Alt. 7.5, lon. 7.5, diam. 6 mm.

Only a single valve of this very distinct little species was obtained. Owing to the alternation in the sculpture it has somewhat the aspect of *Criocardium*.

Subgenus **TRACHYCARDIUM** Mörch.

The only Eocene representative of this group is *C. bellum* Conrad (1875, in Kerr, N. Car. Rep., App.), which has not been figured or sufficiently described. From the description it would appear to resemble *C. isocardia.* In the Oligocene the fauna is much richer. We have *C.* (*T.*) *dominicense* Gabb, 1873, from St. Domingo, easily known by its sixty ribs; *C.* (*T.*) *lingualeonis* Guppy, 1866, from Bowden, Jamaica, a species allied to the recent *C. Belcheri* of the Gulf of California, but with more numerous and less elevated ribs, *C.* (*T.*) *inconspicuum* Guppy, and a number of undescribed species. The National Collection contains fragments of a large flat-ribbed species with narrow wrinkled interspaces, not unlike *C. marmoreum* Lam., and of another species also large and strong with narrower, keeled-muricate ribs, both from Bowden, which may furnish better specimens later on. From the Chipola horizon at Alum Bluff, Chattahoochee River, Florida, comes another species with very narrow imbricate ribs and much wider wrinkled interspaces, only represented in the collection by a fragment.

Cardium (Trachycardium) inconspicuum Guppy.

Cardium inconspicuum Guppy, Quart. Journ. Geol. Soc., London, vol. xxii., p. 293, pl. xviii., fig. 12, 1866.

Oligocene of the Bowden, Jamaica, marl, and of the Chipola marl, Calhoun County, Florida.

This species really has a little resemblance to *C. subelongatum* Sowerby, and probably Gabb confused this with *C. lingualeonis* Guppy when he placed (wrongly) the latter name as a synonym under *C. subelongatum.* The species actually labelled by the last-mentioned name in Gabb's collection are quite a different thing again, as will shortly be shown.

The present species has from thirty-six to forty-two ribs, which, when they preserve their outer coat, have a beautiful close concentric threading over the whole shell, except the ribs of the posterior area, which are smooth and polished; the loops of the threads as they pass over the body ribs (as usual in *Cardium*) are convex towards the umbones. When this coating is removed by wear the tops of the ribs will be flat and polished while their sides show fringing wrinkles. If erosion attack the second surface, the structure of the shell will reproduce pretty faithfully the reversed loops of the original outer coat.

Cardium (Trachycardium) dominicanum n. sp.

PLATE 48, FIGURE 16.

Cardium subelongatum Gabb, Geol. St. Dom., p. 250, 1873 (syn. exclus.); not of Sowerby, P. Z. S., 1840.

Oligocene shales near Gatun, on the line of the Panama Canal, Rowell; Oligocene of St. Domingo, Gabb.

Shell ovate, solid, heavy, inflated, with high, conspicuous prosogyrate beaks, and a very short and heavy hinge; sculpture of twenty-seven similar, subequal, strong ribs, subtriangular in section, the longer side of the rib in each case inclining towards the middle line of the shell; interspaces very narrow, not regularly channelled, but rather formed by the sides of the ribs; the whole shell is covered with fine concentric lineation, and the summit of each rib when perfect carries a line of small nodules, usually rounded or oblong and transverse, and on a few of the ribs near the posterior end more or less $\wedge$-shaped; shell nearly equilateral, internal margin fluted, upper part of the posterior margin serrate. Alt. 28, lon. 20.5, diam. 23 mm.

This shell has obviously little resemblance to *C. subelongatum*, and Gabb's statement that it resembles perfectly the recent specimens of that species from the same region is one of those puzzles which are inexplicable.

(Group of *C. isocardia* Linné.)

Cardium (Trachycardium) cestum n. sp.

PLATE 48, FIGURE 14.

Oligocene marl of the Chipola River, Calhoun County, Florida; Burns.

Shell moderately large, solid, inflated, slightly oblique, subequilateral; beaks high and rounded; sculpture of thirty-four triangular radial ribs, on the summit of which is developed a thin elevated keel of which the summit is somewhat like the top of a T-rail, overhanging at the sides, when intact, and flattened and smooth on top; the sides of the keels and ribs, up to the twenty-second, are vertically striated and sparsely sprinkled with minute granules; the posterior twelve ribs are asymmetrical, the keels being placed behind the summits of their sustaining ribs and crenulate or surmounted by obliquely set transverse nodules; the first nine ribs are somewhat similarly imbricate or nodulous, and ventrally in adults near the margin are often pressed over backward and strongly transversely wrinkled with their interspaces flat and rather wide, while over the disk the interspaces are chiefly narrow and V-shaped; different individuals show minor modifications of these details of ornament; interior with the margins fluted, the posterior margin deeply serrate, the internal face with shallow grooves extending upward from the flutings; hinge normal. Alt. 50, lon. 40, diam. 36 mm.

This profusely ornamented species is naturally usually more or less defective, but under all conditions is a remarkable shell.

Cardium (Trachycardium) lingualeonis Guppy.

Cardium lingualeonis Guppy, Quart. Journ. Geol. Soc. London, vol. xxii., p. 293, pl. xviii., fig. 7, 1866.

< *Cardium subelongatum* Gabb, Geol. St. Domingo, p. 250, 1873; not of Sowerby, 1840.

Oligocene marl of the Chipola horizon on Shoal River, Walton County, Florida; and of Bowden, Jamaica.

This species has thirty-two ribs, which are closer together than in the preceding species, while the edges of the surmounting keels are undulated, twisted, and rippled as confectioners do with ribbons of pulled candy. The shell is narrower and less oblique than *C. cestum*.

Cardium (Trachycardium) delphicum n. sp.

Plate 48, Figure 18.

Oligocene of the Ballast Point, Tampa, silex beds, and of the Oak Grove sands, Florida.

Shell small, solid, thick, subovate, with high beaks, nearly equilateral; sculptured with twenty-eight to thirty-one strong, high, triangular ribs, with much narrower, hardly channelled interspaces, both longitudinally and concentrically feebly striated; the first six or seven ribs are furnished with the usual cup-like projections, but succeeding ones show the cups narrowing and compressed above so as to form strong $\wedge$-shaped imbrications; at about the nineteenth rib the anterior wing of the $\wedge$ seems to become obsolete and the posterior wing, persisting on the posterior side of the ribs, more and more oblique and nodulous; interior margin with rather small flutings continued as sulci nearly to the middle of the shell; posterior margin feebly serrate; hinge short, strong. Alt. 33, lon. 28, diam. 24 mm.

This represents in the Oak Grove fauna the *C. isocardia* type. The Ballast Point specimens have only twenty-eight ribs and may belong to another species; as they are rather poor silicious pseudomorphs I have preferred to class them here, at least temporarily.

Cardium (Trachycardium) Emmonsi Conrad.

Cardium muricatum Emmons, Geol. Rep. N. Car., p. 301, figs. 232-233, 1858; Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 576, 1863; not of Linné, 1758, nor Tuomey and Holmes, 1856.

Cardium Emmonsi Conrad, Am. Journ. Conch., iii., p. 13, 1867.

Cardium floridanum Heilprin, Trans. Wagner Inst., vol. i., pp. 92, 103, pl. xi., fig. 25, 1887.

Pliocene marls of the Caloosahatchie and Shell Creek, Florida, Willcox; of North Carolina, at Walker's Bluff, Cape Fear River, Emmons.

This form has nine ribs on the posterior with hood-like imbrications; ten on the disk with high, arching imbrications continuous on the posterior side; and ten anterior, with cup-like ornaments like strung convolvulus flowers. The nearest recent relative is *C. consors* Broderip, of the Pacific coast. It is rather rare in the marls.

Cardium (Trachycardium) isocardia Conrad.

< *Cardium isocardia* Linné, Syst. Nat., ed. x., p. 679, 1758; ed. xii., p. 1122, 1767; Dillwyn, i., p. 118.

Cardium isocardia Chemnitz, Conch. Cab., vi., p. 182, pl. 17, figs. 174-176, 1782; Reeve, Conch. Icon., ii., *Cardium*, pl. 17, fig. 84, 1845.

Cardium Egmontianum Shuttleworth, Journ. de Conchyl., v., p. 472, 1856.

?*Cardium eburniferum* Guppy, Ann. Mag. N. Hist., 4th Ser., xv., p. 51, pl. vii., fig. 3, 1875.

Miocene of North Carolina at Wilmington; Pliocene of the Caloosahatchie and Myakka Rivers, Florida; Pleistocene of North Creek, Osprey, Florida; recent from off-shore near Cape Hatteras, North Carolina, southward through the West Indies to Trinidad.

This is the type of the subgenus, and has about twenty-seven to thirty-three ribs, with comparatively low and distant arcuate imbricating scales; the ribs are squarish and the interspaces channelled, the scales tend to be seated on the posterior side of the ribs; on the anterior face of the shell the imbrications are closer, lower, and heavier, but these ornaments change their form very gradually from one end of the shell to the other.

Linné and the earlier writers confounded this shell with a similar form from the East Indies which was afterwards named *C. squamosum* by Gmelin. A specimen of the West Indian shell was in the Linnean cabinet and serves to hold the name, though among the figures cited by him several referred to the Oriental shell. Guppy has described a shell from the Gulf of Paria which appears to be this species, though with rather more ribs than usual, but I know it only from his figure.

The spines are sometimes more distant and are then usually longer than common.

(Group of *C. muricatum* Linné.)

Cardium (Trachycardium) precursor n. sp.

PLATE 48, FIGURE 10.

Oligocene of Vicksburg, Mississippi; L. C. Johnson.

Shell small, moderately inflated, rather thin, nearly equilateral, the beaks small and slightly prosogyrate; sculpture of thirty-seven to thirty-eight strong, well-defined ribs, mostly of triangular section, with narrower channelled interspaces; the ribs on the anterior face minutely nodulous, the posterior ten flattened and more or less spinose with minute prickles; the whole shell finely concentrically striated, so that in perfect specimens the summit of the ribs on the disk is probably minutely crenate; internal margin sharply fluted; hinge normal, strong. Alt. 22.5, lon. 22, diam. 14.5 mm.

The single valve of this species in the National Collection appears distinct from any of those heretofore described from the Vicksburgian, and by its sculpture foreshadows the type to become so well-developed.

Cardium (Trachycardium) virile n. sp.

PLATE 48, FIGURE 1.

Oligocene of the Chipola marl, Calhoun County, Florida; Dall and Burns.

Shell small, solid, strong, rounded, subovate, with about thirty-eight rather close-set ribs, with narrower channelled interspaces; the anterior ribs to the number of about fourteen exhibit the strung and flattened cup-imbrication like *Cardium consors* in miniature; the posterior fourteen are asymmetrical, with an undulate or irregularly twisted serrate keel on the anterior side of the rib; those in the middle of the disk have a similar keel on the posterior side of the rib; the outer posterior ribs are more or less muricate or spinulose, and the posterior margin is serrate, the rest merely fluted internally; exceptionally perfect small specimens show small and extremely delicate spines on the medial ribs. Alt. 27, lon. 25.5, diam. 18 mm.

The delicacy and fragility of the ornamentation of this little shell are such that not a single specimen of many preserved its sculpture intact.

Cardium (Trachycardium) parile n. sp.

PLATE 48, FIGURE 17.

Oligocene of the lower bed at Alum Bluff and on the Chipola River, Calhoun County, Florida.

Shell small, suborbicular, inflated, nearly equilateral, the posterior end slightly more attenuated and produced; beaks full but not high; sculptured with twenty-five ribs having in section the form of a truncated pyramid, separated by narrower channelled interspaces, elegantly concentrically closely striated; the anterior ten ribs bear ∧-shaped projections, the anterior wing of the ∧ being broad and produced, the posterior narrow and appressed; the four ribs next posterior have on their tops slender arcuate transverse rather sparse imbrications; behind these the projections shift to the posterior side of the summits of the ribs, gradually becoming more oblique, losing the anterior wing of the arch, and finally appearing as delicate spinules nearly parallel with the ribs; interior margin behind strongly serrate, below and in front fluted, the flutings continued to the umbonal cavity as shallow sulci; hinge normal, delicate; a narrow, smooth area between the most anterior rib and the hinge-margin. Alt. 15, lon. 15.5, diam. 10 mm.

This little species appears to be rather abundant in the sands.

Cardium (Trachycardium) malacum n. sp.

Plate 48, Figure 4.

Oligocene sands of Oak Grove, Santa Rosa County, Florida.

Shell small, solid, somewhat oblique, the upper anterior and lower posterior margins produced, beaks small and low; sculpture of thirty-two rounded-triangular rather high ribs with very narrow channelled interspaces, which, with the sides of the ribs, are concentrically striated; the first twelve ribs have cup-like imbrications of the strung-convolvulus type, behind which they change by the modification of the anterior part to 7-shaped, and finally to the usual transverse oblique nodulous type; interior margin sharply and deeply fluted, the channels continued half-way up the disk, the upper posterior margin with seven or eight serrations. Alt. 24, lon. 24, diam. 16 mm.

This species has a peculiar obliquity that I have not elsewhere noticed, otherwise its characters are not striking.

Cardium (Trachycardium) var? bowdenense Dall.

Cardium muricatum Guppy, Geol. Mag., Dec. ii., vol. i., p. 450, 1874; not of Linné, 1758.

This species from the Bowden marl and from the silex beds at Ballast Point, Tampa Bay, Florida, was identified with the recent *muricatum* by Guppy. It has about the same number of ribs (thirty-seven to forty-one) and the sculpture is much the same in character, but the similarities are all in miniature; the shell is always small (alt. 15.5, lon. 15.5, diam. 9 mm. for the largest seen), less inflated proportionately than *C. muricatum* of the same size, with the ribs more compressed and crowded. *C. muricatum* has not been found in any horizon between Bowden and the Pleistocene, which is in itself a strong reason for doubting whether the older shell is identical with the newer. I therefore propose for it the name of *bowdenense,* which, if connecting links should hereafter be found, may be regarded as of varietal value.

Cardium (Trachycardium) oedalium Dall.

Cardium muricatum Tuomey and Holmes, Pleioc. Fos. S. Car., p. 64, pl. 19, fig. 2, 1856; not of Linné, 1758.

Cardium carolinensis (*sic*) Conrad, Am. Journ. Conch., iii., p. 13, 1867; not of Conrad, 1862.

Pliocene of Florida, on the Caloosahatchie, Alligator, and Shell Creeks, Dall and Willcox; of South Carolina, near Darlington, Burns and Holmes.

Shell suborbicular, moderately inflated, nearly equilateral, with low beaks and a narrow smooth space above the upper anterior rib in each valve; sculpture of twenty-seven to thirty-one rounded triangular ribs, separated by narrow, finely cross-striated channels; the anterior nine ribs bear on their anterior edge small ovate or reniform disks with convex lower surfaces, on each rib connected together by a raised line; the nine ribs next posterior bear on their summits a similar series of half funicular projections, which become more and more indented in the median line until on the last of the nine ribs the series is composed of double leaflets instead of a single arch; on the remaining ribs the projections are laid on the posterior side as a single series (on each rib) of subtriangular leaflets oblique or nearly parallel with the rib on which they stand; internal margin deeply fluted, disk sulcate, posterior margin feebly serrate, hinge normal, delicate, shell not very heavy. Alt. of type 30, lon. 31, diam. 19 mm. Some specimens reach an altitude of 46 mm.

This is the Pliocene representative of *Cardium muricatum,* which has not been found in the marls so far, but a close examination will show the very different and much more developed character of the murication. This, however, is found occasionally more or less dwindled; a variety *depauperatum* has the ornaments represented only by sparse and feeble spinules, which, however, preserve their original form whenever intact. This shows much less variation than *C. muricatum* in the number of ribs, of which there are almost always thirty-one. In studying the sculpture of this and allied species it is very necessary to select perfectly preserved examples, as in the great majority the minor characteristics have been lost.

This species is the subject of one of Conrad's perennial blunders. In 1862 he proposed the name of *C. carolinensis* (*sic*) for the *C. magnum* of Tuomey and Holmes, which he supposed not to be *C. magnum* of Born. Again in 1867 he proposes the same name for the *C. muricatum* of Tuomey and Holmes. In 1875 he again uses the name for a supposed new species of *Trachycardium* from the Cretaceous of North Carolina, making three distinct species to which he has applied the specific name *carolinensis* in the genus *Cardium*, besides his *Protocardia carolinensis* of 1875, also from the North Carolinian Cretaceous.

Cardium (Trachycardium) muricatum Linné.

Cardium muricatum Linné, Syst. Nat., ed. x., p. 680, No. 69, 1758 (not p. 679, No. 62, = *aculeatum* in errata, p. 824). Not of Emmons, 1858, Tuomey and Holmes, 1856, or Guppy, in part, 1874.

Cardium campechiense Bolten, Mus. Boltenianum, p. 191, No. 407, 1798.

Cardium muricatum Reeve, Conch. Icon., ii., *Cardium*, pl. vi., fig. 33, 1844.

Cardium Gossei Deshayes, P. Z. S., 1854, p. 330.

Pleistocene of Florida, the Atlantic coast of Middle America, and the West Indies; recent from the coast of North Carolina near Cape Hatteras southward to Santa Caterina, Brazil; among seaweeds in one to four feet of water, Krebs, but in deeper water towards the extremes of its range.

The typical locality for this species is Campeche, and considering its variability in some particulars it is curious that the species has but two synonyms. The species has from thirty to forty-one ribs, the first twelve of which have seated on the anterior side of their flattened summits pedunculated nodules in a single, not crowded series, resembling little incisor teeth pointing with their broad edges towards the umbo of the valve; the next posterior pair of ribs have a double series, one on each side of the top of the rib, alternating, and not unlike the cusps of little canine teeth, also pointing upward; the number of ribs with this double series varies from one to four, but is usually two; about fourteen ribs next posterior have only a single series set obliquely on the posterior side of the ribs; then follow about six with similar processes but more blade-like and twisted, then one with a double set of blades, and three or four with a single set rather longer and more crowded; the interspaces are narrow and hardly channelled; the inner margin has short serrations all round and radial sulci extend over the inner disk to the umbonal cavity.

There is practically no smooth area between the most anterior ribs and the hinge-margin in a typical specimen. The details of the ornament vary more or less but are more constant than one would expect in structures whose minute details can hardly affect the economy of their builder, but are the result of minute modifications of the mantle margin.

I have been at the trouble to count the ribs of fifty-five specimens of this species from all parts of its range and record the result, the figures representing the number of ribs and those following in parentheses the number of specimens having the number of ribs indicated by the units preceding the parenthesis:

30 (2), 31 (9), 32 (5), 33 (8), 34 (7), 35 (8), 36 (6), 37 (5), 39 (3), 40 (1), 41 (1).

The only generalization that seemed authorized is that the ribs are less numerous in specimens from near the northern border of the range of the species, and also in the fossils; the specimens with thirty-seven to forty-one ribs are nearly all from the southern half of the area inhabited. There was no diminution of ribs towards the southern extreme of the range and no regularity in the variations of the murication which could be correlated with difference of habitat.

(Species of the group of *C. elongatum.*)

Of this group, which resembles species of the *C. isocardia* type with the ornament removed from the tops of the ribs, and existing, if at all, only on their sides in the interspaces, we have two unidentified species indicated by fragments in the Bowden Oligocene marl of Jamaica; one, *C. declive* Gabb (1881, very similar to *C. inconspicuum* Guppy), from the Pliocene of Costa Rica, and the following species:

Section *Acrosterigma* Dall.

Cardium (Trachycardium) Dalli Heilprin.

Cardium Dalli Heilprin, Trans. Wagner Inst., vol. i., p. 131, pl. 16*a*, fig. 70, 1887.

Pliocene marls of the Caloosahatchie and Shell Creek, Florida; Willcox and Dall.

This magnificent species has thirty-five ribs, of which seven belong to the posterior area and are flattened and grooved, with traces of minute spinules in the interspaces near the hinge; the other ribs are broadly arched, almost flat, nearly smooth, with faint longitudinal and concentric striæ; the edges of these ribs overhang so much as to nearly roof over the narrow channelled interspaces; on the upper fifth of the shell the sides of the ribs, and on the umbo their tops, are gently crenulated. Internally the margins in front and below are fluted, the sulci extending half-way up the shell; the posterior margin is distantly denticulated by the ends of the ribs of the posterior area.

A singular feature, and one which seems to be worthy of sectional discrimination, is presented by this species, though not mentioned in the original description. Internally, from the umbo, nearly in the middle of the shell a stout, elevated, solid rib is given off and extends downward on the shell wall to about the level of the lower end of the posterior lateral tooth. An examination of *C. elongatum* and many other exotic species of *Cardium* revealed no such feature in any, though *C. pseudolima* and a few other species have the thickened ridge in the wake of the posterior adductor scar common to so many bivalves.

While this rib is conspicuous only in full-grown shells, it exists in the youngest hitherto examined.

The measurements of the largest pair of *C. Dalli* in the National Collection are: Alt. 136.0, lon. 93.0, diam. 51.0 mm.

In concluding this review of the *Trachycardia* it may be mentioned that the enormous *C. quadragenarium* Conrad, 1838, is reported by Cooper to occur in the Pliocene and Pleistocene beds of California as well as in the existing fauna from San Pedro southward. It is the *C. luteolabrum* of Gould, 1851, and *C. xanthocheilum* (Gld. MS.) Carpenter, 1856.

Subgenus RINGICARDIUM Fischer.

Cardium procerum Sowerby (1833, of which *C. laticostatum* Sowerby is said to be the young, and *C. panamense* Sowerby, 1843, very closely allied) is known from the Pliocene of the well in the City Park at San Diego, California, and also from the Pleistocene of the coast. In the recent fauna it ranges from Lower California and the Gulf to Panama.

Subgenus CERASTODERMA Mörch.

This group contains the greater number of our Neocene cockles and is by far the most imposing in point of size. Of its two sections, one, the typical group, is circumboreal in distribution; the other, *Dinocardium*, is, so far as I know, exclusively American and confined to the warmer waters of the coast, where it takes the place in faunal economy occupied by the typical group in the more northern waters.

The Eocene species, which might be, perhaps, included in this group and are excluded by their characters from any of the other groups of the genus, are few in number. *C. Harrisi* Vaughan, 1896, from the Lower Claibornian of Louisiana, which, except that the shell does not gape, might be supposed to belong to *Tropidocardium* and is believed to have large, flat spines externally, and *C. Cooperi* Gabb,* of California. There is a poorly preserved species with numerous rounded ribs found in the lower marls at Shiloh, New Jersey, which was referred by Whitfield in his description of the marl fauna to *C. craticuloide* Conrad. A comparison with the true *craticuloide,* which is a Plum Point Miocene shell with thirty very elevated narrow ribs, shows that this identification is incorrect. The Shiloh species, in the absence of better material, does not seem to differ from casts in the limestone of Jacksonboro', Georgia, referred by Conrad to his ill-defined Shell Bluff group, and both appear extremely close to, and possibly identical with, *C. eversum* Conrad, described from the Vicksburgian Oligocene in 1848. Another species, *C. vicksburgense,* was described by Conrad from the same horizon at the same time.

In the Miocene there is a fine showing of these shells. *C. acutilaqueatum* Conrad (Medial Tert., p. 34, pl. xviii., fig. 2, 1839) has been obtained from the Miocene of Alum Bluff, Florida; from that of the Natural Well and Magnolia, Duplin County, North Carolina; Suffolk, on the Nansemond River, Grove Wharf, on the James River, and Petersburg; Virginia. It is somewhat compressed, elevated, and has about forty ribs. *C. laqueatum* Conrad, 1831 (*op. cit.*, p. 31, pl. xvii., fig. 1), is a somewhat similar but more inflated and trigonal species with thirty-four to forty-one ribs, and is usually found in a very decayed state. It is known from the Natural Well and Magnolia, North Carolina; from the north end of the Dismal Swamp, from Cove Point and Petersburg, Virginia, Jones Wharf and St. Mary's, Maryland. It is the *C. ingens* Wagner, 1839. *C. leptopleura* Conrad, 1841, from Calvert Cliffs, Maryland, is a rare species, notable for its relative width and thirty-one distant, angular, carinated ribs. I have not succeeded in collecting this species in its typical form, and specimens which have been referred to it from Plum Point seem to differ more or less from Conrad's figure. A *Cardium modestum* Conrad (1855, Pacific R. R. Reports, vol. v., p. 322, plate iii., fig. 15) is de-

* This is, however, claimed to be really a Cretaceous species.

scribed as having twenty-two ribs and being subtruncate behind, but has not been recognized since, and may be a young *Fragum* or a small species of the present group. It is said to have been collected from the Miocene of the San Diego Mission, though no Miocene is known at present in this vicinity. It is not the *Cardium modestum* of Adams and Reeve, "Zoology of the Samarang," 1850.

On the Pacific coast in the Pliocene and later we have several fine species. Chief among these is *Cardium corbis,* Martyn, 1784 (*C. Nuttallii* Conrad, 1838, + *C. californianum* Conrad, 1838, + *C. Nuttallianum* Carpenter, 1864). This species ranges from the Pliocene to recent seas in time, and at present from Bering Sea to Monterey and from California to Kamchatka. Another is *C. californiense* Deshayes, 1839 (+ *C. pseudofossile* Reeve, 1844, + *C. blandum* Gould, 1850), a more triangular and less inflated species with forty to forty-eight rounded, nearly smooth ribs, which is recorded from the Pliocene and Pleistocene of California and ranges in the recent state from North Japan to Bering Sea and south to Monterey, California. In the bowlder clays of Vancouver Island a variety of this species has been found by Dr. Newcombe in which the ribs are much depressed and flattened, and the interspaces reduced to narrow, shallow grooves. This may take the name of var. *comoxense* Dall. It reaches about forty millimetres in length.

Cardium (Cerastoderma) waltonianum n. sp.

PLATE 48, FIGURE 19.

Oligocene (?) of Flournoy's mill-race at Summerville, two miles east of Argyle Post-Office, Walton County, Florida; L. C. Johnson.

Shell solid, coarse, strong, elevated, short, with about forty narrow, flat-topped radial ribs separated by subequal channelled interspaces crossed by lines of growth; a narrow, smooth area on the hinge-margin on each side of the high, rather pointed beaks; hinge very strong; internal basal and anterior margins with short flutings. Lon. 45, alt. 45, diam. 28 mm.

This shell is more trigonal than *C. craticuloide* and has less elevated ribs; it is not so produced at the ends as *C. leptopleura* Conrad, has narrower and more crowded ribs and a different outline.

Cardium (Cerastoderma) pansatrum n. sp.

PLATE 40, FIGURE 14.

Oligocene of Walton County and of the Oak Grove sands, Santa Rosa County, Florida; Johnson and Burns.

Shell small, solid, plump, slightly oblique and inequilateral, suborbicular, with moderately prominent beaks; sculptured with twenty-one strong, rounded ribs (of which six are smaller and on the posterior area) separated by narrower, sharply channelled interspaces; concentric sculpture irregular but rather marked, cross-striating the channels and forming thickened loops over the backs of the ribs; surface polished, a small, smooth, pseudo-lunule in front of the beaks, hinge normal, strong for the size of the shell, the internal margins deeply channelled, the sulci reaching well up on the disk. Alt. 11, lon. 11, diam. 9 mm.

It is possible that this species should be placed next to *C. ctenolium* among the typical *Cardia,* but the sculpture is more like that of *Cerastoderma.*

Cardium (Cerastoderma) druidicum n. sp.

PLATE 40, FIGURE 7.

Oligocene of the Oak Grove sands, Santa Rosa County, Florida; Burns.

Shell small, rather thin, with moderately high beaks; produced and pointed behind, rounded below and in front; sculptured with about sixteen strong, rounded ribs with narrower channelled interspaces; on the posterior area are five flattened, smooth ribs separated by narrow sulci; the anterior ribs, especially towards the margin, show low transverse ridges rather regularly and distantly arranged, as in *Dinocardium,* the anterior four or five ribs, however, are smaller and smooth; transverse sculpture, except that just mentioned, only of incremental lines; a small, smooth pseudolunule; hinge small, delicate, normal; anterior and basal margins fluted, the sulci ascending as high as the lower edges of the adductor scars. Lon. 25, alt. 22.5, diam. 15 mm.

This is an elegant little shell foreshadowing the characters of *Dinocardium,* but also related intimately to *Cerastoderma.*

Cardium (Cerastoderma) virginianum Conrad.

Cardium virginianum Conrad, Fos. Medial Tert., Cover of No. 1, and p. 33 (No. 2), pl. 18, fig. 1, April, 1839; not *Protocardia virginiana* Conrad, 1864.

Cardium ingens Conrad, as of Wagner, *op. cit.,* p. 33, 1840; not of Wagner (MS. 1839), Trans. Wagner Inst., v., p. 10, pl. 3, fig. 2, 1897.

Cardium quadrans Rogers, Trans. Am. Phil. Soc., 2d Ser., vol. v., p. 375, pl. xxx., fig. 1, Dec., 1839.

Miocene of Virginia at Suffolk and Grove Wharf; of Alum Bluff, Florida; and of Gay Head, Martha's Vineyard, Massachusetts.

This very rare and remarkable shell is almost invariably so eroded and decayed as to obscure its characters. It is very oblique, flattened, angular in front, with twenty-four flattened, longitudinally striate ribs separated by shallow channels on the disk, with the posterior area smooth and sculptured by about eight radial very narrow grooves. Near the beaks the channels are cross-striated. The hinge is strong, with the anterior minor cardinal unusually well developed, and an oblong pseudolunule on the hinge-margin externally above it. The characteristics of this shell, except its compression and anterior wing, ally it to *Dinocardium,* but it is almost worthy of a section to itself.

Cardium (Cerastoderma) leptopleura Conrad.

Cardium leptopleura Conrad, Fos. Medial Tert., p. 66, pl. 37, fig. 5, 1845; Proc. Acad. Nat. Sci. Phila., i., p. 29, 1841.

Miocene of Plum Point, Maryland; Burns.

Shell resembling the *C. waltonianum,* but thinner, less inflated, with the anterior part of the basal margin less rounded and produced; ribs lower than in *C. craticuloide* and the shell more triangular and oblique; the tops of the ribs are keeled, but the keel is not sharp or angular, but squarely flattened like the edge of a board; the ribs number from thirty-one to thirty-seven in different individuals,—thirty-three appears to be the most common number,—but the shells are very poorly preserved and always more or less eroded.

I have identified these Plum Point shells with Conrad's *C. leptopleura,* although their correspondence with his figure left something to be desired, because in a general way his description fits them as far as it goes, and no shell agreeing perfectly with his figure has been collected even in his original locality after careful search. Should the present form be found to be separable I would suggest for it the name of *Cardium leptopleura* variety *marylandicum.*

Cardium (Cerastoderma) tæniopleura n. sp.

PLATE 49, FIGURES 1, 2.

Miocene of Yorktown, York River, and Suffolk, Nansemond River, Virginia; Burns and Harris.

Shell thin, oblique-ovate, inequilateral, with moderately elevated beaks; sculptured, with thirty-one to thirty-four narrow, elevated ribs with the section of a T-rail, separated by wider, not channelled interspaces; the rounded-flattened overhanging tops of these ribs are crossed by concentric sculpture which is obscure on the summits but on their edges stands out at regular intervals at right angles to the ribs, giving a remarkable articulated appearance to them; the six ribs of the posterior area are asymmetrically appressed and are exempt from the tænia-like structure; hinge normal, strong, with a well-marked pseudolunule above the anterior part of it. Lon. 35, alt. 30, diam. 23 mm.

The very remarkable sculpture of this species would enable one to recognize even a small fragment of it, but the ribs are hollow and the substance of the shell of a spongy character, lending itself to solution or erosion, and the specimens obtained are all extremely dilapidated.

Cardium (Cerastoderma) ciliatum Fabricius.

Cardium ciliatum O. Fabricius, Fauna Grönl., p. 410, 1780.

Cardium islandicum Chemnitz, Conch. Cab., vi., pp. 146, 200, pl. 19, figs. 195, 196, 1782; Spengler, Mag. Ges. Naturf. Freunde zu Berlin, ii., p. 121, 1808; Wood, Gen. Conch., p. 225, pl. lv., figs. 2, 3, 1815; Index Test., p. 26, pl. v., fig. 27, 1825; Gould, Rep. Inv. Mass., p. 89, fig. 58, 1841; De Kay, Zool. N. York, v., p. 206, pl. xxiii., fig. 252, 1843; Mighels, Boston Journ. Nat. Hist., iv., p. 321, 1843; Reeve, Conch. Icon., ii., *Cardium,* pl. xi., fig. 54, 1844; Stimpson, Shells of N. Eng., p. 19, 1851.

Cardium edule Mohr, Isl. Naturh., p. 128, 1786; not of Linné.

Cardium pubescens Couthouy, Boston Journ. Nat. Hist., ii., p. 61, pl. iii., fig. 6, 1838.

Cardium arcticum Sowerby, P. Z. S., 1840, p. 106; Conch. Ill., i., pl. 51, fig. 26, 1841.

Cardium Dawsoni Stimpson, Proc. Acad. Nat. Sci. Phila. for 1862, p. 58, figure.

Cardium Hayesii Stimpson, Proc. Acad. Nat. Sci. Phila. for 1863, p. 142, 1863.

Cardium (*Cerastoderma*) *ciliatum* Mörch, Yoldi Cat., ii., p. 34, 1853.

Cardium (*Serripes*) *islandicum* H. and A. Adams, Gen. Rec. Moll., ii., p. 456, 1857.

?*Cardium boreale* Broderip and Sowerby, Zool. Journ., iv., p. 368, 1829.

Pleistocene of the post-glacial silts and bowlder clays of the entire boreal region; recent, from the Arctic seas southward to Cape Cod on the Atlantic and to Puget Sound on the Pacific coast.

This well-known species is one of the most characteristic shells of the cold-water Pleistocene throughout the northern hemisphere. It is curious that the typical form figured by Chemnitz should have been the one Stimpson was led to separate from the other varieties as a distinct species under the name of *Hayesii.* The *C. boreale* of Broderip and Sowerby is perhaps the same as *C. blandum* Gould, but it has not been figured and the description is insufficient to certainly identify the shell. It is certainly either *blandum* or the present species.

Tryon, curiously enough, refers this species to Linné under the name *islandicum* (which does not occur in the Syst. Nat.), and gives for it the reference to *C. pectinatum* Linné (cf. Am. Marine Conch., p. 175).

Like most northern shells this is very variable, but the differences are inconstant. The law that the greater the number of serial parts the greater the range of variation of that number in different individuals holds good in this case, as usual. The original description of Fabricius calls for thirty-two to thirty-eight ribs. Chemnitz allows from twenty-six to thirty-six; *C. Hayesii,* thirty-three to thirty-five, and *C. arcticum* is figured as having about twenty-nine ribs. The most usual number is thirty-five, always well separated from one another, and having a tendency to angularity, most marked in the adult.

Cardium (Cerastoderma) decoratum Grewingk.

Cardium decoratum Grewingk., Verh. Min. Ges. St. Peters. for 1848-49, p. 274, pl. iv., figs. 3 *a-g;* 1850.

Pliocene? of St. Paul Island, Unga Island, and Aliaska Peninsula, Alaska; Pleistocene of Kadiak and Atka Islands and Pavloff Bay, Alaska, and in the bowlder clay deposits south and east to Comox and Victoria, Vancouver Island.

This is a very characteristic species of the bowlder clays of the northwest coast, narrower and proportionately heavier than *C. ciliatum,* showing usually concentric color zones when well preserved; twenty-five to thirty-one ribs, frequently reticulated by concentric elevated lines.

Section *Dinocardium* Dall.

Cardium (Cerastoderma) phlyctaena n. sp.

PLATE 48, FIGURE 13.

Oligocene of the silex beds at Ballast Point, Tampa Bay, Florida; Willcox and Dall.

Shell solid, squarish, with rather elevated beaks and convex valves; sculptured with thirty-one flattish, narrow radial ribs, the anterior half of which have the usual lepidote sculpture of this group, the posterior half being nearly smooth and all separated by somewhat narrower channelled interspaces; posterior area large, nearly smooth, with sparse radial grooves along which are set minute distant pustular spines; a small pseudolunule is present; hinge normal, solid, internal margin in front and below with very short flutings. Alt. 27, lon. 25.5, diam. 18 mm.

The specimens are silicious pseudomorphs and may be defective, yet, except in respect of the almost microscopic pustules on the grooves of the posterior area, it seems to have all the characteristics of *Dinocardium.*

Cardium (Cerastoderma) chipolanum n. sp.

Plate 40, Figure 8.

Oligocene of Alum Bluff and the Chipola beds of the Chipola River, Florida, Burns; and of Roberts, Escambia County, Alabama, E. A. Smith.

Shell thin, polished, with large, full beaks; subequilateral, rounded in front and below, obliquely subtruncate behind; sculptured with about twenty-four strong ribs, of which the anterior five or six are smooth, thence to the middle of the shell with thickened adherent scale-like ornaments (which I call lepidote for short) especially near the margin, the remainder of the ribs smooth, except on their sides, where they are cross-striated, as are the narrow channelled interspaces; posterior area smooth with obsolete radial grooves, one or two near the hinge stronger; no pseudolunule; hinge normal, strong; internal margins sharply fluted, sulci reaching well up on the disk. Lon. 34, alt. 36, diam. 24 mm.

This shell in its general characters is a miniature *Cardium robustum,* and is especially characteristic of the Chipola horizon.

Cardium (Cerastoderma) taphrium n. sp.

Plate 40, Figure 9.

Oligocene of the Ballast Point silex beds, Tampa Bay (?), and of the Oak Grove sands, Santa Rosa County, Florida; Dall and Burns.

This at first sight might be taken for the preceding species, but an examination shows that the ribs are one-third more numerous, being usually thirty-three or thirty-four; there is a rather large pseudolunule, the shell is proportionately more produced behind and below and actually larger when mature. The specimen figured is 35 mm. long, but a full-grown one, obtained later, measures lon. 48, alt. 47, diam. 34 mm.

The radial grooves on the posterior area are usually sharper and stronger than in the preceding species. The types come from Oak Grove, where the shell seems characteristic of that horizon. A very poor pseudomorph from Ballast Point is temporarily placed here, though probably more perfect specimens would show it belonged elsewhere. It has thirty-two ribs and is apparently of squarer form than *C. taphrium.*

Cardium (Cerastoderma) robustum Solander.

Cardium robustum Solander, Portland Catalogue, p. 58, 1786, after Lister, Hist. Conch, pl. 328, fig. 165, 1770.

Cardium ventricosum Bruguière, Enc. Méth., i., p. 228, 1789; plates vol. i., pl. 299, fig. 1, 1792; Wood, Gen. Conch., p. 220, 1815.

Cardium magnum Born, Ind. Mus. Vind., p. 34; Test. Mus. Vind., p. 46, pl. 3, fig. 5, 1780; not of Linné, Syst. Nat., ed. x., p. 680, 1758.

Cardium magnum Reeve, Conch. Icon., ii., *Cardium*, pl. iv., fig. 20, 1844; and of the majority of American authors, but not of Linné.

Cardium maculatum Gmelin, Syst. Nat., vi., p. 3255, No. 38, 1792; Dillwyn, Cat. Rec. Shells, i., p. 121, 1817; Ravenel, Cat., p. 5, 1834; not of Reeve, 1844.

Cardium robustum Solander, Dillwyn, *op. cit.*, i., p. 121, 1817.

Cardium carolinensis (*sic*) Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 576, 1863; not of Conrad, in Kerr, Rep. Geol. N. Car., App., p. 15, 1875.

Cardium magnum Tuomey and Holmes, Pleioc. Fos. S. Car., p. 63, pl. 19, fig. 1, 1856; Heilprin, Trans. Wagner Inst., i., p. 103, 1887.

Upper Miocene of Wilmington, North Carolina, Stanton; Pliocene of Darlington, South Carolina, of the Croatan beds of North Carolina, of the Caloosahatchie and Shell Creek, Florida; Pleistocene of Simmons Bluff, South Carolina, of the Brunswick Canal, Georgia (Couper), and of many localities in the Floridian, Gulf, and Antillean region; recent from Cape May, New Jersey, south to Cuba, Jamaica, and Campeche.

As Solander gives a reference to Lister's perfectly recognizable figure (the same upon which Gmelin's name of *maculatum* was afterwards founded), there can be no doubt his name should be adopted.

As regards the ribs, the fossil species vary in having from twenty to twenty-eight, the majority in the list having between twenty and twenty-four. The recent ones vary between twenty-two and thirty, the majority having twenty-three to twenty-seven. These figures are exclusive of the flattened rays on the posterior area, which are invariably seven or eight, there being one more on one valve than on the other. The total rays or ribs would then amount to from thirty to thirty-five in the great majority of specimens. There is in the list as I have recorded it for my own study a slight apparent tendency to a less number of ribs in the fossils than in the recent shells, and in the northern compared with the southern specimens, as has been observed heretofore with ribbed pelecypods considered by me in this memoir. The number of specimens of which the ribs were counted was forty-five. The Miocene specimens examined had twenty-seven and twenty-three ribs, and those with fewer ribs than this were only four in number, of which one was a recent shell from Yucatan and the others from the Pliocene of Florida. The two specimens with twenty-nine and thirty ribs came from Florida and Vera Cruz, Mexico, but a valve from Cape May, New Jersey, had twenty-eight ribs, and so did one from the Pliocene of the Caloosahatchie. Thirty-one of the forty-five specimens had between twenty-three and twenty-six ribs. The species is very uniform in its general character, becoming more oblique and elongated with age, and having the two forms common to all species of *Cardium*, one more elongated and oblique, and one more quadrate and equilateral.

There is no living member of *Dinocardium* on the Pacific coast, but *C. Meekianum* Gabb, 1869, from the Pliocene of California is related to *C. robustum*.

Roemer described a *Cardium elegantulum* in 1849 from the American Cretaceous, but as this was transferred to the genus *Liopistha* before its conflict with *C. elegantulum* Beck, 1842, was noticed, there will be no occasion for any change now.

There is a *Cardium multisulcatum* from the South American Tertiary described from Darwin's collections in 1846, but this name had previously been used by Sowerby (P. Z. S., 1833) and the former species (cf. Philippi, Tert Verst. Chile, p. 178, 1887) may take the name of *C. Darwini*.

Subgenus FRAGUM Bolten.

Section *Fragum* s. s.

Cardium (Fragum) gatunense n. sp.

Black Eocene shales of Gatun, Isthmus of Darien; R. T. Hill.

Shell solid, high, truncate behind, rounded in front, nearly equilateral, radiately ribbed with flattened ribs separated by narrower channelled interspaces; there are sixteen ribs in front of the truncation, which is bordered by a single rib more prominent than the others, behind which are about ten others; the truncation is bordered by an obtuse margin and the edges of the ribs in the channels are, as it were, fringed by small imbrications; on the body and posterior truncation the ribs are dotted sparsely with small globular tubercles, generally worn off; in front of the somewhat anteriorly gyrate umbones and also behind them near the margin are spaces where the ribbing is obsolete, but not defined as lunule or escutcheon by any boundary; the margins are serrate or squarely notched, and the internal flutings run well up on the disk; the hinge and scars are normal. Lon. 23, alt. 28, diam. circa 23 mm.

This well-marked species is abundant in the shales, but the matrix is so much tougher than the remains of the shell that the characters have to be determined from a large number of imperfect specimens.

Cardium (Fragum) sp. indet.

Oligocene marl of Bowden, Jamaica; Henderson and Simpson.

A fragment of a *Cardium* resembling *C. medium* was obtained from the marl but is too imperfect for description and is noted here to avoid the omission of this element in the Bowden fauna. It may be the same as the following species, but is very much larger than any of the Chipola specimens.

Cardium (Fragum) Burnsii n. sp.

PLATE 48, FIGURE 15.

Oligocene of the Chipola River, Calhoun County, Florida; Burns.

Shell small, subquadrate, moderately inflated, truncate behind, rounded in front, with rather low beaks; sculpture of on the body twenty-two to twenty-four subequal rounded ribs with narrower channelled interspaces, sharply cross-striated between the ribs; on the posterior truncation twelve to fourteen similar but smaller ribs, a few near the hinge-margin wider than the rest, with no marked smooth area between them and the margin either in front of or behind the umbones; an easily detachable outer layer covers the ribs with fine concentric threading, rising at intervals into semilunar small nodules, all of which is frequently worn off when the ribs appear polished; internally, the margin is strongly fluted; hinge normal, strong. Lon. 6.5, alt. 7.0, diam. 6.0 mm. A single broken valve reaches 10 mm. in height.

This little shell stands almost midway between typical *Fragum* and *Trigoniocardia,* having the striated interspaces of the latter and the numerous similar subequal ribs of the former. It seems abundant in the marls.

Cardium (Fragum) medium Linné.

Cardium medium Linné, Syst. Nat., ed. x., p. 678, 1758; ed. xii., p. 1122, 1768; Reeve, Conch. Icon., ii., *Cardium,* pl. vi., fig. 30, 1844; Roemer, Conch. Cab. Neue Ausg., p. 102, pl. iv., figs. 5-7, 1869.

Cardium venustum Dunker, Mal. Blätt., viii., p. 37, 1861.

Hemicardium columba Heilprin, Trans. Wagner Inst., i., p. 93, pl. xi., fig. 26, 1886.

Miocene of St. Mary's River, Maryland, W. B. Clark; of the Natural Well, Duplin County, North Carolina; Pliocene of the Caloosahatchie River, of Shell Creek, and of Alligator Creek, south Florida; recent in two to fifteen fathoms from Cape Lookout, North Carolina, to the West Indies and south to Santa Marta, Brazil.

This species is abundant in the West Indies and differs especially in the amount of impression of the posterior area and the elevation of the upper part of the posterior margin projecting from the central part of the depression when the valves are closed. Some specimens have only a slight depression, others have it very marked, and the intermediate stages are so common that it is evident they are of little systematic value. Professor Heilprin compared, as it happened, extreme specimens, which have a very different aspect without the connecting gradations.

Cardium (Fragum) arestum n. sp.

PLATE 40, FIGURE 10.

Pliocene of the Caloosahatchie River, Florida.

Shell solid, thick, elevated, rather oblique, with the anterior region very short; beaks high, involute; sculpture of on the body thirty and on the posterior truncation fourteen flattened ribs with very narrow channelled interspaces, the whole crossed by extremely fine, close, concentric threads, and on the body supplemented by sparse imbricating arched nodules, low and distant, which towards the middle of the shell tend to stand on the posterior half rather than in the middle of the ribs; posterior truncation well marked, bordered near the beaks by a sharp keel which lower down becomes obtuse; interior normal, the margins fluted below the hinge. Alt. 24, lon. 19, diam. 21 mm.

This species in its form and sculpture appears to be the Pliocene representative of the Pacific *C. planicostatum* Sowerby, but differs from that species in the unusual brevity and obliquity of the anterior end of the shell. In a large number of specimens of *C. medium* both recent and fossil I have seen nothing approaching it at all closely.

Cardium (Fragum) biangulatum Sowerby.

Cardium biangulatum Sowerby, Zool. Journ., iv., p. 367, 1829; Conch. Ill., *Cardium*, p. 7, pl. 46, fig. 2, 1841.

Pliocene of San Quentin Bay, Lower California; Pleistocene of Santa Barbara, California; recent in ten to twenty fathoms, Catalina Island, California, and south to Panama.

This seems to be the Pacific coast representative of *C. medium,* but has much wider ribs.

Section *Trigoniocardia* Dall.

This group seems especially characteristic of the Middle American and Antillean region to which it is, so far as known, confined. It is an offshoot of the *Fragum* group starting in the Eocene and more or less abundantly represented to the recent fauna, which contains, on the Atlantic side, *C. antillarum* Orbigny (1845, + *C. ceramidum* Dall, Blake Rep., i., p. 269, pl. 4, fig. 6, 1886) and on the Pacific side *C. graniferum* Broderip and Sowerby, 1829; *C. alabastrum* Carpenter, 1857, and *C. obovale* Sowerby, 1833.

Of species belonging to this group which have been described from the Tertiary there are *C. castum* Guppy, 1866, of the Eocene of Manzanilla, Trinidad; *C. haitense,* Sowerby, 1849, of the St. Domingo, Curaçao, and Jamaica Oligocene; *C. galvestonense* Harris, 1895, from the Upper Miocene of the deep well at Galveston, Texas; and *C. callopleurum* Gabb, 1881, from the Pliocene of Costa Rica. These appear to be well-founded species, and it is now practicable to add materially to the list: *Hemicardia affinis* Nelson, 1870, from the Tertiary of Peru, is compared by the author to *C. obovale,* but is unfigured and insufficiently described.

Cardium (Trigoniocardia) alicula n. sp.

Plate 40, Figure 12; Plate 48, Figure 5.

Oligocene of the Ballast Point silex beds, Tampa, Florida, Dall; of the lower bed at Alum Bluff; and the marls of the Chipola River, Calhoun County, Florida, Burns.

Shell obliquely subtriangular, elevated, narrow, truncate behind the beaks, rounded above in front and pointed below; beaks high, carinated behind the keel defining the posterior area; posterior area with eight low, flat ribs, the upper ones broader; body with twelve similar but larger ribs separated by narrow cross-striated channels deeper near the keel and almost obsolete in front; on top of the ribs when perfect are rounded pustules, sparse, very fragile, and usually worn off; the pustules on the ribs of the posterior area are more elongate, oblique, and rarely arcuate; margin fluted internally, hinge strong. Alt. when fully mature, 19, lon. 14, diam. 14 mm.

The specimen first figured (pl. 40, fig. 12) is worn and has lost its pustules, being only a pseudomorph in silica; the subsequent figure (pl. 48, fig. 5) illustrates the unworn sculpture.

This species has much of the aspect of the Oriental forms of the section for which I have revived the name of *Hemicardium,* but this is probably merely an adaptive resemblance, as it is not likely to be genetically connected with them.

Cardium (Trigoniocardia) Simrothi n. sp.

PLATE 48, FIGURE 8.

Oligocene marls of the Chipola River, Calhoun County, Florida; Dall and Burns.

Shell small, oblique quadrate, plump, rounded in front and especially on the anterior basal margin, truncate and slightly alate behind; beaks high, involute and prosogyrate; body with eleven broad, flat, rapidly widening low ribs separated by narrow interspaces in which the cross-grooves are so wide that their interspaces appear as narrow, elevated, concentric threads; ribs on the truncation seven or eight, smaller and more crowded; when perfect the ribs are surmounted by small pustules, oblong in a transverse sense on the body and drop-like in a vertical sense on the truncation; internal margin fluted, hinge normal, strong, with very deep sockets and conical teeth. Alt. 13, lon. 9.5, diam. 10 mm.

In measuring these oblique species the altitude is taken from the point of the valve below to the top of the umbo. This shell much resembles the Caloosahatchie species, but is squarer, with the hinge-margin more produced behind and with pustules of a more transverse and different shape.

Cardium (Trigoniocardia) aminense n. sp.

PLATE 48, FIGURE 11.

Oligocene of the Potrero, Rio Amina, St. Domingo.

Shell elongate, narrow, carinate, very convex; beaks high and narrow; body with ten or eleven high flat ribs, the margins overhanging the narrower cross-threaded channels; truncation with ten lower and narrower but very similar riblets; when perfect the ribs carry a series of, on the body, transverse wedge-shaped nodules with the long slope of the wedge pointing downward; the nodules on the truncation are smaller and connected, resembling a string of tear-shaped beads with the small end of the drop upward; internal margin with rather long flutings, hinge normal, shell rather thick. Alt. 14, lon. 9.5, diam. 12 mm.

This is the longest and narrowest species, but somewhat more ovate and less pointed than *C. aliculum.*

Cardium (Trigoniocardia) maturense n. sp.

PLATE 48, FIGURE 7.

Cardium haitense Guppy, *pro parte,* Geol. Mag., Dec., ii., vol. i., p. 450, 1874; Geol. Mag., vol. ii., 1865, p. 256; not of Sowerby, 1849.

"Pliocene" of Matura, Trinidad; Guppy.

The National Museum contains among the types of Mr. Guppy's West Indian fossils some specimens of a *Cardium* which was identified and listed as above, under the name of *C. haitense,* by Mr. Guppy. The appearance of the fossils differs from any Pliocene fossils I have seen from Middle or South America or the Antilles, and I should judge them, from their aspect, to be of greater age. However this may be, the shell in question is undoubtedly quite distinct from *C. haitense* and offers the following characters:

Shell small, obovate, not carinate, short, elevated, somewhat oblique; posterior area with eight or nine ribs, body with twelve or thirteen; ribs rounded, low, those before the middle having a long slope anteriorly and a row of very small, bead-like nodules near the summit which is close to the short slope; all the ribs have this disproportionately small nodulation; the interspaces are narrow but not channelled, at the bottom is a cross-striation in arcuate lines; beaks not elevated for this group, shell with no sharp angles anywhere. Lon. 6.6, alt. 9, diam. 7 mm.

C. haitense has ten ribs on the truncation and fourteen on the body; they are narrower, much higher, and of different form from those of *C. maturense;* the nodulation of the former species is as broad as the rib it stands on and of a wholly different shape from that of the latter.

Cardium (Trigoniocardia) apateticum n. sp.

PLATE 48, FIGURE 6.

Uppermost Oligocene of the Oak Grove sands, Santa Rosa County, Florida; Burns.

Shell small, oblique, produced behind at the hinge-line, obliquely truncate, evenly rounded from in front into the base; beaks rather high, carinate behind, and prosogyrate; truncation with nine and body with thirteen ribs, low, flat, wide on the body and rapidly broadening with very narrow interspaces squarely channelled; on the truncation the ribs, as usual, are smaller and more crowded and decrease in size from within outward; the channels are crossed by fine, sharp, evenly spaced elevated lamellæ which have a punctate appearance in the narrower interspaces; these threads rise on the sides of the ribs and pass over them as fine concentric threads; internal margin fluted, hinge strong, with a small, smooth space on each side of the umbones simulating lunule and escutcheon. Alt. 11.5, lon. 8, diam. 7 mm.

This is the only species which when perfectly intact is without nodules.

Cardium (Trigoniocardia) Willcoxi n. sp.

PLATE 48, FIGURE 9.

Pliocene marls of the Caloosahatchie and Shell Creeks, Florida; Willcox and Dall.

Shell small, plump, oblique, ovate triangular, obtusely carinate behind, with high involute, prosogyrate beaks; body with nine, truncation with eight ribs; on the body the ribs are high, flat-topped, with channelled, cross-striated interspaces narrower than the ribs; on the truncation the ribs are smaller and lower; when intact the ribs carry a row of nodules (rounded in the young, more or less transverse in the adult) which do not extend quite to the sides of the top of the rib on which they are seated; on the truncation the nodules appear to remain hemispherical at all ages; the cross-striation of the channels is close and very elegant; there is a small, smooth space in front of the most anterior rib; the inner margins are fluted and the hinge strong, but more transverse than in many of the species. Alt. 11, lon. 8, diam. 9 mm.

This elegant little shell is very abundant in the Caloosahatchie marl. It most resembles *C. Simrothi* Dall, and the Pacific coast recent *C. alabastrum* Carpenter, but is more elongate, more pointed below, and has no backward wing to the hinge-margin. The large ribs are proportionately smaller and less elevated than in *C. alabastrum*.

Subgenus PAPYRIDEA Swainson.

Cardium (Papyridea) spinosum Meuschen.

?Cardium rugatum Gronovius, Zoophyl., p. 278, pl. 18, fig. 5, 1781.

Cardia spinosum Meuschen, Mus. Gevers., p. 442, No. 1637, 1787 (after Lister, pl. 342, fig. 179, Jamaica, and Knorr, vi., pl. 7, fig. 6).

?Cardia hiatus Meuschen, *op. cit.*, p. 442 (after Gualtieri, pl. 85, fig. H).

Solen bullatus Chemnitz, Conch. Cab., vi., p. 65, pl. 6, figs. 49, 50, 1782; not of Linné, Syst. Nat., ed. x., p. 673, 1758 (= *Arca* sp., Rumphius, pl. 44, fig. N, Amboyna).

Cardium bullatum of Authors, as of Linné, not of Mörch, 1853.

Cardium soleniforme Bruguière, Enc. Méth., Vers., i., p. 235, 1789; Wood, Gen. Conch., p. 233, pl. 56, fig. 3, 1815.

?Cardium latum Born, Index Mus. Vind., p. 67, 1778; Test. Mus. Vind., p. 48, pl. iii.,

fig. 9, 1780 (in text wrongly as fig. 8), after Knorr, Vergn., vi., pl. 7, fig. 6; ?not *C. latum* "Borne" Reeve, Conch. Icon., fig. 21.
Cardium hiuleum Reeve, Conch. Icon., *Cardium*, pl. xxi., fig. 123, 1845 (*fide* E. A. Smith).
> *Cardium aspersum* Sowerby, P. Z. S., 1833; p. 85; Conchological Ill., fig. 15, 1841.
> *Cardium asperum* Roemer, Conch. Cab., Neue Ausg., *Cardium*, pp. 76, 122, 1869.
Papyridea soleniforme Swainson, Malac., p. 374, 1840.

This species has a confused synonymy, owing to the fact that the earlier writers confused several distinct shells under one name, and applied a Linnean name (*Solen bullatus*) based on a figure, supposed to represent an *Arca*, in Rumphius's work on Amboyna shells to the present species. I have not access to Gronovius's work, and his species by many authors is cited as identical with *C. apertum* L., while other authorities refer it to the shell now under consideration. The name *C. latum* was given by Born to a shell figured by him which closely resembles worn specimens of *C. latum* Reeve in the Conchologia Iconica, figure 41. The description, however, as pointed out by Smith (Challenger bivalves, p. 158) might serve very well for the present species, and if identical the name would be prior. I hesitate to accept it, however, on account of the uncertainty referred to and the fact that authors most nearly contemporaneous and their successors for more than a century have identified the name with the Chinese shell. The earliest unquestionable name is *C. spinosum* Meuschen, based on a figure of Lister representing a Jamaican specimen of the present species. Meuschen, by the way, also cites Knorr (to which I have not access) for an illustration of his shell, which reference is also given by Born under *C. latum*.

A careful study of a large number of specimens shows that there are several nearly related forms of this shell, which are possibly specific, but which in the absence of a fuller series from the far East I prefer to rank as varieties.

Cardium (Papyridea) spinosum var. **spinosum** s. s.

Cardium soleniforme Bruguière, *ex parte*.

Pleistocene of Florida and the Antilles; recent in the West Indies and from Cape Hatteras, North Carolina, south to Santa Marta, Brazil.

Shell with about forty-six ribs separated by narrower interspaces, in each of which runs a little, elevated narrow thread; the anterior ribs ($\pm$ 16) show low arched imbrications, especially towards the margin; the central ribs ($\pm$ 18) are low and rounded, becoming flatter and wider posteriorly, and are more or less sprinkled with very dehiscent microscopic granulations usually worn off even in living specimens, and more abundant behind the middle part of the shell; the posterior ribs (± 12) have the long slope forward and an abrupt slope on the posterior side, and are surmounted on the posterior side by a supplementary costa from which spring obliquely set spinules; the posterior ribs near the hinder margin are again more crowded.

Cardium (Papyridea) spinosum var. **aspersum** Sowerby.

Cardium aspersum Sowerby, P. Z. S., 1833, p. 85.

Recent on the Pacific coast of America from the Gulf of California south to Panama and Santa Elena.

Shell with about the same number of ribs as the preceding and having them similarly divided into groups, but with the bottoms of the channels flattish rather than filiform, the ribs themselves more elevated, rounded and strong, and the imbrications and spinules coarser and more distant; the microscopic granulations irregularly distributed, very sparse and distant, often wholly absent.

Cardium (Papyridea) spinosum var. **Turtoni** Dall.

Cardium bullatum E. A. Smith, Marine Moll. of St. Helena, P. Z. S., 1890, p. 302.

Pliocene of the Caloosahatchie River, Florida; recent at St. Vincent, Cape Verde Islands, and St. Helena (Turton).

Shell with about fourteen anterior, sixteen to twenty-three medial, and eight to eleven posterior ribs, the interspaces with a well-marked flattish thread between two sharp grooves; the spinules and imbrications as in var. *spinosum;* the medial ribs triangular in section, the apex of the triangle inclining for the most part slightly towards the anterior end of the valve and surmounted by a single row of close-set minute granules, giving it a serrate appearance, and elsewhere polished and destitute of granulation; the form and serration of the ribs obvious to the naked eye; concentric striation regular and fine.

It is a singular thing that the Pliocene fossil should be of the type now confined to the eastern Atlantic; the well-known fact that many of the living deep-water mollusks of the Antillean area are represented in the Italian Pliocene and not in our own may be, in some manner to be determined later, of an analogous nature.

Cardium (Papyridea) semisulcatum Gray.

Cardium semisulcatum Gray, Ann. Phil., ix., p. 137, 1825; E. A. Smith, Challenger Biv., p. 162, 1885.

Cardium ringiculum Sowerby, P. Z. S., 1840, p. 106; Conch. Ill. *Cardium*, p. 2, pl. 48, fig. 11, 1841.

Cardium Petitianum Orbigny, Moll. Cubana, ii., p. 309, pl. 27, figs. 50-52, 1853.
Papyridea Petitiana Dall, Bull. U. S. Nat. Mus., No. 37, p. 54, 1889.

Miocene of the Natural Well, Duplin County, North Carolina; Pliocene of the Caloosahatchie River at Fort Thompson, Dall; recent from Turtle Harbor, south Florida, south to the West Indies and the east coast of Brazil ninety miles southeast of Cape San Roque; in the eastern Atlantic on the coast of Liberia and at Simon's Bay, Cape of Good Hope, in fifteen to twenty fathoms.

Mr. Smith has pointed out the earliest name for this interesting little shell. The single specimen from the North Carolina Miocene exhibits no differences of character from the recent shells.

Cardium (Papyridea) bulbosum n. sp.

Plate 48, Figure 20.

Oligocene marl of the Chipola River, Florida; Burns.

Shell ovate, moderately inflated, with about thirty-eight ribs, nine anterior with minute spines on the anterior side of each rib near the margin; sixteen medial, low and rounded, with narrower channelled interspaces; thirteen posterior, low and obliquely flattened, with their highest part on the posterior side, the last three or four bearing minute spiny pustules; beaks low, pointed, smooth, margin crenulate, serrate above behind; hinge normal. Lon. 27, alt. 23.5, diam. 10 mm.

This species is notably shorter and with fewer ribs than the forms preceding, and is especially notable for the small number of anterior ribs and the very sparse muricate sculpture.

Subgenus **LÆVICARDIUM** Swainson.

This group is well established in the Cretaceous, where we have such species as *C. annulatum* Gabb and *C. linteum* Conrad, from the Chico series of California. No species, however, have been reported from the Eocene, though doubtless the group will eventually be found represented there. In the Oligocene the Vicksburg so far has furnished nothing in this line.

Cardium (Lævicardium) compressum n. sp.

Plate 48, Figure 21.

Oligocene of the Chipola beds at Alum Bluff and on the Chipola River, and of the Oak Grove sands on the Yellow River, Florida; Burns.

Shell small, plump, inequilateral, with convex beaks nearer the anterior end;

surface smooth over a small anterior area, and over the posterior area which is compressed so that the pinch gives to the lower posterior margin a distinct insinuation; between these the disk is covered by minute radii which, though conspicuous in eroded shells, hardly interrupt the smoothness of the surface when perfect; the outline is rounded in front and below and slightly oblique; interior polished, with the adductor scars impressed; the margin, except of the anterior and posterior areas, finely serrate. Lon. 24, alt. 26, diam. 14 mm.

All the species of *Lævicardium* are very similar shells, especially when they have lost color by fossilization, but this species is readily recognizable by the small size of the smooth areas and the peculiar pinching of the posterior area.

Cardium (Lævicardium) serratum Linné.

Cardium serratum L., Syst. Nat., ed. x., p. 680, 1758; ed. xii., p. 1123, 1767; Chemnitz, Conch. Cab., vi., p. 193, pl. 18, fig. 189, 1782.

Cardium lævigatum Lamarck, An. s. Vert., vi., part i., p. 11, 1819 (not of Born, Mus. Vind. Test., p. 47, 1780; nor of Linné, Syst. Nat., x., p. 680, 1758).

Cardium citrinum Woód, Gen. Conch., p. 223, pl. 54, fig. 3, 1815.

Liocardium pictum Ravenel, Proc. Acad. Nat. Sci. Phila. for 1861, p. 44, 1862 (*pullus*).

Cardium hiatus "Meuschen" *fide* Krebs, W. I. Cat. Sh., p. 115, 1864.

Cardium lineatum Krebs, *op. cit.*, not of Gmelin, 1792.

Cardium pristis Valenciennes, *fide* Krebs, *op. cit.*

Cardium oviputamen Reeve, Conch. Icon., *Cardium,* pl. vii., fig. 36, 1844.

Cardium venustum Gabb, Geol. St. Domingo, p. 251, 1873.

Cardium serratum Dall, Proc. U. S. Nat. Mus., xix., No. 1110, p. 327, 1896 (not *serratum* of Pennant, 1778).

Oligocene of Bowden, Jamaica; Miocene of Alum Bluff, Florida; Pliocene of the Caloosahatchie and Myakka Rivers, Florida, and Tilly's Lake in the Waccamaw District, South Carolina; Pleistocene of south Florida and the Antilles; recent from Cape Hatteras, South Carolina, to Bahia, Brazil, in water from a few feet to one hundred fathoms in depth.

After a good deal of study and thought upon the subject with a large series of specimens I have been led to the conclusion that the differences between the shells commonly known as *serratum, lævigatum,* and *oviputamen* are not of specific value. I am unable to specify any distinctive characters between the Bowden fossil and recent specimens of "*serratum*" of the same size. All the fossils observed are of the *serratum* type. I have seen none of the squarish form usually called *lævigatum* Lamarck, which is not the original *lævigatum* of Linné. Small specimens from Bowden, to which a correspondent attached a manuscript name, are apparently not to be distinguished in form from the deep-water variety named by me, in the Blake Report, *sybariticum*, and perhaps Ravenel's *pictum*.

Cardium (Lævicardium) sublineatum Conrad.

Cardium sublineatum Conrad, Trans. Am. Geol. and Nat., p. 110, pl. v., fig. 13, 1842; Am. Journ. Sci., xli., p. 347, pl. ii., fig. 13, 1842; Medial Tert., p. 66, pl. 37, fig. 4, 1845; Tuomey and Holmes, Pleioc. Fos. S. Car., p. 64, pl. 19, fig. 3, 1856.

Miocene of Wilmington, of the Natural Well and Magnolia, Duplin County, North Carolina; Pliocene of the Waccamaw beds, Tilly's Lake, and Darlington, South Carolina; Holmes and Burns.

This species is easily recognized by its heavy shell, often with a marked furrow, internally, from the centre of the umbonal cavity towards the base midway between the adductor scars. It is also more compressed than any of the other species.

Cardium (Lævicardium) Mortoni Conrad.

Cardium Mortoni Conrad, Journ. Acad. Nat. Sci. Phila., vi., p. 259, pl. 10, figs. 5, 6, 7, 1830; Gould, Inv. Mass., p. 91, 1841.

Liocardium Mortoni Stimpson, Checkl. E. Coast Shells, p. 2, 1860; Dall, Bull. 37, U. S. Nat. Mus., p. 54, pl. 58, fig. 8, 1889.

Lævicardium Mortoni Perkins, Proc. Bost. Soc. Nat. Hist., xiii., p. 150, 1869.

Miocene of Jones Wharf, Maryland; Pliocene of the Caloosahatchie and Shell Creek, Florida; Pleistocene of South Carolina, and of Osprey, Florida, at North Creek; recent from Nova Scotia south to Santa Marta, Brazil.

The material in hand considerably extends the range, both in time and space, of this well-known species.

Other fossil American species are *C.* (*L.*) *bulla* Gabb (described as a *Serripes*), 1873, from the Tertiary of Santo Domingo; *C.* (*L.*) *substriatum* Conrad, 1838, from the Pleistocene of San Pedro, California; the great *C.* (*L.*) *elatum* Sowerby, 1833, from the Pleistocene of San Diego, California; and *C.* (*L.*) *Milleri* Gabb, 1881, described from an internal cast of a Miocene fossil from Costa Rica which may prove to belong to the genus *Protocardia*.

Genus **SERRIPES** Beck.

Serripes grönlandicus Beck.

Venus islandica O. Fabricius, Fauna Grönl., p. 411, 1780; not of Linné.

Cardium grönlandicum Chemnitz, Conch. Cab., vi., pp. 146, 202, pl. xix., fig. 198, 1782;

Mohr, Isl. Naturh., p. 129, 1786; Gmelin, Syst. Nat., p. 3252, 1792; Spengler, Mag. Ges. Naturf. Freunde zu Berlin, ii., p. 126, 1808; Wood, Gen. Conch., p. 227, 1815; Dillwyn, Cat. Rec. Sh., i., p. 129, 1817; Lamarck, An. s. Vert., vi., i., p. 13, 1819; Gould, Inv. Mass., p. 92, 1841; Moller, Ind. Moll. Grönl., p. 20, 1842; Mörch, Fort. Grönl. Blöddyr, p. 20, 1857.

Mactra radiata Donovan, Brit. Sh., v., p. clxi., 1799; Turton, Conch. Dict., p. 80, 1819.

Cardium edentulum Montagu, Test. Brit. Suppl., p. 29, 1808; Sowerby, Genera Sh., pt. 34, fig. 2, 1831.

Cardium radiatum Gray, App. Parry's Voy., p. 244, 1824.

Aphrodite columba Lea, Trans. Am. Phil. Soc., N. S., v., p. 111, pl. xviii., fig. 54, 1834; Obs. Gen. Unio, i., p. 223, 1837.

Cardium boreale Reeve, Conch. Icon., ii., *Cardium*, pl. xxii., fig. 131, 1845; not of Broderip and Sowerby, 1829.

Cardium Fabricii Deshayes, P. Z. S., 1854, p. 333.

Cardium grönlandicum Middendorff, Mal. Ross., iv., p. 41, pl. 16, figs. 6, 7 (not figs. 8, 9), 1849.

Acardo edentulum Swainson, Malac., p. 374, 1840.

Serripes grönlandicus Beck, in Gould, Inv. Mass., p. 93; 1841; Mörch, Yoldi Cat., ii., p. 35, 1853; H. and A. Adams, Gen. Rec. Moll., ii., p. 456, 1857; Dawson, Notes on Post-Pl. of Canada, p. 77, 1872.

Pleistocene of Quebec and along the St. Lawrence River; Lawlor's Lake, New Brunswick; Labrador; Cape Elizabeth and Portland, Maine; the coast of Alaska and southward to the vicinity of Puget Sound; recent throughout the Arctic seas and south to Cape Cod on the Atlantic and to Puget Sound on the Pacific side.

This species occurs in a recent state in vast numbers on muddy bottom and is one of the species most consumed by the walrus in boreal seas. It varies considerably in relative length and height, and in the extension of the radial sulcations, which are almost always absent from the middle of the disk. The name *Fabricii* was given to a short, heavy mutation of the typical shell, while the more elongate variety was left nameless by Deshayes, who probably had the facts reversed in his mind by some accident. The elongate variety might be called var. *protractus*.

Serripes Laperousii Deshayes.

Cardium Laperousii Deshayes, Révue Zool. Soc. Cuv., p. 360, 1839; Mag. Zool., pl. 48, 1841; Carpenter, Rep. Brit. Assoc., 1856, pp. 203, 207; Suppl. Rep. Brit. Assoc., 1863, p. 528; Moll. West. N. Am., p. 14, 1872.

Cardium (?Serripes) Laperousii Dall, Am. Journ. Conch., vii., p. 148, 1871.

Pleistocene of the Aleutian Islands and bowlder clay of southeastern Alaska near Juneau; recent from the Kamchatkan coast at Avatcha Bay, eastward through the Aleutians, the southern part of Bering Sea, and southeastward to Sitka, Alaska.

This fine form is not to be confounded with *S. grönlandicus* var. *protractus*, which occurs wherever *S. grönlandicus* extends, though rare. The present shell far exceeds *S. grönlandicus* in size and is restricted to the range above mentioned.

I have already mentioned that *Serripes bulla* Gabb (Santo Domingo, 1873) should be referred to *Lævicardium;* and *Cardium centifilosum* Cpr., which has been referred to *Serripes* by some authors, is a *Protocardia.* In this group the teeth are often strongly developed in young specimens, but the cardinals, and much more rarely the laterals, become more or less obsolete in the adult or senile specimens.

Genus **PROTOCARDIA** Beyrich.

The Eocene species of *Protocardia* known in our Tertiary are as follows: *P. curta* Conrad (1870, not *Cardium curtum* Meek and Hayden, 1861), from the Eocene marls of New Jersey, a doubtful species founded on an internal cast which does not admit of an exact determination of the species; *P. lenis* Conrad (1855, unfigured, + *P. virginiana* Conrad, 1864; not *P. lenis* var. Harris, 1897), from the Eocene of Pamunkey River, Virginia; *P. Harrisi* Dall (1900, = *P. virginiana* Harris, Proc. Acad. Nat. Sci. Phila. for 1896, p. 475, pl. 20, figs. 7, 8), from the Chickasawan of Alabama; *P. Nicoleti* Conrad (1841, + *P. lima* Conrad, 1865, which is merely the shell retaining its posterior tubercles which are frequently lost), Jacksonian, and *P. virginiana* Conrad (1864, = *P. lenis* Conrad, 1855), from the Eocene of Virginia.

The young of *P. diversa* shows the interspaces of the ribs crossed by somewhat irregular elevated lamellæ (often worn away); the young of *P. Nicoleti* has, when perfect, strawberry-shaped pustules on top of the ribs, the channels smooth or nearly so; specimens of *P. Harrisi* Dall show minute tubercles on the anterior sides of the ribs in the channels, but the tops of the ribs are smooth; this species is more quadrate, with less produced terminal margins. It is a smaller shell and more glistening and with more conspicuous anterior sculpture than the others. Sundry large specimens in somewhat imperfect condition, from Naheola Bluff, are in the National Collection. They may be an undescribed species, or possibly the adults of *P. Harrisi.*

The Oligocene has the well-known *P. diversa* Conrad, 1848, for the more sinuous specimens of which Gregorio (Mon. Claib., 215, 1890) has proposed the varietal name of *mittens.* His magnified figure of the posterior sculpture is quite inadequate. *P. gambrina* Gabb, from the Texas Oligocene, is the young of *P. diversa,* as Gabb suspected. *P. Newberryana* Gabb, 1881, from the Oligocene sandstones of Gatun, on the Panama Canal, has the appearance of a cast of *P. diversa,* but is really unrecognizable.

There is a small species in the Bowden marl of Jamaica which much resembles the recent *P. peramabilis* Dall, but on the Pacific coast the Tertiary has not yet furnished any species, though there is a recent species, *Cardium centifilosum* Cpr., 1863 (+ *C. Richardsoni* Whiteaves, 1878), as well as the lovely *P.* (*Lophocardium*) *Annettæ* Dall, 1889, and *P.* (*L.*) *Cumingi* Sowerby, 1833.

Protocardia jamaicensis n. sp.

PLATE 48, FIGURE 3.

Oligocene of the Bowden marl, Jamaica; Henderson and Simpson.

Shell small, plump, subquadrate, with rather high subcentral umbones; anterior end evenly rounded, posterior very slightly rounded truncate; surface with very numerous radiating threads crossed by concentric lines evenly disposed, which at the intersections reveal themselves by rendering the radii beaded; this sculpture covers a little less than the anterior half of the disk, behind which the radials are narrower and not beaded, separated by still narrower channels; in the channel separating the anterior from the posterior type of sculpture rises a low crest like a string of small beads, behind which in each second or third channel rises a row of small, stout, very caducous spines, those on the posterior area smaller and shorter than those on the disk; internally the margin is minutely serrate; the hinge is normal. Lon. 6.2, alt. 6.0, diam. 4.5 mm.

This species is nearest *Protocardia peramabilis* Dall, a recent deep-water species of the Antilles, but differs by its smaller size, more delicate sculpture, and less numerous rows of spines. It is also differentiated from the other living Antillean species, *P. tincta* Dall, by its sculpture and much smaller size.

Superfamily LEPTONACEA.

The *Leptonacea* form a very interesting and puzzling group. Their characters combine features characteristic in other Teleodonts of immaturity, with such as are more probably due to environmental modifications. Without being in themselves prototypes, they exhibit features which we may readily suppose might have been characteristic of prototypic Teleodonts. Groups which are really starting-points for numerous subsequently developed genera are usually notable for their tendency to vary and interchange characters. In the present case perhaps the very general habit of commensalism, or parasitism, has produced degeneration or afforded an excessive protection, inducing or accompanied by a revival of atavistic primary characters. The fact that authors, struck by similarity of dental features to those of immature specimens of genera of widely different origin, have too hastily referred species of *Leptonacea* to such families as the *Mactridæ* or *Cyrenidæ* is significant in this connection.

It must be confessed at the outset that our knowledge of the anatomy of recent *Leptonacea* is lamentably deficient. We have to assume (which is never safe) that forms with similar shell characters are generally similar in other points of structure, except where we know to the contrary. We find, moreover, that the dentition is frequently indistinctly developed or somewhat amorphous, rendering it difficult to make out the homologies of the different parts of the hinge. It is certainly unsafe to assume, as Bernard has sometimes done, that the position of a dental lamina is sufficient to settle its homology. The dynamic reactions of teeth upon each other are, I am confident, of the utmost importance in the development of the hinge. As in the vertebrate skeleton, pressure and friction in localized areas will produce directly a response in facets and buttresses. In fact, to the eye trained to take such matters into account, every hinge shows more or less evidence of the mutability of hinge-structure and its responses to stress, as well as inherited tendencies of form. In no group are these more obvious than in the *Leptonacea.*

The prototypic hinge of the group,—or that which with slight modifications will exhibit any of the various types of hinge-structure found in the group,—is very simple and has been figured by Bernard in his illustrations of a minute form which he has named *Pachykellya.* His invaluable researches upon the early features of the hinge have shown that among the *Teleodesmacea* the so-called laterals and cardinals are dissevered parts of an originally single lamina sharply bent at its proximal, or umbonal, end and having somewhat the form of a figure seven (7). In *Pachykellia* the hinge is composed of an internal resilium not obviously separated from the ligament and inclined obliquely backward, as in many nepionic Teleodonts. On each side of this in each valve is a pair of the ⌐ -shaped lamellæ, of which most have developed more or less distinctly the proximal or cardinal "hook." The lower ones are less engaged in the various stresses to which the laminæ are subjected in use, and hence, as might be expected, the hook is less evident or even undeveloped.

From this type of hinge all the others can be developed by trifling modifications. The laminæ may be long or short; when the outer limb is short we have a Λ-shaped tooth; if the angle proceeds to that stage of development when its continuity is lost, we may have a hinge like that of *Cyamiomactra;* the severed hook may be modified by pressure to a petaloid shape, which again by degeneration may be reduced to two obscure minute conical projections, as in some species of *Galeomma.* Any part or the whole of the hinge may become obsolete; the resilium and ligament may separate or continue in connection; the latter frequently becomes external and often obsolete, though traces of it almost always exist.

The arrangement of the groups must, in our present state of knowledge, be provisional. No linear arrangement will show the exact inter-relations of the different genera, and yet we are confined to a linear arrangement. The present tentative scheme is based on our present insufficient information, and, where only shell characters are known, chiefly on those of the hinge. It is difficult at present to say what should be done with *Montacuta.* According to the literature, it has Lucinoid gills and Thyasiroid hepatic digitations, while the shell is obviously Leptonoid. The anatomical combinations that the other groups would exhibit are at present unknown in many cases. It may be for the present most convenient to place the Montacutas and Aligenas at the end of the list with an unassigned value, as they certainly seem to lead up to the *Thyasiridæ,* in spite of the differences of the gills.

It does not seem practicable to associate *Sportella, Anisodonta,* and other genera in which the soft parts are permanently retained within the shell, with forms like *Galeomma,* in which they are exserted, covering a large part of the valves. The only data we have on *Anisodonta* (*quadrata*) would indicate that the mantle edges are largely united, the gills as in *Thyasira* (*Cryptodon*), but united behind the foot, and, contrary to the rule in the *Leptonacea,* the incurrent orifice, though not developed into a siphon, is complete and posterior. Yet the shell characters merge so gradually into those of typical *Anisodonta,* and these into those of *Sportella,* that one feels that without more definite information they can hardly be separated. The interchanges of characters, and the multiplicity of forms separated by apparently trifling details of structure, make this group one of the most perplexing I have ever tried to review.

It should not be forgotten that in certain groups, such as *Galeomma* and *Lasæa,* individual variation among the teeth is very prevalent within the species. Features which in some other genera might be important are here often of no systematic importance whatever, and are liable to lead the "closet naturalist" into serious error.

In connection with these studies I have repeatedly met with the difficulty so commonly encountered when one begins to take up a group which has obscure characters and inconspicuous minute shells. The descriptions and figures of authors, whose attention has not been especially directed to these troublesome little species, are frequently inaccurate and misleading to a degree which can hardly be realized until one comes to deal with them. I have, therefore, discarded literature whenever it was possible to obtain a specimen of the shell in question or a magnified drawing of an author's type by a trusty hand. My descriptions, identifications, and consolidations are based on specimens in nearly every case; I have not worried myself about the conflicting statements of authors; and this has been, as far as possible, my method of procedure throughout this work. I need hardly say I have depended freely upon the excellent figures of Bernard and Verrill, and am under great obligations to the unfailing courtesy of Mr. E. A. Smith, of the British Museum.

The following scheme is provisionally adopted. The name of the typical species follows the date of the genus. The series commences with the most specialized forms:

Family CHLAMYDOCONCHIDÆ.

Chlamydoconcha Dall, 1884. *C. Orcutti* Dall.

Family GALEOMMATIDÆ.

Ephippodonta Tate, 1889. *E. Macdougalli* Tate.
Galeomma Turton, 1825. *G. Turtoni* Broderip and Sowerby.
Sections: *Amphilepida* Dall, 1899. *G. polita* Deshayes.
Paralepida Dall, 1899. *G. formosa* Deshayes.
Libratula Pease, 1865. *L. plana* Pease.
Salecordia Conrad, 1849. *S. eburnea* Conrad.
Subgenera: *Scintilla* Deshayes, 1855. *S. philippinensis* Deshayes.
Spaniorinus Dall, 1899. *S. Cossmanni* Dall.
Scintillorbis Dall, 1899. *S. crispata* Fischer.
Vasconiella Dall, 1899. *Vasconia Jeffreysiana* Fischer.

Family SPORTELLIDÆ.

Sportella Deshayes, 1858. *Psammobia dubia* Deshayes.
Section? *Fabella* Conrad, 1863. *F. constricta* Conrad.
Anisodonta Deshayes, 1858. *A. complanata* Deshayes.

Sections: *Fulcrella* Cossmann, 1886. *Poromya paradoxa* Deshayes.
? *Basterotia* Mayer, 1870. *Corbula quadrata* Hinds.
?*Hindsiella* Stoliczka, 1871. *Modiola arcuata* Defrance.

Family LEPTONIDÆ.

Entovalva Voeltzkow, 1890. *E. mirabilis* Voeltzkow.
Lepton Turton, 1822. *Solen squamosa* Montagu.
Subgenera: *Neolepton* Monterosato, 1875. *L. sulcatulum* Jeffreys.
Lutetina Velain, 1876. *L. antarctica* Velain.
Epilepton Dall, 1899. *Lepton Clarkiæ* Clark.
Planikellia Cossmann, 1887. *Erycina radiolata* Lamarck.
Erycina (Lamarck, 1806) Récluz, 1844. *Erycina pellucida* Lamarck.
Subgenera: *Scacchia* Philippi, 1844. *Tellina elliptica* Scacchi.
Anomalokellia Cossmann, 1887. *A. catalaunensis* Cossm.
Pseudopythina Fischer, 1884. *P. macandrewi* Fischer.
Bornia Philippi, 1836. *Erycina corbuloides* Bivona.
Section: *Ceratobornia* Dall, 1899. *Lepton longipes* Stimpson.
Subgenus: *Pythina* Hinds, 1844. *P. Deshayesiana* Hinds.
Kellia Turton, 1822. *Mya suborbicularis* Montagu.
Sections: *Mancikellia* Dall, 1899. *Zoë pumila* Monterosato.
Kelliola Dall, 1899. *Kellia symmetros* Jeffreys.
Divarikellia Cossmann, 1887. *K. nitida* Caillat.
Thecodonta A. Adams, 1864. *T. Sieboldii* Adams.
?Subgenera: *Serridens* Dall, 1899. *Pristiphora oblonga,* Cpr.
Dicranodesma Dall, 1899. *Mysella calvertensis* Glenn.
Rochefortia Vélain, 1876. *R. australis* Vélain.
Subgenera: *Pythinella* Dall, 1899. *Montacuta cuneata* Verrill.
? *Sphenalia* S. Wood, 1874. *Montacuta donacina* S. Wood.
Pachykellya Bernard, 1897. *P. Edwardsi* Bernard.

* * *

Kasæa Leach, 1827. *Cardium rubrum* Montagu.
Myllita Orbigny, 1850. *M. Deshayesii* Récluz.
Perrierina Bernard, 1897. *P. taxodonta* Bernard.

Family KELLIELLIDÆ.

Kelliella Sars, 1870. *K. abyssicola* Sars.
Lutetia Deshayes, 1860. *L. parisiensis* Deshayes.
Alveinus Conrad, 1865. *A. parvus* Conrad.

Pauliella Munier Chalmas, 1895. *P. Bernardi* M. C.
Cyamiomactra Bernard, 1897. *C. problematica* Bernard.
?*Turtonia* Alder, 1848. *Venus minuta* Fabricius.

INCERTÆ SEDIS.

Cyamium Philippi, 1845. *C. antarcticum* Philippi.
Scioberetia Bernard, 1896. *S. australis* Bernard.
Montacuta Turton, 1822. *Ligula substriata* Montagu.
Sections: *Decipula* Jeffreys, 1875. *D. ovata* Jeffreys.
Orobitella Dall, 1900. *Montacuta floridana* Dall.
Aligena H. C. Lea, 1845. *Abra æquata* Conrad.
?Section: *Spaniodon* Reuss, 1867. *S. nitidus* Reuss.
Cycladella Carpenter, 1865. *C. papyracea* Carpenter.
Asbiornsenia Friele, 1886. *A. striata* Friele.*

FAMILY GALEOMMATIDÆ.

Genus GALEOMMA Turton.

Galeomma Turton, Zool. Journ., ii., p. 361, 1825. Type *G. Turtoni* Brod. and Sby., *loc. cit.*, p. 362, pl. 13, fig. 1.

Parthenope Scacchi, Oss. Zool., pp. 8, 19, 1833. Type *P. formosa* Scacchi (= *G. Turtoni* Brod.); not *Parthenope* Fabr., 1798.

Galeomna Hanley, Ill. Cat. Rec. Sh., p. 59, 1844 (err. typ.).

Thyreopsis H. Adams, P. Z. S., 1868, p. 14. Type *G. coralliophila* H. Adams, *loc. cit.*

Lepirodes Fischer, Man. de Conchyl., p. 1031, 1887. Type *G. formosum* Desh. (not *Lepyrodes* Guen., 1854; Lepid.).

Libratula Pease, P. Z. S., 1865, p. 512, sole ex. *L. plana* Pse., *loc. cit.*

Psammobia (sp.) Lamarck; Quoy and Gaimard.

Hiatella (sp.) Costa, Ann. Sci. Nat., viii., p. 169.

Galeomma Deshayes, Expl. Algérie, Moll., i., Atlas, pl. 81-82; Mittré, Ann. Sci. Nat., 3d Ser., vii., p. 169, pl. 5, figs. 1-8.

This remarkable genus is represented by a type which has the mantle covering a large part of the valves, a thin amphidetic ligament, and a short, stout resilium with the hinge-margin smooth or retaining traces of the provinculum. The resilium is seated in a small chondrophoric pit, shallow or having its anterior and posterior margins somewhat projecting. In typical *Galeomma* the shell has sharp radial sculpture; in *Libratula* it is smooth and the valves are

* Referred by Friele to *Tellinidæ* following Jeffreys's advice, but possibly related to *Montacuta*.

held nearly in the same horizontal plane, being very flat. *Ephippodonta* Tate (Trans. Roy. Soc. S. Austr., xi., p. 63, 1889, and xiv., p. 267, type *E. Macdonaldi* Tate, *loc. cit.*) is closely related to *Galeomma* and *Libratula.*

In the absence of anatomical details *Galeomma* may be divided as follows:

Section *Galeomma* s. s. (Type *G. Turtoni* Brod.)

Valves radially ribbed, hinge edentulous. Gape moderate.

Section *Amphilepida* Dall. (Type *G. polita* Desh.)

Valves smooth or concentrically faintly striated, hinge with a small dentiform process on each side of the resiliary pit; gape moderate.

Section *Paralepida* Dall. (Type *G. formosa* Desh.)

Valves radially sculptured, hinge with a dentiform process on each side of the pit; widely gaping.

Subgenus *Libratula* Pease. (Type *L. plana* Pse.)

Valves flat and smooth, carried horizontally both in the same plane, hinge as in *Galeomma.*

The summary of this group is added for completeness. No species are known from the American Tertiary or recent fauna.

Genus **SOLECARDIA** Conrad.

Solecardia Conrad, Proc. Acad. Nat. Sci. Phila., iv., p. 155, 1849; Journ., 2d Ser., i., p. 278, pl. 39, fig. 1, 1850. Type *S. eburnea* Conr., *loc. cit.,* Lower California.

> *Scintilla* Deshayes, P. Z. S., 1855, p. 171; 1st sp. *S. Cumingi* Desh., *loc. cit.,* p. 173 (Panama), which is selected as type by Woodward, Man. Rec. and Fos. Shells, Suppl., p. 470, 1856; H. and A. Adams, Gen. Rec. Moll., ii., p. 480, 1857; Desh., An. s. Vert. bas Paris, i., p. 697, 1858; Fischer, Man. Conchyl., p. 1031 (fig. 775 exclus.), 1887; Cossmann, Cat. Ill. Fos. Paris., ii., p. 50, 1887.

Barclayia H. Adams, P. Z. S., 1874, p. 585; sole ex. *Scintilla incerta* Desh., Moll. Reunion, p. 18, pl. 2, figs. 16-18, 1863.

Barclaya, Zool. Record for 1874, p. 184; Fischer, Man. de Conchyl., p. 1032, 1887.

Lionelita Jousseaume, Mém. Soc. Zool. de France, i., p. 204, 1888.

Sportella sp., Deshayes; *Psammobia* sp., Quoy, etc.

The genus *Solecardia* Conrad was well defined and based upon a single species, which, six years later, was redescribed by Deshayes under the name of *Scintilla Cumingi.* In his account of the genus *Scintilla* Deshayes mentioned no type, but his first species was *S. Cumingi,* which was named as type by Woodward in the Supplement to his Manual published in the following year. There is no doubt, as suggested by Fischer (Man., p. 1032), that the original list of *Scintilla* contained a partly heterogeneous assembly, but, until something is known of the anatomy it will be difficult to divide them accurately. To determine which portion of the group shall retain the name *Scintilla* it is necessary to proceed by the method of elimination. *S. Cumingi* (= *S. eburnea* Conrad non Mörch) cannot be selected as the type because it was already the type of *Solecardia*.

The next work treating of *Scintilla* is H. and A. Adams's "Genera of Recent Mollusca," in which *S. philippinensis* Desh. is named and figured as an example in 1857, a course followed by Chènu (ii., p. 128) in 1862. This is one of the rather short species, but its hinge agrees with the original diagnosis, though the exterior seems devoid of punctations. It is probable that it will be best to adopt this species as the type.

In his Manual Fischer figures (after Mœbius) *Scintilla aurantia* (Lamarck as *Psammobia*, = *S. mauritiana* Sby., not *S. aurantiaca* Desh.) and gives as an example of the genus *S. vitrea* Quoy and Gaimard (as *Psammobia*, = *S. aurantiaca* Desh. but not *S. vitrea* Desh.), but as far as the shells go, the latter of these agrees with *S. philippinensis* and therefore presents no advantages as type over that species.

Henry Adams has proposed a genus *Barclayia* for a species of *Scintilla* with faintly reticulate surface sculpture, or, rather, a granular surface resulting from the intersection of radial and incremental lines, but, as this feature is suggested by the surface of *S. Cumingi* (= *eburnea*) when unworn, it is probable that the differential value of this character is not very great.

The surface of *S. eburnea* (Conrad non Mörch) when worn is polished, with minute punctate and divaricate sculpture, but when fresh a large part of the surface is covered with a finely granular calcareous layer which is raised into elevated concentric lines along the incremental sculpture. From this it seems probable that the reflection of the border of the mantle over the valve does not extend so far towards the umbones as in *Galeomma*. There are also radial impressed lines, especially towards the posterior end, which result in faint serrations of the basal margins of the valves and probably correspond to appendages of the mantle. The cardinal teeth are small and rather variable in form, the ligament elongate and obsolete, the resilium wholly internal, and the hinge-plate deeply excavated. A marked peculiarity is the situation of the subcircular adductor scars entirely within the pallial line, a situation which is probably correlated with the extension of the mantle edge externally. As far as can be judged from separated valves, the ventral gape, when the valves are closed, must be very narrow and mostly posterior.

In typical *Solecardia* there is a narrow, external ligament, which leaves very little trace of its insertion on the shell, and a strong internal resilium with a good deal of calcareous matter ventrally distributed in its substance but not consolidated into an ossiculum. The external ligament is usually ignored in descriptions of *Scintilla,* but it exists more or less developed in all the fresh specimens of this genus which I have been able to examine. It is stronger in the type mentioned than in some of the others, but in all there seem to be some traces of it.

It does not seem advisable, in the absence of anatomical data and authoritative material, to attempt at present any subdivision of the recent Scintillas, although it is quite possible that the group as it remains is not thoroughly homogeneous. The fossil forms of the Paris basin, however, do not seem to agree in character with the typical *Scintilla* and, with a number of American Tertiary species, require to be eliminated from the subgenus.

The essential characters of the several groups are as follows:

Genus *Solecardia* Conrad.

Shell partially covered by the mantle with an amphidetic obsolete external ligament and an oblique internal resilium, without a lithodesma; right valve with two divaricating, well-defined lamellæ on each side of the resilium; left valve with a single lamella on each side fitting between those of the opposite valve; hinge-plate excavated; adductor scars rounded, small, situated within and distinct from the pallial line; valves subequilateral, with low beaks, the surface more or less punctate. Type *S. eburnea* Conrad, 1849.

?Subgenus *Scintilla* Deshayes (em.).

Shell almost wholly covered by the mantle, with an amphidetic obsolete external ligament and an oblique internal resilium, without a lithodesma; right valve with one or two short anterior and one or rarely two feeble posterior lamellæ on the hinge-plate; left valve with two (rarely one) anterior lamellæ and one, or rarely two, behind the resilium; hinge-plate flat or excavated; adductor scars ovate, continuous with the pallial line; valves subequilateral with low beaks, the surface polished, smooth, radiately striate, or punctate. Type *S. philippinensis* Deshayes, 1855. *Scintillula* Jousseaume, 1888, belongs hereabouts. The teeth in *Solecardia* are clean cut and strong; in *Scintilla,* being practically functionless, they appear obsolete and rather shapeless; as a rule, only one is at all distinct. In *Solecardia* the valves appear to close all round, in *Scintilla* there is more or less of a gap between them, sometimes even dorsally. Arranged according to their dental formulæ * some of the species of *Scintilla* fall into the following groups, but so amorphous are the feebly developed teeth that I feel some suspicion that these differences may prove somewhat inconstant even within the species.

$\frac{\text{L. 1 r 2}}{\text{R. 1 r 1}}$. *S. philippinensis* Desh., *S. ambigua* Desh., *S. Forbesii* Desh., *S. timorensis* Desh., *S. semiclausa* Sby., *S. Hanleyi* Desh., *S. Deshayesii* Sby., *?S. crenulata* Cpr.; $\frac{\text{L. 1 r 2}}{\text{R. 2 r 1}}$ *S. faba* Desh.; $\frac{\text{L. 1 r 1}}{\text{R. 2 r 1}}$ *S. Strangei* Desh.; $\frac{\text{L. 1 r 2}}{\text{R. 1 r 2}}$ *S. vitrea* Quoy and Gaimard, *S. aurantiaca* Desh., *S. candida* Desh., and *S. pellucida* Desh.; $\frac{\text{L. r 1 r}}{\text{R. 1 1 1}}$ *S. rosea* Desh.; $\frac{\text{L. 0 r 2}}{\text{R. 0 r 1}}$ *S. crispata* Jeffreys; $\frac{\text{L. 2 r 2}}{\text{R. 2 r 2}}$ *S. aurantia* Lam., *S. mauritiana* Sby.; $\frac{\text{L. 1 r 1}}{\text{R. 2 r 2}}$ *S. angusta* Desh.,† *S. Cumingi* Desh. (=*Solecardia*).

Subgenus *Spaniorinus* Dall.

Shell with an oblique internal resilium in front of which, in each valve, is a prominent tooth, that in the right valve stronger, conical, and sometimes with traces of a minute obsolete lamella behind it, while in front and above the dorsal margin of the valve is produced laterally, forming a small rounded projection which fits under the dorsal margin of the opposite valve; left valve with the tooth horizontally flattened and triangular; the hinge-plate is flattened, rounded, or slightly excavated, but behind the resilium carries no distinct

* In the formula L stands for left and R for right valve, 1 or 2 for lamellæ, and r for resilium. The formula reads from behind forward.

† As *Galeomma*, 1855. In this connection some confusion of names may be referred to. The names *ambigua, anomala,* and *angusta* have been used by Deshayes more than once for species of *Scintilla.* In 1855 (P. Z. S., p. 170) he described a *Galeomma angusta* which has since been referred to *Scintilla.* In 1858 he described a *Sportella angusta* (Bas. Paris, p. 598) which is now referred by M. Cossmann to *Scintilla.* In 1855 Deshayes described as *Galeomma ambigua* another species of *Scintilla,* and also a *Scintilla anomala.* In 1858 he used the name *ambigua* for a Parisian fossil, which in the explanation of the plates in the Atlas is called *S. anomala.* Reeve's *Scintilla ambigua* is intended for Deshayes's *Galeomma ambigua* and, as this antedates the Parisian fossil, it is the latter which should have a new name. M. Cossmann has proposed for the former the name of *S. Reevei,* which, unfortunately, cannot stand for the above reasons. The name *anomala,* being earlier in use, is unavailable, but I prefer to leave it to the French naturalists to rename their fossil. S. V. Wood in the Crag Moll. (ii., p. 120) identified with *Erycina ambigua* Nyst a Crag shell which turns out to be a *Scintilla* according to M. Cossmann, who has named it *Scintilla Woodi* (Cat. Illustr., App., ii., p. 9, 1896). It has the hinge of *Spaniorinus. S. eburnea* Mörch, 1874, not Conrad, 1849, from the Antilles, has been named *S. Mörchii* in my recent synopsis.

posterior lamella in either valve; adductor scars as in *Solecardia;* exterior concentrically or radially striate; form variable but resembling *Scintilla* and approaching *Fulcrella.* Type *Scintilla Cossmanni* Dall, Miocene of Virginia.

This group is intermediate between *Fulcrella, Sportella,* and *Scintilla,* but most nearly related to the latter. It is often difficult to say whether one of the smaller more inequilateral forms is a *Montacuta* or should be placed here. Nearly all the species I have been able to examine have a single tooth in each valve and no trace of a posterior lamella. The difference in form between the right and the left tooth is very marked. As far as I can judge from figures all the species from the Parisian Eocene referred by M. Cossmann to *Scintilla* will find a place in this group, together with all the American Tertiary forms. The obsolete amphidetic external ligament of the recent Scintillas leaves little or no trace of its existence on the shell; I believe it likely that *Spaniorinus* had a similar ligament, but this must remain in doubt for most of the species. In allotting the species of these puzzling shells to a genus I have placed those with a coarse hinge, double anterior cardinals, and which show a distinct scar of the external ligament in *Sportella;* those very inequilateral, with delicate hinge and no external ligament, in *Montacuta,** and, in *Scintilla,* those with the hinge above described, with nearly equilateral shells, no external ligament scar, and frequently with radial sculpture of fine, sharp striæ.

Scintilla recondita Fischer would probably belong in *Spaniorinus.* In spite of Jeffreys's opinion, I do not think it identical with the Eocene *S. Caillati* Desh. But specimens from Monte Mario, distributed under Deshayes's name by Rigacci, belong to Fischer's species.

Subgenus *Scintillorbis* Dall.

Shell compressed, orbicular, extremely thin, with radial and concentric sculpture, an obsolete external ligament, a stronger internal resilium; dental formula $\frac{\text{L. r 2}}{\text{R. r 1}}$. Type *S. crispata* Fischer, 1872.

This is entirely unlike the typical *Scintilla,* and, except for the hinge, resembles an orbicular *Lepton.* It does not appear that any of the so-called *Scintillas* of Europe or America, recent or fossil, closely resemble the tropical and chiefly Oriental typical forms.

* *Sportella corbulina* Deshayes, from his figure, would be placed in this paper under *Montacuta.*

Solecardia (Spaniorinus) Cossmanni n. sp.

Plate 45, Figures 27, 27*a*.

Miocene of Petersburg, Virginia; Burns.

Shell thin, nearly equilateral, rounded at both ends, the posterior end blunter, shorter, and higher than the anterior; surface with rather irregular obvious incremental lines, smoother near the beaks; base nearly straight, posterior dorsal slope arcuate, descending; anterior arcuate, beaks low, inconspicuous; right valve with the tooth narrow, slender, in a transverse vertical plane, the anterior dorsal margin expanded slightly just in front of it, the scar of the resilium strong, narrow, oblique; left valve with the tooth flattened in a horizontal plane, the anterior part longer; interior with faint, obsolete radiations; adductor scars rather large, ovate; margins entire. Lon. 8, alt. 5.2, diam. 3.5 mm.

This species has also been found in the Miocene of Maryland at various points by the State Geological Survey, and some of their specimens exceed ten millimetres in length. A single valve was also found at Petersburg which differs from *S. Cossmanni* by having a somewhat proportionately longer shell, the two ends being practically equal in height and rotundity, while the interior shows distinct radiations. This may be a variety of *S. Cossmanni*, of which more material is required to decide the range of variation.

A *Scintilla alabamiensis* has been described by Cossmann from Claiborne. The Chickasawan supplies a species which has been named by Aldrich *Scintilla Clarkeana*. In the Vicksburgian Conrad has named a *Scintilla oblonga* which belongs in the group I have called *Spaniorinus*. Only one left valve is known. A fragment of a species, different from any of the above, but too imperfect to name, was collected by Burns from the Chipola marl.

Family SPORTELLIDÆ Dall.

Genus **SPORTELLA** Deshayes.

Sportella Deshayes, An. s. Vert. bas. Paris, i., p. 593, 1858. Type *Psammotea dubia* Desh., Coq. Fos. bas. Paris, i., p. 76, pl. 10, figs. 13-14, 1824.

Fabella Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, pp. 574, 586, 1863. Type *Amphidesma constricta* Conr., Med. Tert., p. 76, pl. 43, fig. 10, 1845.

Angusticardo Cossmann, Cat. Illustr., ii., p. 17, 1887; section of *Sportella*. Type *Poromya rotundata* Desh., Cossmann, *op. cit.*, pl. 1, fig. 9.

This genus, though sometimes cited as of 1852, was proposed by Deshayes in 1858. Both Deshayes and Conrad seem to have recognized its characters only in part. Deshayes describes the ligament as external, seated on a nymph, but says nothing of the resilium; Conrad mentions the cartilage pit, but mistakes the nymphæ for lateral teeth and says nothing of an external ligament. The type of *Fabella* undoubtedly possessed both, somewhat more strongly developed than in the French fossil. The dentition of the two is identical, and after a careful study of several species of *Sportella,* including the typical species, for which I am indebted to the courtesy of M. Cossmann, I am of the opinion that *Sportella* also possessed an internal resilium. The scar is faint and if at all worn not visible in *S. dubia,* but in *S. gibbosula* Deshayes I find it well defined, though in any case less impressed than in the American species. The surface of *S. dubia* is sculptured with faint, almost microscopic radial scratches, traces of which may be found in most of the species, though obsolete in some of them. The pallial area of the inner surface of the shell is sometimes punctate. All these features tend to unite it with the other Leptonacea. *Myllita* has a similar duplex ligament; some of the Kellias and *Cyamium* have both separately developed. The differences between the American *Fabella* and the European *Sportella* are trifling and only of degree, but for those who prefer very minute subdivision in such groups I suppose the name *Fabella* might be kept in a sectional sense for the American species.

The earliest *Sportella* recorded in our Tertiary is the *Fabella oblonga* Aldrich (Bull. Am. Pal., ii., No. 8, p. 182, pl. 5, fig. 2*a*, 1897; Harris, Bull. Am. Pal., ii., No. 9, p. 250, pl. 2, figs. 7-8, 1897) from the Lignitic or Chickasawan at Wood's Bluff, Alabama. The Claibornian offers *S. Gregorioi* Cossmann (Notes Compl., p. 11, pl. 1, figs. 11-12, 1894, Ald. Bull. Am. Pal., No. 8, p. 173, pl. 5, fig. 4, 1897) and Aldrich's *Lepton? alabamense* (*op. cit.,* p. 182, pl. 5, fig. 9) has, though obscure, the aspect of *Sportella.* The hinge is certainly not that of *Lepton.* I have examined the type specimen. It is Claibornian.

Curiously enough the Upper Eocene and the Oligocene up to the Oak Grove sands have not afforded any species of *Sportella* so far, unless some of the species we have included under *Montacuta* would more properly find a place here. In the sands, however, the genus seems to reappear as follows:

Sportella obolus n. sp.

Plate 44, Figure 18.

Oak Grove sands, Santa Rosa County, Florida; Burns.

Shell small, solid, subcircular and flattish; interior polished, the cicatrices feeble; exterior smooth or faintly marked with incremental lines, and, in very perfect specimens, microscopic radiating striæ; umbones small, polished, conspicuous; dorsal margins of the hinge-plate inflected in the right valve; hinge-plate strong; right cardinal stout; prominent; left valve with the dorsal margins of the hinge-plate slightly bevelled, cardinal teeth subequal, small. Alt. 4, lon. 4.5, diam. 1.0 mm.

This is a peculiar little shell whose rounded form does not suggest the genus, but it has the typical hinge. The radial striæ are extremely fine and visible only under magnification in perfect specimens.

Sportella unicarinata n. sp.

Plate 44, Figure 13.

Oak Grove sands, Santa Rosa County, Florida; Burns.

Shell small, solid, compressed, ovate, with the anterior part somewhat more produced and attenuated, interior polished, scars distinct; exterior divided into two areas by a single sharply defined small thread extending obliquely from the beak to the posterior part of the base, the area behind the thread depressed, surface smooth or faintly microscopically radially striate, with faint irregularly distributed incremental lines; nepionic shell smooth, conspicuous; hinge normal, the hinge-plate thickened in front of the conspicuous right cardinal tooth; left cardinals unequal, the anterior most elevated, the left hinge-plate with the posterior dorsal margin slightly inflected. Alt. 4, lon. 5.5, diam. 1.5 mm.

This species is notable for its depressed posterior areas, which distinguish it from any of our other species. It and the following were found with *S. obolus*.

? **Sportella lubrica** n. sp.

Plate 44, Figure 9.

Oak Grove sands, Santa Rosa County, Florida; Burns.

Shell small, thin, polished, ovate-trigonal, sculptured only by incremental lines, which are feeble generally but at intervals strong; beak low, decurved; hinge-plate narrow, right cardinal slender, prominent, with a small prominent callus in front of it on the dorsal margin; shell moderately convex. Alt. 4, lon. 5, diam. 2 mm.

A single right valve, somewhat broken, is all that is known of this species. It has not exactly the aspect of *Sportella,* though nearest to that genus, to which until more material is received it is provisionally referred.

Sportella lioconcha n. sp.

PLATE 44, FIGURE 24.

Oligocene sands of Oak Grove, Santa Rosa County, Florida; Burns.

Shell oblong, moderately inflated, evenly rounded, the ends subequal in outline; surface smooth or with some incremental irregularities, sculptured with very fine concentric and obsolete, microscopic, radial striæ; interior polished, with faint radial striations; beaks low, inconspicuous, with a minute, brilliantly polished prodissoconch; hinge narrow, cardinals more or less duplex in the young, single, straight and prominent in the adult; pit for the resilium distinct, triangular, short; ridge for the ligament small, short but obvious. Lon. 14, alt. 9.5, diam. 6 mm.

This is a very elegant species with somewhat the aspect of a *Scintilla* but the typical hinge of *Sportella.*

Sportella Whitfieldi Dall.

Abra nuculoides Whitfield, Mio. Moll. N. J., p. 81, pl. 15, figs. 7-9, 1894; not of Conrad.

Lowermost Miocene marl at Jericho, Cumberland County, New Jersey, and uppermost Oligocene of the Oak Grove sands, Santa Rosa County, Florida; Burns, Miocene of Maryland, State Geological Survey.

Professor Whitfield's type is in the National Collection, together with a fragment, apparently of the same species, from the Oak Grove sands. This species resembles some of the species we have referred to *Montacuta,* but has a coarser and heavier hinge. It recalls *S. corbulina* Desh. In some respects it foreshadows the *S. constricta,* but is more inflated and much more inequilateral, the anterior side produced, the posterior very short, blunt, and almost truncate.

Sportella constricta Conrad.

PLATE 25, FIGURE 4, 4*a*.

Amphidesma constricta Conrad, Am. Journ. Sci., xli., p. 347, pl. 2, fig. 15, 1841; Trans. Am. Assoc. Nat. and Geol., i., p. 110, pl. 5, fig. 15, 1842; Fos. Med. Tert., p. 76, pl. 43, fig. 10, 1845.

Syndosmya constricta Conrad, Proc. Acad. Nat. Sci. Phila., vii., p. 29, 1854.

Fabella constricta Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, pp. 574, 586, 1863; Meek. S. I. Checkl. Mio. Fos. N. Am., p. 11, 1864; Dall, Bull. 37, U. S. Nat. Mus., p. 48, 1889.

Sportella constricta Dall, Trans. Wagner Inst. Sci., p. 920, pl. 25, figs. 4, 4*a*, 1898.

Miocene of Petersburg, Virginia, of North Carolina at Magnolia and the

Natural Well, Duplin County, and on the Cape Fear River; Pliocene of the Waccamaw beds, South Carolina, and of the Caloosahatchie and Shell Creek, Florida.

This very characteristic little shell has the hinge more robustly developed than in most of the species, though its teeth, etc., are otherwise precisely similar. This may account for the fact that Conrad referred two of the closely allied species to *Abra* while erecting a genus for this one. The outer surface is sculptured mainly by rather prominent incremental lines, but occasionally shows a fine shagreening or minutely pustular sculpture. This character is not constant in most but is occasional or habitual in nearly all the American species as well as some European ones. The living shell, which in my "Mollusks of the Southeastern Coast of the United States" I too hastily referred to this species, has with further study proved to be the *Eucharis* (=*Anisodonta*) *elliptica* of Récluz. The resemblances, however, suggest that the latter genus may eventually find a place in the vicinity of *Sportella*. The form and muscular scars, the tendency to pustulation of the surface, and to a less extent the characters of the hinge point in this direction. Up to the present time, though not intrinsically improbable, there is no conclusive evidence of the survival of *Sportella constricta* in the recent fauna.

Sportella protexta Conrad.

PLATE 25, FIGURE 3.

Amphidesma protexta Conrad, Am. Journ. Sci., xli., p. 347, 1841; Trans. Am. Assoc. Geol., i., p. 110, 1842; Fos. Med. Tert., p. 73, pl. 41, fig. 7, 1845.

Hiatella lancea H. C. Lea, Trans. Am. Phil. Soc., 2d Ser., ix., p. 242, pl. 34, fig. 24, 1845.

Syndosmya protexta Conrad, Proc. Acad. Nat. Sci. Phila., vii., p. 29, 1854.

Saxicava fragilis Holmes, Post-Pl. Fos. S. Car., p. 57, pl. 8, fig. 18, 1859.

Abra protexta Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 574, 1863; Meek, S. I. Checkl. Mio. Fos. N. Am., p. 11, 1864.

Sportella lancea Dall, Trans. Wagn. Inst. Sci., iii., part iv., p. 920, pl. 25, fig. 3, 1898.

Miocene of Petersburg, Virginia, of North Carolina at Wilmington, and in Duplin County at Magnolia and the Natural Well; Pliocene of the Cape Fear River, North Carolina; of Tilly's Lake, Waccamaw River, South Carolina, and of the Caloosahatchie beds of Florida; Pleistocene of Simmons Bluff, South Carolina; living off Cape Lookout, North Carolina, in twenty-two fathoms, sand, dredged by the United States Fish Commission.

This species is notable for its solenoid form, more pronounced in the young, its conspicuous nepionic stage visible on the beaks, and its sparse pustulation, which is easily eroded and therefore apparently absent in a certain proportion of specimens. The pustulation is more conspicuous on fully grown specimens, and the adolescent sometimes do not have any. The outline varies somewhat, not only with age but also in different individuals, and has led to the suspicion that the *S. compressa* may perhaps only be an extreme variation of *S. protexta*. A single fresh valve of the latter was dredged off Cape Lookout by the United States Fish Commission.

Sportella petropolitana n. sp.

PLATE 45, FIGURE 10.

Miocene marl of Petersburg, Virginia; Burns.

Shell small, oblong, subequilateral, moderately convex, the dorsal slopes evenly arched, the base nearly straight, and the ends rounded; beaks low and inconspicuous; outer surface nearly smooth or sculptured with incremental lines; hinge with the cardinal tooth single, smooth, and conical, the pit small, triangular, and the ligamentary ridge obscure. Lon. 5.75, alt. 3.75, diam. 2 mm.

A single small valve establishes the presence of this species at this locality. From *S. constricta* of the same size it can be distinguished by the even arch of the dorsal margin, the thinner and more elegant shell, and the absence of the posterior dorsal reflection which gives this part of the shell in *S. constricta* a squarish aspect. The cardinal tooth is also smaller and more slender.

Sportella compressa H. C. Lea.

PLATE 25, FIGURE 3*a*.

Petricola compressa H. C. Lea, Trans. Am. Phil. Soc., 2d Ser., ix., p. 239, pl. 34, fig. 15, 1845; Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 574, 1863; Meek, S. I. Checkl. Mio. Fos. N. Am., p. 9, 1864.

Sportella compressa Dall, Trans. Wagn. Inst. Sci., iii., part iv., p. 920, pl. 25, fig. 3*a*, 1898.

Miocene of Petersburg, Virginia, Lea; Pliocene of the Caloosahatchie beds, Florida, Dall.

This species is much like *S. protexta*, but more equilateral and of more ovate form. It appears to be relatively rare.

Sportella yorkensis n. sp.

PLATE 44, FIGURE 1.

Miocene of the York River, Virginia, near Yorktown; Harris.

Shell small, subovate, slightly inequilateral, compressed; beaks moderately prominent, exterior sculptured with moderately conspicuous incremental lines or smooth; posterior end slightly shorter, both ends evenly rounded, base arcuate; hinge with a large pit for the resilium, left valve with the anterior cardinal large and prominent, the hinge-plate thickened behind the pit, narrower in the right valve. Alt. 5, lon. 7, diam. 2 mm.

This species is represented by four somewhat worn valves in the National Collection. They show no traces of pustulation, which may, however, have been worn off. It recalls *S. constricta* but is smaller, less inflated, and more compact.

Sportella pelex n. sp.

PLATE 44, FIGURE 10.

Miocene of Petersburg, Virginia, Burns; Cove Point, Maryland, Maryland Geological Survey.

Shell small, solid, compressed, inequilateral, the posterior side quite short and blunt; beaks low, surface sculptured with fine regular incremental lines, of which a few at wide intervals are more conspicuous; basal margin nearly straight, anterior end produced, rounded, posterior bluntly rounded; left valve with a strong hinge, the anterior lamella obsolete, but the one behind it prominent and strong, socket of the resilium deep, the hinge-plate above it obscurely thickened, a narrow but distinct groove for the external ligament; interior polished, the adductor scars rather high up, the disk faintly radially striated, the margin entire. Lon. 7.3, alt. 5.5, diam. 2 mm.

This species has a good deal the shape of a small *Mesodesma* and is nearest to *S. yorkensis,* compared with which it is higher and more inequilateral and with a more oblique anterior dorsal slope.

Several other species of *Sportella* as yet undescribed appear in the collections of the Maryland State Geological Survey from the Miocene, among which one from the Cove Point, Maryland, Miocene has received the manuscript name of *Sportella recessa* from Mr. L. C. Glenn of the Survey. I have included (Plate 45, Figure 13) an illustration of this species with the others.

Genus **ANISODONTA** Deshayes.

Eucharis Récluz, Journ. de Conchyl., i., p. 164, 1850. Type *Corbula quadrata* Hinds; Fischer, *op. cit.,* viii., p. 83, 1860; xxxiv., p. 193, 1886; not of Latreille, 1804.

Poromya Deshayes, An. s. Vert. bas. Paris, i., p. 248, 1857; not of Forbes, 1844.

Anisodonta Desh., An. s. Vert. bas. Paris, i., p. 542, 1858; Cat. Moll. Réunion, p. 15, 1863; Cossmann, Cat. Ill. bas. Paris, i., p. 136, 1886; ii., p. 204, 1887.

Basterotia C. Mayer, in Hörnes, Fos. Wiener beckens, ii., p. 40. Type *B. corbuloides*, *op. cit.*, pl. iii., fig. 11, 1870; Dall, Blake Moll., p. 316, 1886; not of Bayle (MS. *fide* Jousseaume), 1884.

This genus has been associated with the Corbulas, which are not closely related to it, with *Poromya*, and with the Cypricardians. The general features of the soft parts have been described by Fischer, but his account is not sufficiently detailed to enable us to locate it definitively. At present all that can be said is that it may belong near *Haloconcha* or in the vicinity of *Sportella*.

As far as can be judged at present the genus is divisible into the following sections, which are not separated from each other by any very distinct characters:

Section *Basterotia* Mayer, 1870.

Shell inflated, quadrate, carinated behind, more or less gaping behind and ventrally, with a granular surface sculpture, glassy texture, and simple pallial line; hinge with a single prominent denticle under the incurved beaks separated by a gap from a short dentiform nymph bearing an external ligament. Type *B. corbuloides* Hörnes.

Section *Fulcrella* Cossmann, Cat. Ill. bas. Paris, i., p. 136, 1886. Type *Poromya paradoxa* Desh.

Shell like *Basterotia* but without posterior carina, the surface usually concentrically striate and not granular; rounded quadrate, the tooth less prominent, the nymph longer, and without any conspicuous notch or gap between it and the tooth, and the valves more or less close fitting.

Section *Anisodonta* Deshayes, 1858. Type *A. complanata* Desh., *op. cit.*, pl. xxii., figs. 1-4 (bad).

Shell elongated, more or less carinate and pointed behind, beaks not conspicuous, valves gaping little if at all, surface granulose, teeth moderately developed; nymph rather elongate, not prominent.

The original type specimen was diseased and consequently the figure is very misleading. The identification has been cleared up by M. Cossmann. The distinctions between the three sections are very slight.

The relations of the genera *Passya* Desh., and *Fabagella* Cossmann (i., p. 41, 1886, type *F. faba* (Desh.), pl. ii., figs. 40-41) to *Basterotia* will bear investigation.

Anisodonta (Basterotia) bowdeniana n. sp.

Oligocene of the Bowden beds, Jamaica; Henderson.

A species of *Basterotia,* which appears to be clearly distinct from *B. quadrata* Hinds, is represented by a broken right valve in the collection made by Henderson and Simpson at Bowden. Hardly complete enough to figure, it may be described as distinguished from *B. quadrata* by the following characters. The keel, which is so prominent a feature in *B. quadrata,* in the present shell is well marked only on the beak, rapidly becoming obsolete distally and represented only by a rounded ridge, which passes imperceptibly into the general convexity of the valve. The beaks in *B. bowdeniana* are less angular and elevated, the shell thinner and more ovate, the hinge-line longer, the elevated tooth smaller in proportion to the shell and much more delicate. The surface is minutely sagrinate, the length 10.5, the diameter about five millimetres.

Anisodonta (Fulcrella) (elliptica Récluz? var.) **carolina** Dall.

PLATE 45, FIGURE 20.

Eucharis elliptica Récluz, Journ. de Conchyl., i., p. 168, 1850.
Mya simplex Holmes, Post-Pl. Fos. S. Car., p. 55, pl. 8, fig. 16, 1858.

Miocene of Duplin County, North Carolina, at the Natural Well and Magnolia, Burns; Pleistocene of Simmons Bluff, South Carolina, Holmes; living in eighteen to twenty-two fathoms off the coast of North Carolina, United States Fish Commission.

I am somewhat in doubt as to the distinctness of the Miocene shells from *A. elliptica* Récluz, characteristic specimens of which are found associated with those, which I have named *A. corbuloides,* off the coast of North Carolina. Holmes's figure is very like the recent *A. elliptica,* and a little larger and more rounded behind than the Miocene fossils. These differences, however, appear to correspond to the differences between young and adult *A. elliptica.* Two right valves of the Miocene form were collected, and more profuse material is needed before their position with regard to *A. elliptica* can be ascertained. Should they prove distinct the Miocene species will require a new name. *A. simplex* will at any rate be annexed to *A. elliptica* as a synonym, Récluz's name having seven or eight years' priority, for the recent and Pleistocene form.

Anisdonta americana n. sp.

PLATE 36, FIGURE 7.

Pliocene marls of the Caloosahatchie, Monroe County, Florida; Dall.

Shell small, thin, elongate, subquadrate, the anterior end shorter and rounded, the posterior longer and obliquely pointed; surface minutely granose and with concentric incremental sculpture, a rounded ridge extending from the umbo to the posterior basal angle; beaks low, rather incurved; hinge delicate, a small subconical cardinal under the umbo in the right valve and a slightly excavated nymph behind it for the reception of the ligament and resilium, which are external; base and posterior hinge-line nearly parallel, the latter terminating at an angle of the dorsal margin beyond which the margin slopes downward; the outer edges of the nymphs are incised, forming a narrow groove; interior of shell smooth, anterior muscular scar impressed, posterior and pallial line faint and obscure. Lon. 6, alt. 3.7, diam. 2.9 mm.

A single right valve was obtained. From the Miocene form of the last species this is distinguished by its greater length and more conspicuous granulation. In reality, however, the differences between *Fulcrella* and the typical *Anisodonta* are insignificant.

Genus **HINDSIELLA** Stoliczka.

Hindsia Deshayes, An. s. Vert. bas. Paris, i., p. 693, 1858; not of Adams, 1853.

Hindsiella Stol., Cret. Fauna India, Pelecypoda, p. 266, 1871 (type *Modiola arcuata* Defrance, Desh., *op. cit.*, p. 695, pl. 53, figs. 32-35, 1858); Cossmann, Cat. Ill., ii., p. 53, 1887.

Vasconia Fischer, Les fonds de la Mer, ii., p. 83, 1873.

Kellia (sp.) De Gregorio, Cossmann.

The peculiar form of the shell with its median constriction, which led to the institution of a genus for the Parisian fossil, is probably due to the commensal habit, and may therefore occur in commensal species of different genetic relations. My attention was first drawn to this explanation by the discovery of the *situs* of "*Pythina*" *rugifera* Cpr. of the Alaskan fauna. This little bivalve is byssiferous and has the same median arcuation as the *Hindsiella*. It lives attached by the byssus to one of the abdominal segments of *Gebia pugetensis* Stm., a burrowing crustacean of the northwest coast. The mollusk, by means of its arcuate medial sinus, precisely fits the convex surface, to which it is attached by its byssus, and it is difficult, after examining one *in situ*, to doubt that its location and form have not a certain relation of cause and effect. By fitting closely and thus being able to keep itself hanging symmetrically on the abdomen of the crab the mollusk avoids the shocks which it would receive if it swung to one side, and is able to maintain its position sheltered from the carnivorous gastropods always so ready to drill holes in thin-shelled bivalves. Besides this the fragments of the crab's food in the burrow probably attract many infusoria and other minute organisms which serve as food for the bivalve. Such burrows are known to be frequented by various commensal *Leptonacea.* Stoliczka supposed that it would be necessary to remove *Hindsiella* from the vicinity of the *Erycinidæ* on account of its external ligament. But the fact is that ligament and resilium are both represented in a majority of the *Leptonacea,* sometimes one is obsolete and sometimes the other, but it is doubtful whether either is absolutely deficient in any case. A careful examination of the hinge of *H. arcuata* leads to the belief that the ligament of this type was not, as Deshayes supposed, entirely external. At all events, from all the facts, it does not seem that a sufficient reason has been advanced for separating this group from the *Leptonacea.* As Smith has already shown, a variety of forms have been referred to these groups solely on account of their external form. The type of *Hindsiella* has in the right valve a single small conical tooth under the umbo, behind which the hinge-plate is wide, somewhat excavated, and exhibits what appears to be an elongated thickening upon which the resiliary part of the ligament was seated. In the left valve the hinge is similar, but there is a second small tooth behind the more prominent one in front of the resilium, the resiliary process is less prominent, and a distinct groove may be seen where the posterior part of the external ligament terminated. The ligament and resilium were in contact, but both were present. It is difficult to decide whether the elongate posterior lamina is a "tooth" or a resiliifer. Whichever is the case, it appears in the American species also. I am indebted to M. Cossmann for the opportunity of studying authentic valves of this curious little shell.

Deshayes's name being preoccupied, Stoliczka modified it to *Hindsiella,* while, a short time after, Fischer, apparently ignorant of Stoliczka's action, proposed *Vasconia* for the same reason. As he specifically states this, it is not practicable to use his name for a curious little shell described at the same time by Fischer as *Hindsia Jeffreysiana,* and which is separated from *Hindsiella* by good characters. The latter is a purely external shell, usually with a distinct unpolished periostracum, and the sinuosity in its base is merely a sinuosity without distinct boundaries. The *H. Jeffreysiana,* however, is a shell almost entirely if not wholly internal, without an epidermis, with a solely internal, small, short, subumbonal resilium and no external ligament; the sulcus in the valves is a sharp slit, leaving a fasciole with sharply defined boundaries, and the cardinal tooth, unlike those of *Hindsiella,* though similarly placed, is clean cut and sharp. These differences obviously correspond to serious anatomical characteristics of which *Hindsiella* has no trace in its shell, and therefore I have proposed for *H. Jeffreysiana* the generic name of *Vasconiella.*

Hindsiella is represented in the American Tertiaries, so far as known, by the following species:

Hindsiella faba O. Meyer.

Hindsiella faba O. Meyer, Bull. Ala. Geol. Surv., i., p. 82, pl. 1, fig. 25, 1886.

Kellia faba De Gregorio, Mon. Claib., p. 211, pl. 30, fig. 16, 1890; Cossmann, Notes compl., p. 12, 1894.

Eocene of the Claiborne sands, Claiborne, Alabama.

These small shells with their obscure cardinal characters are very puzzling and difficult to diagnose clearly. M. Cossmann expresses the opinion that this shell is a *Kellia,* but if *Kellia* is to be judged by its type, *K. suborbicularis,* the two hinges, though allied, cannot be regarded as identical. The hinge of *H. faba* seems to me to agree in all essentials with Deshayes's figure (Bas. Paris, pl. 43, fig. 33), though the posterior part of the hinge-plate in *H. faba* is proportionately narrower and does not show the minute groove for the external ligament clearly. The shades of obsolescence in the ligamentary characters among these shells are so delicately graded that I cannot regard this as a matter of importance. The dental characters of *Kellia* include one very large and one small cardinal and three distinct laterals in the two valves, and therefore it seems to me far more distinct from *H. faba* than it is from *H. arcuata.* It is not at all impossible that, as is the case in *Kellia,* different individuals have the hinge somewhat differently developed. Where the teeth are so unformed and amorphous as they are in many of the *Leptonacea* too much stress cannot prudently be laid on minute differences.

Hindsiella (**faba** var?) **donacia** Dall.

PLATE 45, FIGURE 12.

Eocene of Claiborne, in shell sand; Burns.

Shell small, donaciform, with variable outline, rather compressed, inequilateral, the posterior side shorter, anterior dorsal margin sloping to the rounded anterior end, base slightly insinuated; posterior dorsal margin with a shorter and steeper slope, the posterior end of the shell subtruncate obliquely, the basal angle rather marked; the whole shell slightly twisted; surface with concentric somewhat irregular incremental lines and microscopic partly obsolete radial striæ; interior polished, hinge like that of *H. faba* but with the right cardinal more prominent and stem-like, the left cardinal obsolete; in some specimens the resiliary insertion was directly on the surface of the valve, in others (probably more mature) there was a distinct thickening, especially about the margin of the scar. Lon. 2.2, alt. 1.7, diam. 0.6 mm.

This shell is probably distinct from *H. faba*. It is more triangular, more inequilateral, and more compressed. The sinuation of the base is much less conspicuous, the cardinal tooth is longer, and the laminæ proportionately shorter that in *H. faba*. Several specimens with the valves in the natural position indicate that there was a small external ligament in addition to the large internal resilium.

The hinge characters of both these species and the type *H. arcuata* seem to me to be most nearly allied to those of *Montacuta*, especially those *Montacuta* * which, like *M. ferruginosa* Mtg., have only the right cardinal and the left anterior lamina well developed. To these in *Hindsiella* is added a more or less developed external ligament, and if the peculiar form of the shell is due, as has been suggested, to a commensal situs on the ventral segments of crustacea it is not improbable that the animal wants the broad external frills of the mantle which have been observed in the free *Montacuta*.

Hindsiella nephritica n. sp.

Plate 45, Figure 8.

Oligocene of the lower bed at Alum Bluff, Calhoun County, Florida; Burns.

Shell small, short, inflated, subequilateral, with rather prominent umbones, near which the valves are smooth, elsewhere with irregular, more or less prominent incremental lines; centrally vertically constricted, which produces a shallow insinuation in the basal margin; umbones prosogyrate with the dorsal margin impressed in front of them; hinge narrow, in the right valve a single subumbonal short tooth, behind and below the beak a narrow elongate scar for the resilium, and farther back a slender posterior lamella separated by a groove from the dorsal margin; adductor scars narrow, rather high up; interior of the shell polished with entire margins. Lon. 4.75, alt. 3.5, diam. 3 mm.

A single right valve of this species was collected.

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* Other forms which, from their arcuate outline, have wrongly been referred to *Hindsiella* will be discussed under *Bornia, Pythinella,* and *Montacuta*.

Hindsiella carolinensis n. sp.

PLATE 45, FIGURE 4.

Miocene of the Natural Well, Duplin County, North Carolina; Burns.

Shell small, rounded, moderately compressed, with low, inconspicuous beaks, subequilateral, with a feeble mesial constriction; sculpture of faint incremental lines crossed by microscopic radial striation sometimes partly obsolete; right valve with a small stout subumbonal tooth, a resiliary scar behind the umbo, and a faint groove in the posterior distal part of the narrow hinge-plate; left valve with two anterior teeth, the posterior one subumbonal and smaller, the anterior hinge-plate excavated, the posterior with a narrow elongate resiliary scar and a faint ridge representing the lamella; interior of the valve polished and faintly radially striate. Lon. 5.5, alt. 4.5, diam. 2.0 mm.

The radial striæ are only visible with a good light and strong magnification.

Hindsiella acuta n. sp.

PLATE 45, FIGURE 9.

Miocene of the Natural Well, Duplin County, North Carolina; Burns.

Shell small, cuneate, inflated, subequilateral, the posterior side broader and rounded, the anterior narrower, more pointed and decurved; anterior dorsal margin declining, posterior arcuate; middle of the base conspicuously insinuate; surface sculptured with crowded, rather prominent, incremental lines, feebler towards the anterior end, which shows some faint radial markings; hinge-plate narrow, left valve with a prominent subumbonal tooth and a feeble lamella a little in front of it, a strong resiliary scar, and a minute, obsolete, very distant posterior lamella; right valve with an arcuate, short, subumbonal lamina, a deep pit for the opposite cardinal above it, and a short, distant, sharp groove corresponding to the posterior lamella of the opposite valve; interior of the valves polished, faintly radially striate, the adductor scars rather low down. Lon. 6.0, alt. 4.0, diam. 3.0 mm.

This species is especially characterized by its relatively acute anterior end, which, in all the individual variations noted, is still preserved.

It should be observed that, like nestlers in general, the species of *Hindsiella* exhibit a good deal of variation among individuals; much more than free bivalves usually show. Slight differences of outline count for little, but there is always a certain *facies* which may serve as a sufficient guide in discriminating one species from the others, provided one has a satisfactory amount of material for study.

Family LEPTONIDÆ.

Genus LEPTON Turton.

Lepton Turton, Dithyra Brit., p. 61, 1822. Type *L. squamosum* Montagu.

Eupolcme Leach, Moll. Gt. Brit., p. 279, 1852. Same type.

Neolepton Monterosato, Nuova Revista, 1875, p. 12, *nota;* Nom. Conch. Medit., p. 15, 1884. Type *Lepton sulcatulum* Jeffreys.

In this genus we have the hinge composed in the left valve of an anterior lamella at the umbonal end of which is a nascent cardinal or "hook" which may or may not be completely detached from the lamella; behind this is a stout internal resilium, behind which is a posterior lamella which rarely becomes obsolete. In the right valve a pair of lamellæ on each side of the resilium is disposed in such a manner as to form a socket for the lamella of the opposite valve. The hinge is concentrated in comparison with that of most of the *Leptonacea,* the lamellæ are short, the resilium is short, stout, and nearly central. In the typical species there is only one cardinal "hook," and that is in the left valve. The shells are usually somewhat compressed, subquadrate, and polished, with a minute surface-sculpture, punctate or sagrinate; the beaks are nearly central and erect. The anatomical characters are remarkable, but it is only necessary to state here that the mantle is reflected over the valves which it normally covers to a greater or less extent.

The hinge of all the *Leptonacea* is fundamentally based on the same plan, the different genera merely exhibit modifications of detail. The notion that any relation to *Mactra, Cyrena,* and other alien genera is shown by these modifications is unwarranted and superficial. The apparent resemblances are not genetic, but due to convergence, except in so far as they exhibit features common to the nepionic stages of Teleodesmacea in general. The careful student will see in the hinge of *Lepton* relations to *Scintilla, Myllita, Bornia,* etc., but it is impossible to say which, if any, of these predominates. Hardly any three of the species have a precisely similar dentition, and the sections hereinafter enumerated must therefore be considered as merging peripherally into each other.

Section *Lepton* s. s. Type *L. squamosum* Mtg.

Characters mainly as given in the generic diagnosis, an anterior cardinal hook in the left valve, none in the right valve.

Section *Neolepton* Monterosato. Type *L. sulcatulum* Jeffreys.

Shell inflated, concentrically striate, more or less inequilateral, impunctate; hinge essentially the same as in *Lepton* proper.

Section *Epilepton* Dall. Type *Lepton Clarkiæ* Jeffreys.

Shell much as in *Neolepton;* hinge with a simple posterior and a hooked anterior lamella in each valve, not concentrated, the resilium in an oblique posterior furrow.

Lepton glabrum Fischer, from deep water in the Bay of Biscay, also has the typical hinge of this section, which verges on that of *Erycina.*

Section *Planikellia* Cossmann. Type *Erycina radiolata* Lam.

Shell recalling *Lepton* but with radial sculpture; hinge with a central resilium between two diverging lamellæ in the left, which are received between paired lamellæ in the right valve; there is no "hook" or cardinal in either valve.

I was enabled to study the hinge in specimens kindly sent by M. Cossmann. It differs from the hinge of *Lepton* s. s. chiefly in the absence of the cardinal hook in the left valve. There are several species in the Parisian Eocene.

The genus *Lepton* is not represented in our Tertiaries as far as explored. Only one species belonging to the genus as restricted is known from the Atlantic coast recent fauna. *Lepton alabamensis* Aldrich proves to be a *Sportella; L. mactroides* and *fabagella* Conrad are referable to *Bornia* and *Kellia.*

The genus has been considered here to make the discussion of the *Leptonacea* more complete and because the manuals are, as a rule, very defective in their treatment of this puzzling group.

Genus **ERYCINA** Lamarck.

< *Scacchia* Philippi, Moll. Sicil., ii., p. 27, 1844; 1st sp. *Tellina elliptica* Scacchi, Phil.,

= *Erycina* Récluz, Revue Zool., vii., pp. 291, 325, 1844. Type *E. pellucida* Lam., Ann. du Mus., vi., p. 413; Deshayes, An. s. Vert. bas. Paris, pl. 6, figs. 19-21.

= *Erycina* Cossmann, Cat. Illus., ii., p. 50, 1887; Fischer, Man. de Conchyl., p. 1025, 1887.

Not *Erycina* Philippi, Moll. Sicil., i., p. 12, 1836, type *E. Renieri* Brown (= *Abra*); nor *Erycina* Brown, Zool. Textb., p. 461, 1833, type *E. striata* Brown, pl. 90, fig. 21 (= *Atactodea*).

> *Scacchia* Philippi, Moll. Sicil., ii., p. 27, 1844; 1st sp. *Tellina elliptica* Scacchi, Phil., *op. cit.*, pl. 14, fig. 8.

= *Neæromya* Gabb, Trans. Am. Phil. Soc., xv., p. 247, 1873; Proc. Acad. Nat. Sci. Phila. for 1872, p. 274. Type *N. quadrata* Gabb, *loc. cit.*, pl. 10, figs. 4, 4*a*, 4*b*, 1872.

The genus *Erycina* as instituted by Lamarck was extremely heterogeneous, the first species being a *Cyrena,* the third a *Corbula,* the fourth a *Tellina,* the fifth a *Psathura* (only doubtfully admitted by Lamarck), and the sixth a *Diplodonta*. The essential feature of the genus as understood by Lamarck was the possession of an internal resilium situated in a fossette *between* the cardinal teeth instead of *at one side* of the cardinals, as in *Mactra*. The species enumerated (1, 4, 5, 6) which do not possess this character were, being fossils, supposed to have it by Lamarck, who mistook the triangular gap between the divergent cardinals for a fossette. The correction of this error leaves only two species corresponding to the diagnosis. *Corbula* had been instituted several years previously, so we are reduced to the single type, *Erycina pellucida*, as the exemplar of the genus.* In the absence of an exact knowledge of the facts the genus was misunderstood by many of the early writers and was only put on a sound foundation later by the researches of Récluz, Fischer, and Cossmann. It contains a large number of species, especially in the Eocene, when all incongruous elements are eliminated. *Neæromya* Gabb, as sagaciously supposed by Cossmann, is a true *Erycina*. The obsolescence of some of the elements of the hinge among the peripheral species renders some subdivision into sections necessary. The most characteristic feature of the group as a whole is the combination of the minute subumbonal cardinals with the long lateral laminæ, the latter being most prominent distally. The following arrangement is proposed:

Subgenus *Erycina* s. s. Type *E. pellucida* Lam.

Shell small, somewhat compressed or not very convex, exterior concentrically striate, smooth, or rarely with partially radial sculpture, sometimes punctate or sagrinate; hinge with an obsolete external ligament, sometimes hardly traceable, and a well-marked internal resilium which is attached to the shell in an oblique fossette behind the beaks and close to the cardinal border; teeth, normally, one or two minute cardinals and two lateral laminæ in each valve, the latter near and sometimes confounded with the dorsal margin of the valve, usually long, low proximally, more elevated distally, and often recurved upon themselves, like a segment of a cylinder; in the right valve sometimes double with the socket for the laminæ of the opposite valve between them. Pallial line with a slight insinuation.

* Froriep in his Neues Syst. Conch., p. 38, 1807, gave an outline of the Lamarckian system in which he named as type of *Erycina* Lamarck's first species; but, since this does not agree with Lamarck's diagnosis, while *E. pellucida* does, Froriep's selection cannot be accepted. This is lucky, as otherwise we should have to use the name *Erycina* for the genus *Cyrena*.

Lepton, which is closely related to *Erycina,* is distinguished from it by the greater concentration of the dentition, which is usually lower down in the valve from the dorsal margin, by the much shorter and straighter lateral laminæ, the valves flattened by compression and more equilateral and quadrate in outline, and by the greater extension of the mantle-edge over the outside of the shell.

Subgenus *Scacchia* Philippi. Type *Tellina elliptica* Scacchi.

One right and two left cardinals; laminæ obsolete; external ligament small but distinct; pallial line simple; foot compressed.

The left anterior tooth may be a concentrated lamina and not a cardinal. In the right valve the dorsal margins are extended, as if to take the place of laminæ, functioning, in connection with the dorsal margins of the opposite valve, like the grooves in *Erycina.* *S. tenera* Jeffreys has only one cardinal in each valve. This group appears to be represented by a fragment of a hinge from the Chipola beds.

Subgenus *Anomalokellia* Cossmann. Type *Erycina catalaunensis* Cossm., Cat. Illus., ii., pp. 75-76, pl. iii., figs. 29-31, 1887.

Hinge with two left and one right cardinal, the posterior laminæ developed, the anterior wanting, the resilium small, leaving a feeble pit behind the cardinals. Otherwise as in *Erycina.*

Only one species is known, a fossil of the Parisian Eocene.

Subgenus *Pseudopythina* Fischer, 1884. Type *Kellia MacAndrewi* Fischer, J. de Conch., xv., p. 194, pl. 9, fig. 1, 1867.

Shell rather large for the family, reniform, with a coarse rugose periostracum; hinge with two projections of the right dorsal margin fitting into sulci of the opposite valve, one right and one left cardinal, a strong internal resilium, sometimes with a lithodesma, and an evident but small external ligament; laminæ absent or not distinct.

The nude name without means of identification appeared in a list published by Fischer in 1878. I have not found it characterized earlier than 1887, but it was identified with its type by Monterosato (Nom. Conch. Medit., p. 17) in 1884. It is probably commensal with crustacea.

?Subgenus *Turquetia* Vélain, Comptes Rendus, July 24, 1876; Faun. St. Paul et Amst., p. 134, 1878. Type *T. fragilis* Vélain, *op. cit.,* p. 135, pl. 5, figs. 15-17, 1878.

Hinge like *Pseudopythina,* one cardinal in each valve; resilium long, narrow; valves truncate behind. This is regarded by Bernard as probably the fry of a Lucinoid shell.

Lutetina Vélain, of the same publication, is from Bernard's recent figures * referable to the vicinity of *Neolepton,* where it may perhaps form a separate section. Without his figures it could not be identified.

For the proper determination of these minute exotic forms it is generally unsafe to depend upon anything but the actual specimens, as experience has repeatedly shown the incapacity of many draughtsmen to clearly delineate objects whose characters are so minute and unfamiliar as the hinges of these little shells. I am therefore obliged to omit any characterization of several such forms.

A few American Eocene species of *Erycina* have been described. From the Claibornian are *Erycina Whitfieldi* Meyer (Ala. Bull., p. 82, pl. 1, fig. 20, 1886) and a form which Cossmann (Notes Compl., p. 12, 1894) has indicated as (a flatter, more equilateral, and more oblong) variety *Meyeri.* From the Jacksonian Meyer has described *E. Zitteli* (Ber. Senckenb. Nat. Ges., 1887, p. 11, pl. 2, fig. 8) and a form which he refers to *E. Whitfieldi,* but which if his figure is reliable is more likely to be a variety of *E. Zitteli* or even a distinct species. *Neæromya quadrata* Gabb (Geol. St. Dom., p. 247, 1873, and Proc. Acad. Nat. Sci. Phila. for 1872, p. 274, pl. 10, figs. 4 *a-b,* 1873) is a typical *Erycina,* as I have determined from an examination of the types. It is found in the Oligocene of St. Domingo and Bowden, Jamaica. To these we are now enabled to add the following species: †

Erycina plicatula n. sp.

PLATE 44, FIGURES 7, 12.

Eocene of the Claiborne sands at Claiborne, Alabama.

Shell compressed, ovate, inequilateral, the anterior side longer; beaks low, pointed, somewhat prosocœlous; surface near the beaks faintly concentrically striate or smooth; about half-way to the margin from the umbo the sculpture grows stronger, consisting of fine, low, rather sharp plications, not always continuous nor in exact harmony with the incremental lines; anterior dorsal

* Bull. Mus. d'Hist. Nat., 1898, No. 2, p. 79.

† Several undescribed species are in the collections of the Maryland Geological Survey from the Miocene.

margin depressed in front of the beaks, nearly straight for a short distance, then rounding evenly to the anterior end; base arcuate, posterior end more bluntly rounded, with the posterior dorsal margin arcuate and high; hinge-plate narrow, channelled, with a short obscure anterior lamella, whose "hook" is represented by a small pustular elevation; posterior lamella long, arcuate, almost fused with the margin but rising distally to a small elevation; interior of the valve smooth or with faint radial lines; adductor scars narrow, long, extending well down towards the base. Lon. 9.5, alt. 7, diam. 2.2 mm.

Two left valves of this well-marked species were found in the marl. The other species described from this horizon are much smaller and more inflated, and the young of *E. plicatula,* judging by the incremental lines, had a different outline from either of the others.

Erycina undosa n. sp.

PLATE 45, FIGURE 3.

Oligocene of the Chipola beds at Alum Bluff and on the Chipola River, Calhoun County, Florida; Burns and Dall.

Shell small, compressed, polished, *Semele*-form, anterior end rounded. longer; posterior end shorter and more bluntly rounded; beaks low but rather pointed; surface with equidistant concentric impressed lines separating wider, flattish interspaces; hinge strong, teeth normal; adductor scars large, the pallial impression wide and slightly irregular. Lon. 3.5, alt. 2.8, diam. 1.5 mm.

The shell varies somewhat in proportional length and some specimens may reach 4.5 mm.

Erycina chipolana n. sp.

PLATE 44, FIGURE 15; PLATE 45, FIGURE 17.

Oligocene of the Chipola marls of Alum Bluff and the Chipola River, Calhoun County, Florida; Burns and Dall.

Shell small, compressed, smooth, polished, donaciform; posterior end shorter and with more abrupt descent of the dorsal margin; beaks rather low, hinge strong, the distal portions of the laminæ prominent with a marked groove above them; posterior adductor scar larger and lower down than the anterior; basal margin arcuate. Lon. 4.1, alt. 3.0, diam. 2 mm.

The principal characteristic of this small species is its trigonal shape; the laminæ are also more prominent than usual.

Erycina fabulina n. sp.

Plate 45, Figure 1.

Upper Oligocene sands of Oak Grove, Santa Rosa County, Florida; Burns.

Shell small, ovate, subequilateral, moderately convex, with low umbones; surface polished, with numerous faint incremental striæ; dorsal margin and base nearly equally arcuate, ends rounded, the anterior slightly longer and higher; hinge normal, the laminæ rather long and somewhat recurved; adductor scars small, subequal. Lon. 5, alt. 3.6, diam. 2 mm.

Erycina curtidens n. sp.

Plate 45, Figures 14, 15.

Upper Oligocene sands of Oak Grove, Santa Rosa County, Florida; Burns and E. A. Smith.

Shell small, thin, smooth, polished, moderately convex, with low beaks, rounded ovate varying to suborbicular, slightly inequilateral; hinge in the right valve with notably short and strong laminæ, the dorsal margin above them thickened so as almost to form a second pair in some cases; laminæ of the left valve longer and narrower; adductor scars small, subequal, and pretty high up. Lon. 3.66, alt. 3, diam. 1.2 mm.

This little species is brilliantly polished and the different valves vary considerably in rotundity, some being almost orbicular.

Erycina carolinensis n. sp.

Plate 44, Figures 3, 22.

Miocene of Duplin County, North Carolina, at the Natural Well (fig. 3) and Magnolia, at Wilmington, and on the Cape Fear River, North Carolina; Pliocene of the Waccamaw River, South Carolina (fig. 22); and the Caloosahatchie marls of Florida; Burns, Stanton, Johnson, and Dall.

Shell large for the genus, inequilateral, somewhat compressed, elongated, the anterior end produced, rounded, the posterior end shorter, downwardly arcuated; base nearly straight, slightly insinuated near the middle, corresponding to a slight mesial constriction of the shell; anterior dorsal margin nearly parallel with the base, posterior declining to a rounded point at its junction with the base; beaks small, low, pointed; surface with rather strong, irregular, concentric incremental lines but very little radial striation; hinge normal, the lamellæ rather long, and the hook (or cardinal) small; resiliary groove deep and strong, elongated; interior of the valves smooth or faintly radially striated towards the margins; adductor scars high up, the anterior larger, the pallial line rather wide, somewhat irregular. Lon. 13.25, alt. 7, diam. 4 mm.

This is the largest and apparently the most common species of *Erycina* in the later Tertiary of the Carolinas. On occasional specimens a little faint radial striation may be observed under the shelter of the concentric sculpture, but many specimens do not show it, and on none does it appear to cover the surface. From the next species, which has a somewhat similar form, this is distinguished by the well-developed lateral lamellæ.

Erycina (Pseudopythina?) americana n. sp.

Plate 44, Figures 21, 25.

Miocene of the Calvert Cliffs, Maryland; Harris.

Shell large, moderately convex, inequilateral, rounded at both ends, the posterior side shorter; beaks low, surface sculptured only with rather conspicuous incremental lines; anterior dorsal margin nearly parallel with the base, posterior dorsal margin arcuate; hinge-margin narrow, feebly channelled, edentulous, adductor scars small, narrow, high up; pallial line wide and radially striated. Lon. 16, alt. 10.5, diam. 7 mm.

A single right valve was collected by Harris. The umbonal angle of the anterior dorsal margin is slightly defective, and it is uncertain whether the species had a subumbonal tooth or not. The shell might perhaps be referred to the subgenus *Pseudopythina,* but if the lateral laminæ are present it would be merely an *Erycina* with a rather obsolete hinge armature.

Erycina marylandica Glenn.

Plate 45, Figure 19.

Miocene of Plum Point and three miles south of Fishing Creek; Maryland Geological Survey.

This is a small, short species, with a strongly developed hinge.

Erycina (Pseudopythina) protracta n. sp.

Plate 45, Figure 22.

Pliocene of the Waccamaw River, South Carolina, Johnson; and of the Caloosahatchie marls of Florida, Dall.

Shell small, thin, almost soleniform, inequilateral; surface polished with sculpture only of incremental lines; beaks inconspicuous; anterior end longer, the anterior dorsal margin parallel with the base, the anterior end evenly rounded; posterior dorsal margin arcuate, declining, basal angle rounded; hinge feeble, the distal lamellæ weak and low, the "hook" or subumbonal lamella obscure, low, nearly parallel with the margin; anterior adductor scar high, narrow; posterior larger, lower, both with a few radial lines. Lon. 8.35, alt. 4, diam. 2.2 mm.

This is the most elongated species among those of our Tertiary and appears to be rare.

Erycina Kurtzii Dall.

PLATE 25, FIGURE 12.

Scintilla Kurtzii Dall, Trans. Wagner Inst., iii., part iv., p. 920, pl. 25, fig. 12, 1898.

Pliocene marls of the Caloosahatchie River, Florida; Dall.

Shell small, thin, subquadrate, rather compressed, polished, nearly equilateral; beak very low, inconspicuous; surface sculptured with incremental lines and fine, sharp radial striæ visible only with magnification; hinge nearly obsolete, the lamellæ nearly merged with the dorsal margin and the "hook" reduced to a minute angular projection; ends almost equal in length and rotundity; adductor scars rather large, interior smooth. Lon. 8.5, alt. 5.2, diam. 2.2 mm.

This species resembles *E. americana,* and like it might perhaps be referred to *Pseudopythina.* It retains some faint traces of the lateral teeth, which the typical *Pseudopythina* does not. Than *E. americana* it is more equilateral and differs from it and the other elongate-quadrate species in its fine radial sculpture, which led to its reference in 1898, after a hasty examination, to *Scintilla* instead of its proper genus *Erycina,* which became evident after more careful study. Only one right valve was obtained. It is named in honor of Lieutenant J. D. Kurtz, the associate of Stimpson in the investigation of the shells of the Carolina coast. The *Lepton Kurtzii* of the list of Waccamaw shells on page 210 (part ii.) is the shell above described under the name of *Erycina carolinensis,* and not the present species.

Genus **BORNIA** Philippi.

< *Bornia* Philippi, Moll. Sicil., i., p. 13, 1836. First species *B. corbuloides* Phil. (Bivona as *Erycina*), *op. cit.,* p. 14, pl. 1, fig. 15, 1836.

< *Kellia* Philippi, Moll. Sicil., ii., p. 10, 1844.

Erycina (sp.) Récluz, Revue Zool., vii., pp. 327, 333, 1844.

Bornia Stoliczka, Cret. Pel. India, p. 266, 1871. Type *B. corbuloides* Phil., Fischer, Man. de Conchyl., p. 1026, fig. 772 (wrongly named *B. complanata,* and copied from Moll. Alg. of Deshayes, who called it *Erycina Geoffroyi*), 1887.

> *Pythina* Hinds, Zool. Voy. Sulphur, ii., p. 70, 1844. Type *P. Deshayesiana* Hinds, *op. cit.*, pl. xix., figs. 8, 9; Smith, Ann. Mag. N. Hist. for Sept., 1891, p. 227.

Pythinia Deshayes, An. s. Vert. bassin de Paris, i., p. 694, 1858.

Philippi's genus was heterogeneous, including species of *Kellia* and *Lasæa,* and was afterwards regarded by him as synonymous with *Kellia,* but when the incongruous elements are eliminated there still remain several species which are shown by their anatomical characters to be distinct from *Kellia* and for which Stoliczka and Fischer have revived Philippi's name.

Shell ovate or subtrigonal, subequilateral, with a more or less flattened disk, the periostracum usually brilliant, the surface smooth or divaricately more or less plicate; an obsolete amphidetic external ligament present, a short, slightly posterior, subumbonal internal resilium without a lithodesma, the pallial line not sinuated, and the pallial area frequently punctate or radially striate; hinge with one moderately long posterior and two shorter anterior laminæ in the left valve, and in the right one anterior and one longer, sometimes remote, posterior lamina; one or both the anterior laminæ in either valve may have the aspect of cardinals; hinge-plate usually excavated.

Owing to the gradations which appear in the shells there are hardly sufficient conchological reasons for separating the group into sections, but if this be done *Bornia* must be retained for the smooth and *Pythina* for the divaricate species.

After long search, I finally obtained a specimen of *Pythina Deshayesiana* from the Bishop Museum of Honolulu. It differs from the typical *Bornia* by having the first anterior denticle in each valve strong, conical, and projecting; there are two right and one left posterior laminæ and a small, short, elevated lamina in front of the conical tooth in the left valve only.

It is of course possible that anatomical differences may eventually be found which may definitely separate *Pythina* and *Bornia,* but this remains to be determined. One of the posterior laminæ sometimes becomes duplex in well-developed individuals of *Bornia;* conchologically the flattened disk and shorter, more central resilium enable one to separate the species from the nearly related but more globose Kellias. The reniform outline of many of the species may be due to commensalism. *Ceratobornia* (see p. 1152) has anatomical peculiarities.

Bornia is represented in the Chickasawan or Lignitic Eocene of the United

States by *B. prima* Aldrich (Bull. Pal., ii., p. 181, pl. 5, figs. 3, 3*a*, 1897) of Wood's Bluff and in the Claibornian by *B. Dalli* Cossmann (as *Montacuta*, Notes Compl., p. 12, pl. 1, figs. 13-14, 1894). No species have so far been collected from the Lower Oligocene, though they will doubtless be found on further exploration of the Chipola beds.

Bornia scintillata n. sp.

PLATE 49, FIGURE 10.

Eocene of the Claibornian sands, Claiborne, Alabama; Burns.

Shell small, subtrigonal, subequilateral, polished, finely, sharply radially grooved, the grooving of the middle of the disk finer and closer than that towards the ends; the beaks moderately elevated, nearly smooth, the larval shell small, distinct; hinge armature feeble; the left posterior lamina small, feeble, short; anteriorly the "hooks" of the two anterior laminæ distinct, simulating cardinals, the lateral portions nearly obsolete; the grooving of the exterior faintly visible interiorly towards the anterior end but not crenulating the basal margin; muscular impressions narrow, feeble; basal margin entire. Lon. 3.75, alt. 3.0, diam. 1.5 mm.

A single left valve of this very distinct species was obtained. From *B. prima* Aldrich, it differs by being grooved, not plicated, in the absence of the punctuation which covers the surface in *B. prima*, and in the much more profuse and finer sculpture.

Bornia plectopygia n. sp.

PLATE 49, FIGURE 9.

Eocene of the Claiborne sands, Claiborne, Alabama; Burns.

Shell small, short, rounded ovate, polished, smooth to the eye, except for incremental lines and about three faint radial plications on the posterior basal half; beak low, distinct; hinge armature feeble, the distal laminæ obsolete, the hooks of the left anterior laminæ perceptible but not prominent; anterior side short, rounded, posterior side produced downward and backward, the margin indented by the radial furrows, elsewhere entire; scars obscure. Lon. 4.5, alt. 4.0, diam. 2.0 mm.

A single left valve of this species was collected which though somewhat imperfect cannot be confounded with either of the other species from this horizon. There is a faint microscopic radial striation on the surface, a sulcus for the ligament, and a faint excavation for the resilium.

Bornia dodona n. sp.

PLATE 45, FIGURE 16.

Oligocene sands of Oak Grove, Santa Rosa County, Florida; Burns.

Shell small, thin, compressed, subtrigonal, smooth, brilliantly polished; anterior end slightly shorter, wider, and more rounded, posterior end longer and more pointed; beaks low, the prodissoconch distinguishable, dorsal margins sloping, basal nearly straight; right valve with two lamellæ bearing knob-like teeth on the umbonal end in front of the beak, a subumbonal obliquely directed resiliary scar, and a posterior lamella, separated by a groove from the dorsal margin; left valve with two short divaricating lamellæ under the beak and a feeble rather distant posterior lamella; adductor scars small, rather high up, interior of the valves faintly, radially striated. Lon. 5.25, alt. 3.7, diam. 1.75 mm.

Resembles *B. mactroides* Conrad, but appears to be uniformly of a very much smaller size.

Bornia floridana n. sp.

PLATE 45, FIGURE 2.

Oligocene sands of Oak Grove, Santa Rosa County, Florida; Burns.

Shell thin, compressed, smooth, or with faint incremental lines, brilliantly polished, the prodissoconch obvious; teeth short, the anterior left lamella most prominent, the posterior lamella feeble; hinge normal, form as figured. Alt. 5, lon. 6.6, diam. 1.75 mm.

This species is more compressed, less trigonal, and more elevated in proportion than *B. dodona*, as the figure shows. The proportional elevation seems to increase with age. All the valves obtained were more or less imperfect.

Bornia mactroides Conrad.

Lepton mactroides Conrad, Journ. Acad. Nat. Sci. Phila., vii., p. 151, 1834; Fos. Medial Tert., p. 19, pl. 10, fig. 5, 1838.

Erycina mactroides Orbigny, Prodr. Pal., iii., p. 115, No. 2153.

Kellia mactroides Conrad, Proc. Acad. Nat. Sci. Phila., vol. i., p. 310, 1843.

Miocene of Maryland, near Easton, at Barker's landing, Choptank River, Dover Bridge, Governor's Run, and Peachblossom Creek; Burns, Harris, and Maryland Geological Survey.

This species differs from the next in its more triangular form, pointed ends, mesially compressed disk, and more cuneate vertical section, the shell being quite inflated dorsally and compressed towards the base.

Bornia triangula n. sp.?.

Kellia triangula H. C. Lea, MSS., in Coll. Acad. Nat. Sci. Phila. (Petersburg, Va.).

Miocene of the coastal plain; three miles west of Centreville, Maryland; York River and Petersburg, Virginia; Duplin County, North Carolina; at the Natural Well and Magnolia; and at Darlington, South Carolina; Pliocene of the Caloosahatchie and Shell Creek, Florida.

This is the most common fossil species of our Tertiary. It occurs quite plentifully sometimes, and is readily distinguished from *B. mactroides,* as a rule, by its shorter, more triangular, and less flexuous shell and the other features mentioned under *B. mactroides.* The outline is quite uniform as a whole, and the shell almost always easily separated from *B. mactroides,* for which reason I have retained Lea's unpublished name, though I do not feel wholly confident that both these forms may not eventually prove to be extremes of a single species.

Bornia rota n. sp.

Plate 45, Figure 11.

Miocene of the Natural Well, Duplin County, North Carolina; Burns.

Shell small, subrotund, compressed, brilliantly polished; beaks small and low but conspicuous, valves nearly equilateral, the posterior side rounded, the anterior slightly more pointed and produced; hinge normal, the teeth very small and the posterior lamella nearly obsolete; scar of the resilium elongate; adductor scars ovate, the pallial line nearly as wide as the scars where it joins them but narrower below; margin simple, entire. Lon. 4.2, alt. 3.9, diam. 1.6 mm.

This species is exceptionally small and rounded in its outline.

Bornia lioica Dall.

Plate 25, Figure 6.

Bornia lioica Dall, Trans. Wagner Inst., iii., part iv., p. 920, pl. 25, fig. 6, 1898.

Pliocene marl of the Caloosahatchie River, Florida; Dall.

Shell thin, smooth, compressed, rounded-quadrate, brilliantly polished; nearly equilateral, the posterior portion higher, more rounded, and longer, the anterior shorter and less broad; beaks low, small, and almost pointed; dorsal margins arcuate, the anterior more rapidly descending, the basal margin nearly straight, but towards its posterior end showing four or five subequal, small radial plications which extend but a little way inward over the disk; hinge narrow, teeth normal, very small; interior feebly radially striate. Lon. 9.5, alt. 6, diam. 2.5 mm.

A single valve of this beautiful species was obtained in the marl.

Bornia Mazyckii Dall.

PLATE 25, FIGURE 8.

Bornia Mazyckii Dall, Trans. Wagner Inst., iii., part iv., p. 920, pl. 25, fig. 8, 1898.

Pliocene marls of the Caloosahatchie River, Florida; Dall.

Shell ovate, compressed, subequilateral, faintly concentrically striated, brilliantly polished; beaks low, small, the prodissoconch obvious; hinge narrow, with, in the left valve, a long, narrow posterior lamella, mostly low and feeble, with a small triangular elevated part distally, below this a short resiliary scar near the umbo, and anteriorly two small, short lamellæ, one directly under the umbo, the other larger, longer, and more oblique and the hinge-plate in front of it flattish; in the right valve the teeth are similar with the hinge-plate grooved above them; posterior part of the shell slightly longer, interior faintly radially striated, margins entire. Lon. 11.5, alt. 8.7, diam. 3.8 mm.; a larger fragment was originally about 13 mm. long.

This species appears to be rare. Its outline is not unlike that of *"Montacuta" Bowmani* Holmes (Post-Pl. Fos. S. Car., p. 30), but that shell is described and figured as having the hinge of *Rochefortia*. The horizon to which *M. Bowmani* belongs is not mentioned by Holmes. The present species is named in honor of Mr. W. G. Mazyck, of Charleston, South Carolina.

"Lepton" longipes Stimpson (Proc. Boston Soc. Nat. Hist., v., p. 111, Feb., 1855), from South Carolina, is a *Bornia* so far as the shell is concerned, but the soft parts exhibit characters intermediate between those of *Bornia* and *Lepton*. The mantle has not the hood-like prolongation anteriorly which is found in *B. corbuloides*, though it extends beyond the borders of the shell. There are two long anterior cirrhi and one posterior, dorsally situated, in Stimpson's shell; the foot is very extensile and the posterior portion has a cylindrical extension, distally pointed, from the apex of which a byssal secretion may be ejected. For these reasons I have proposed the sectional name of *Ceratobornia* for this and other species which may eventually prove to have a similar organization.*

* Proc. U. S. Nat. Mus., xxi., No. 1177, p. 889, pl. 88, figs. 10, 11, 13, 1899.

Genus **KELLIA** Turton.

Kellia Turton, Dithyra Brit., p. 56, 1822. Sole ex. *K. suborbicularis* Mtg. (sp.), p. 57, pl. 11, figs. 5-6.

Tellimya, Sect. I., Brown, Ill. Rec. Conch. Gt. Brit., pl. 14, figs. 12-13, 1827; 2d ed., p. 106, pl. 42, figs. 12-13, 1844; sole species (under several names) *T. suborbicularis* Mtg.

Tellimya I., Brown, Zool. Textb., p. 460, 1833; ex. cited *T. suborbicularis* Mtg. (sp.), pl. 90, fig. 14.

Chironia Deshayes, Revue Zool., p. 356, 1839; Mag. de Zool., pl. 11, 1840. Type *C. Laperousii* Desh.

Oronthea Leach, Moll. Gt. Brit., p. 274, 1852.

Goodalliopsis R. and M-C., Journ. de Conchyl., xi., p. 195, 1863. Type *G. Orbignyi* R. and M-C., *loc. cit.*, p. 195, pl. 8, fig. 3; = *Erycina terminalis* Desh., An. s. Vert. bas. Paris, i., p. 713, pl. 50, figs. 38-41, 1860; Cossmann, Cat. Ill., ii., p. 80, pl. 5, figs. 12, 13, 1887.

Zoë Monterosato, Giorn. Sci. Nat. Econ. Palermo, xiii., p. 69, 1878 (not of Philippi, Crust., 1840). Type *Lasæa pumila* S. Wood.

?Divarikellia Cossmann, Cat. Illus., p. 71, 1887. Type *Kellia nitida* Caillat, Desh., An. s. Vert. bas. Paris, p. 705, pl. 50, figs. 5-7, 1868.

Kellya Fischer, Man. Conch., p. 1025, 1887.

There is no question about the type of the genus *Kellia,* which some years later served also as the type of the genus *Tellimya* Brown and *Oronthea* of Leach. *Chironia* Deshayes is based on a large Californian species of *Kellia* in which the hinge is better developed than usual in the genus, having in its best estate two short, so-called cardinals in each valve, one left and two right posterior laminæ. Poorly developed specimens of this species have a hinge exactly like the average *Kellia suborbicularis,* while the latter in exceptionally well-developed specimens shows traces of the extra laminæ referred to. As in so many others, the shells of this genus show a diminished development of the hinge correlated with reduced size and greater depth of habitat. Some of the minute abyssal species retain only one small tooth in each valve. The genus *Goodalliopsis* of de Raincourt and Munier-Chalmas has the same dental formula as *Kellia,* of which it appears to be merely a small compressed species. The gills of *Kellia* are normal; that is, they have both direct and reflected inner and outer laminæ. The viscera are contained within the body mass.

The group may be divided as follows:

Section *Kellia* Turton s. s. Type *K. suborbicularis* Mtg.

Shell rounded and inflated, concentrically striated or smooth; with an obsolete amphidetic external ligament and a large, strong internal resilium without a lithodesma; in its fullest development with two anterior and two posterior teeth in each valve, of which the anterior ones are shorter and usually regarded as "cardinals," which may be concrescent at their umbonal ends, forming a $\wedge$-shaped tooth, or may be free and pustular; the interior face of the valves commonly shows radial striation and the valves are frequently distorted through the effect of the nestling habit. The species retain the young between the valves until pretty well grown, and these young are much more compressed than the adult shells. In many species the dental formula is not fully represented by developed teeth.

Section *Mancikellia* Dall, 1899 (*Zoë* Monterosato, non Philippi). Type *K. pumila* S. Wood.

Shell minute, rounded; hinge with a minute right cardinal in line with a more distant anterior lamina, right posterior lamina distant, feeble; a feeble or obsolete anterior and posterior lamina in the left valve. The posterior laminæ are sometimes wholly absent. (See my recent "Synopsis North American Leptonacea.")

Section *Kelliola* Dall, 1899. Type *Kellia symmetros* Jeffreys.

Shell minute, oblong, turgid, posterior end short; with a strong internal resilium behind the beaks and a single relatively stout anterior tooth in each valve, that of the right valve stouter.

Section *Divarikellia* Cossmann. Type *K. nitida* Caillat.

Shell oblique, rounded; hinge-plate excavated, the edge inflected to serve as laminæ; the cardinals obsolete or absent; the interior of the valves with elevated radial liræ which hardly affect the smoothness of the outer surface.

Anomalokellia Cossmann seems to us better placed as a section of *Erycina*, and *Planikellia* is more closely related to *Lepton*. *Kelliopsis* Verrill and Bush is synonymous with *Aligena* Lea.

Kellia sp. indet.

Miocene of Barker's Landing, Choptank River, Maryland; Harris.

Shell oblong, moderately convex, equilateral, externally smooth or with feeble concentric sculpture; beaks low and inconspicuous; dorsal margins sloping, ends rounded, base arcuate. Lon. 9.5, alt. 7.5, diam. 4 mm.

A single left valve of a species singularly resembling *Kellia Laperousii* Desh. of the Pacific fauna was collected as above indicated. Unfortunately, the hinge was incrusted and worn, so that the generic characters cannot be determined in a satisfactory manner. It is noted here in order that the genus may be detected if present in these beds.

All the species of *Kellia* reported in the literature from the Tertiary of the eastern United States belong to other genera, chiefly *Bornia* and *Aligena,* under which they will be found referred to. *Kellia Laperousii* Deshayes is not uncommon in the Pleistocene of the Pacific coast, but does not seem to have been reported from the older formations. It is extremely variable in form. *Bornia luticola* Val. (Voy. Venus, pl. 24, figs. *7a-b,* 1846) is identical with it, but *Ungulina luticola* Val. (*op. cit.,* pl. 24, fig. 5) is a worn specimen of *Petricola carditoides* Conrad.

Kellia suborbicularis Montagu.

Mya suborbicularis Montagu, Test. Brit., pp. 39, 564, pl. 26, fig. 6, 1804.

Kellia suborbicularis Turton, Dithyra Brit., p. 57, pl. 11, figs. 5, 6, 1822.

?Lepton fabagella Conrad, Am. Mar. Conch., ii., p. 53, pl. 11, fig. 3, 1831; Tryon, Mar. Conch., p. 173, pl. 33, figs. 442-44, 1873.

?Kellia fabagella Conrad, Proc. Acad. Nat. Sci. Phila., i., p. 310, 1843.

?Montacuta Gouldii Thomson, Am. Journ. Conch., iii., p. 33, pl. 1, fig. 15, 1867; Tryon, Mar. Conch., p. 172, pl. 33, fig. 441, 1873.

Pleistocene of California, at San Diego and San Pedro Hill; Hemphill. Recent on the European shores south to Madeira, on the coast of southern New England, and in California.

An examination of Thomson's types in the Academy of Natural Sciences shows that they belong to the genus *Kellia* and are identical with the shell identified by Verrill and others with *Kellia suborbicularis* from New England. The *Lepton fabagella* of Conrad, afterwards referred by him to *Kellia,* is probably the same species, having been obtained in Narragansett Bay only a short distance from Thomson's locality, while the figures are very similar. Conrad's type is lost, and absolute certainty about the species is, therefore, unattainable. I have not thought it worth while to give the long list of European synonyms. It is noticeable that the specimens so far obtained on the New England coast, while externally very similar to the European shell, are more delicate and decidedly smaller than the average of the latter. No specimens like the average adult British *suborbicularis* have ever been obtained on the New England coast. The hinge armature is more slender, the resilium weaker but proportionately longer and decidedly more calcareous than in the British shell. It is probably most prudent therefore for the present to treat the New England shell as a variety, for which Thomson's name may be retained in a varietal sense. The Californian specimens are more like those from Britain, though often difficult to discriminate from the young of *K. Laperousii.*

Genus **THECODONTA** A. Adams.

Thecodonta A. Adams, Ann. Mag. Nat. Hist., xiii., p. 308, 1864. Type *T. Sieboldii* A. Adams, *op. cit.,* Japan.

Shell oval, very inequilateral, the beak nearly terminal in front, hinge with an arcuate short left anterior lamella, behind which is a triangular shelf for the resilium, the posterior lamella long, narrow, separated from the dorsal margin by a narrow groove, the distal portion slightly elevated, then depressed, and rising beyond the depression in a second elevation corresponding to a posterior lateral; pallial area faintly radiated, basal margin entire; right valve unknown.

The long side in this group is posterior, while in *Rochefortia* it is anterior and in this group the posterior and anterior teeth are very unequal in length. I am indebted to Mr. Edgar A. Smith of the British Museum for a careful drawing of the hinge of the type specimen.

?Subgenus *Serridens* Dall. (*Pristiphora* Cpr., 1866; not Blanchard, 1835.)

Shell like *Thecodonta,* but the resilium planted on the inner surface of the valve, not on a shelf, the posterior lamella simple and the teeth proximally finely cross-striated. Type *Pristiphora oblonga* Cpr., Proc. Cal. Acad. Sci., iii., p. 210, 1866. San Pedro, California.

In 1864 (Suppl. Rep. Br. Assoc. for 1863, pp. 611, 643) Carpenter used the name *Pristes* for an undescribed species of shell allied to *Rochefortia,* but when he came to describe it, regarding *Pristes* as preoccupied (Latham, 1794), he proposed the name *Pristiphora* (Proc. Cal. Acad. Sci., iii., p. 210, 1866, sole example *P. oblonga* Cpr., *loc. cit.;* not *Pristiphora* Blanchard, Hymenoptera, 1835), which was also unavailable.

?Subgenus *Dicranodesma* Dall.

Shell rounded-trigonal, in general like *Serridens,* but with the anterior tooth elevated and conical, the hinge-plate excavated, the posterior lamella smooth, stout, and elevated in the left; thin, high, and marginal below a wide groove in the right valve; muscular impressions rounded, small, dorsally situated; pallial area smooth, basal margins entire. Type *D. calvertensis* Glenn. Miocene of Maryland.

I am in some doubt as to whether this form and *Serridens* are to be referred to *Thecodonta* as subgenera, or should form a group apart. The chief difference lies in the spoon-shaped process for the resilium in the latter, while in the former two the resilium is directly applied to the valve.

Thecodonta? (Dicranodesma) calvertensis Glenn.

PLATE 45, FIGURES 23, 24.

Miocene of Maryland at Plum Point; Maryland Geological Survey.

This is a peculiarly solid little shell, convex, polished, and unusually trigonal, with a particularly solid hinge, conical anterior, and stout lamelliform posterior teeth, and small adductor scars. It measures 4.6 mm. in length, 3.5 in height, and about 3 in diameter. It was obtained by Mr. L. C. Glenn of the Survey, who will fully describe it in a forthcoming publication of the Maryland Survey.

Genus **ROCHEFORTIA** Vélain.

Montacuta (sp.) Turton, Dithyra Brit., p. 60, 1822 (*M. bidentata* Mtg.).

Anatina (sp.) Brown, Ill. Conch. Gt. Brit., 1st ed., 1827. *A. bidentata* (Mtg. sp.) Brown, *op. cit.*, pl. 11, figs. 8, 9.

Tellimya, Sect. ii. (sp.), Brown, Ill. Conch. Gt. Brit., 2d ed., p. 107, 1844.

Rochefortia Vélain, Comptes rendus, July 24, 1876; Fauna St. Paul et Amst., p. 133, 1877. Type *R. australis* Vélain, *op. cit.*, p. 133, pl. v., figs. 9-11 (bad); Bernard, Bull. Mus. d'Hist. Nat., 1898, p. 82, fig. 4.

Tellimya H. and A. Adams, Gen. Rec. Moll., ii., p. 478, 1857, type *T. bidentata* Mtg.; not of Brown, 1827.

> *Sphenalia* S. Wood, Suppl. Crag Moll., iii., p. 126, 1874. Type *S. donacina* S. Wood, *loc. cit.*, Jeffreys, P. Z. S., 1881, p. 698; Fischer, Man. Conch., p. 1027, 1887.

Mysella Angas, P. Z. S., 1877, p. 176. Type *M. anomala* Angas, *op. cit.*, pl. xxvi., fig. 22 (very bad); Dall, Proc. U. S. Nat. Mus., xxi., pp. 876, 890, June, 1899.

The name *Tellimya,* as of Brown, has had a considerable currency, owing to Adams's use of it with *T. bidentata* as the type. But *T. bidentata* was not included among the original Tellimyas of 1827. It was referred to *Anatina* by Brown in the publication in which he first proposed the genus *Tellimya,* and consequently cannot be used as a type for that genus.

The original *Tellimya* was divided into two * sections by its author, contain-

* By a very natural mistake Miss Bush (Science, N. S., x., p. 250) has stated that Brown (in 1844) divided his genus *Tellimya* into *three* sections. The supposed third section (Brown, p. 107) is really a section of the family *Mactracea* and not of the genus *Tellimya;* and the confusion arises from the fact that Brown subdivides not only the genus but the family into groups which he calls sections, which are printed in the same type and have their Roman numerals frequently incorrect.

ing respectively short orbicular species and elongate species, and in 1833, and subsequently, Brown cited *Kellia suborbicularis* as an example of the former, making this section an exact synonym of *Kellia,* as all Brown's orbicular Tellimyas were varieties of this species. All the original species of the second section are referable to the prior genus *Montacuta,* the first one of the list being *M. ferruginosa. T. bidentata* was not included with them until 1844, so that the name *Tellimya* must be dropped absolutely into synonymy.

The next name which might be applied to this group is *Sphenalia* S. Wood, which was given to a very peculiar little Pliocene and recent shell which may prove to be possessed of generic rank when the soft parts come to be known.

Jeffreys, however, was in error in supposing that there is no internal resilium. It is present as in *Rochefortia,* and I am unable to make out on his unique recent specimens any evidence of an external ligament. In the uncertainty as to anatomical characters and in view of the peculiarity of the shell it seems best not to extend the scope of *Sphenalia* so as to make it cover species like *T. bidentata.*

In 1877 Angas described and figured badly two small Australian shells which he called *Mysella.* The types were presented to the British Museum and reported on by Mr. Edgar A. Smith (Ann. Mag. Nat. Hist. for Sept., 1891, p. 235), who found no characters differentiating them from the group then called *Tellimya* as represented by *T. bidentata.* I owe to the ever-ready courtesy of Mr. Smith a careful drawing of the hinge of Angas's type *Mysella anomala,* and entirely agree with his determination of its generic relations. I have also been able to study specimens of Angas's second species, *M. donaciformis,* which possesses the same type of hinge. As I have already shown, the name *Tellimya* not being available, *Mysella* might be used for the group, and in my synopsis of the recent and Tertiary Leptonacea of North America and the West Indies, above cited, I adopted it. There is, however, a name still prior to *Mysella,* but which from the figures and descriptions given by its author seemed to differ too much to be safely united with it in the absence of specimens. This is *Rochefortia* Vélain (1876). Since the publication of my synopsis I have received a copy of a paper by the late F. Bernard on the lamellibranchs of St. Paul Island, in which he gives excellent figures of *Rochefortia* from the type specimens. He points out that it is identical with the so-called *Tellimya,** a conclusion which I heartily accept.

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* Identified in Bernard's paper as *Montacuta bidentata.*

We therefore arrive at the conclusion that the name *Rochefortia* must be adopted for the genus, which may be characterized as follows:

Shell small, ovate or rounded-quadrate, anterior end longer; hinge with a short internal subumbonal resilium and traces of an amphidetic, obsolete, external ligament; on either side of the resilium the cardinal margin bears a simple oblique lamina, the pair divaricating from the umbo and without any hook at the proximal ends; they are separated usually in one valve from the dorsal margin by a groove parallel to it, and above this groove the margin in some cases is thickened so as to form another lamina; the single laminæ of the opposite valve, sometimes represented only by inflected and bevelled extensions of the valve margin, are received into the grooves above the laminæ of the first-mentioned valve, are often longer than the latter and themselves of unequal length; the double short laminæ, when both are present, are usually in the left valve, and the right anterior lamina is longer than the right posterior one. From Bernard's researches into the development of the hinge it is evident that these laminæ represent the secondary laminæ of such forms as the *Veneridæ* before the latter break up into cardinal and lateral teeth properly so called; but in rare instances the laminæ of the present group begin to show signs of a tendency to separate, so that the distal portions are more elevated than the medial part and the former might be taken for laterals and the proximal ends for obscure cardinals, which in a genetic sense they really are. The ventral portion of the resilium carries a calcareous coating which in well-developed specimens is distinguishable as a lithodesma or "ossicle." Type *R. australis* Vélain.

Subgenus *Rochefortia* s. s.

Shell ovate or rounded-trigonal, periostracum adherent, usually polished; individuals free or domiciliary in the burrows of crustaceans.

?Subgenus *Pythinella* Dall.

Shell transverse, with a basal insinuation; periostracum rude, individuals commensal with and (?) attached by a byssus to the bodies of crustacea; hinge as in *Rochefortia*. Type *Montacuta cuneata* Verrill and Bush; North Carolina.

This subdivision corresponds, in the line of *Rochefortia*, to *Pseudopythina* in the line of *Erycina*, *Pythina* in the line of *Bornia*, and *Hindsiella* in the line of *Sportella*.

?Subgenus *Sphenalia* S. Wood.

Shell minute, subquadrate, with the umbones nearly terminal, hinge disproportionately small, with two very small and short lamellæ in the left valve, a minute resilium between them (probably without a lithodesma), and in the right valve two minute inflected projections of the cardinal margin taking the place of lamellæ. Type *S. donacina* S. Wood. Pliocene and recent.

Rochefortia Stantoni n. sp.

PLATE 43, FIGURE 11.

Miocene of the Natural Well in Duplin County, North Carolina, Burns; Wilmington, North Carolina, T. W. Stanton.

Shell minute, convex, elongate-ovate, quite inequilateral, the anterior end much longer; surface with faint incremental lines, polished; dorsal margin arcuate in front, descending behind the umbo; ends rounded, an oblique nearly straight bit of margin intervenes between the posterior rounded end and the arcuate base, as if a little of the edge had been shaved off; beaks low, hinge with small lamellar teeth the anterior nearly twice as long as the posterior, resiliary notch small; adductor scars high, rather large, and distinct; margin simple, entire. Lon. 3.6, alt. 2.4, diam. 1.5 mm.

This curious little species recalls *R. Verrillii* Dall (*M. tumidula* Verrill and Bush, Proc. U. S. Nat. Mus., xx., p. 781, pl. 94, figs. 1-2, 1898; not of Jeffreys, Brit. Conch., v., p. 177, pl. 100, fig. 5, 1869), but is a much more solid shell, more cylindrical, and less tumid near the beaks.

These small shells are very puzzling, as their range of variation is for the most part unknown, and they require a good light and strong magnification to bring out their characters.

Rochefortia Stimpsoni n. sp.

PLATE 45, FIGURE 5.

Miocene of the Natural Well and Magnolia, Duplin County, North Carolina; Burns.

Shell small, somewhat compressed, thin, frequently somewhat irregular, and variable in outline; surface marked by obvious incremental lines, not polished, nearly equilateral, rounded, anterior part slightly wider, hinge narrow, resiliary pit directly under the low inconspicuous umbo, with a short recurved oblique lamella on each side of it, the lamellæ nearly equal; adductor scars rather large, the anterior smaller; pallial line simple, high up on the disk. Lon. 6, alt. 5, diam. 2 mm.

This species recalls *R. striatula* Verrill and Bush, but is larger, less distinctly truncate, less regular in form, and somewhat smoother and more convex. The specimens of *R. striatula* I have compared with it have, as a rule, smaller and less stout dental lamellæ.

Rochefortia bidentata Montagu.

Mya bidentata Montagu, Test. Brit., p. 44, pl. 26, fig. 5, 1803.

Montacuta bidentata Turton, Dithyra Brit., p. 60, 1822; Forbes and Hanley, Brit. Moll., ii., p. 75, pl. 18, figs. 6, 6*a*, 1853; Jeffreys, Brit. Conch., ii., p. 208, pl. 5, fig. 1, 1863; v., p. 177, pl. 31, fig. 8, 1869; not of Verrill and Bush, Proc. U. S. Nat. Mus., xx., p. 779, pl. 93, figs. 7, 8, pl. 94, fig. 6, 1898; not of Gould, Inv. Mass., p. 59, 1841.

Anatina bidentata Brown, Ill. Conch. Gt. Brit., 1st ed., pl. 11, figs. 8, 9, 1827.

Mesodesma exiguum Lovèn, Ind. Moll. Scand., p. 42, 1846.

Tellimya bidentata Brown, Ill. Conch. Gt. Brit., 2d ed., p. 107, 1844; H. and A. Adams, Gen. Rec. Moll., ii., p. 478, 1857.

Erycina faba Nyst + *E. nucleola* Récluz, *fide* Jeffreys.

Mysella bidentata Dall, Synopsis Lept. N. Am., p. 890, 1899.

Pliocene of Italy, Great Britain, and Ireland; Pleistocene of Norway; recent from Finmark to the Mediterranean and at Madeira.

The *Montacuta bidentata* of Gould, in 1841, is *Aligena elevata* Stimpson (sp.) non Mörch. The true *R. bidentata* is not known from America, the shell known by that name is the following species:

Rochefortia planulata Stimpson.

Plate 45, Figure 7.

Kellia rubra Gould, Inv. Mass., p. 60 (*ex parte*), pl. 2, fig. 33, 1841; not of Turton, Dithyra Brit., p. 58, 1822.

Kellia planulata Stimpson, Shells of New England, p. 17, 1851; Verrill, Inv. An. Vineyard Sound, p. 688, pl. 30, fig. 6, 1873; Dall, Bull. 37, U. S. Nat. Mus., p. 48, 1889.

Lasæa planulata Jeffreys, Ann. Mag. Nat. Hist., Oct., 1872, p. 239.

Montacuta bidentata Verrill and Bush (and vars. *tenuis* and *fragilis* V. and B.), Proc. U. S. Nat. Mus., xx., p. 779, pl. 93, figs. 7, 8, pl. 94, fig. 6, 1898.

Mysella planulata Dall, Synopsis Lept. N. Am., p. 890, 1899.

Pliocene of the Caloosahatchie marls of Florida; Pleistocene of the Gulf of Maine; recent from Massachusetts Bay to Cape Hatteras and on the coast of Texas (var. *fragilis*) and from Wood's Holl, Massachusetts, to Cape Hatteras, North Carolina (var. *tenuis*).

The variety *tenuis* of Verrill and Bush is distinguished from the typical *planulata* (which is the same as their *M. bidentata* var. *fragilis*) by its larger and thicker hinge laminæ and usually more solid shell. These teeth vary, however, in different individuals so much that it is almost impossible to separate a large series without finding a fair proportion of strictly intermediate specimens, and I find the same true of the original *R. bidentata,* of which I have examined a very large series covering all parts of its geographical range.

These small shells are very puzzling and require close study to discriminate, but I think no one who had gone carefully over the series in the Jeffreys collection would hesitate to pronounce the European and American shells distinct. The former are smaller, more convex, more inequilateral, more quadrate, more elongate, and have smaller dental lamellæ than the average American specimens, and I have not found any adult specimens which could be called intermediate.

The *Kellia rubra* of Dr. Gould in 1841 was a mixture of two species, one of which was *Turtonia minuta,* and the other, which he figured, the present shell, to which Stimpson in 1851 gave the name here adopted. What Dr. Gould thought were the young and found among the roots of seaweed, as he himself informed me, were the *Turtonia.* The *Rochefortia,* when containing the dried remains of the animal, has a ruddy tinge and a pale-brown epidermis, which are lost in the washed valves found on the beach. In Binney's edition of Gould *K. planulata* is rather badly figured and no scale is given for the magnified illustration. Both the typical form and the variety *tenuis* occur in the Caloosahatchie marls. The *R. striatula* V. and B. and the *R. Molleri* Mörch (*Montacuta elevata* Mörch, 1875, not Stimpson, 1851) have also been confused by authors with *R. planulata,* from which both are easily discriminated when the characters are pointed out and carefully studied. Miss Bush states (Science, N. S., x., p. 250, Aug. 25, 1899) that the *Lasæa planulata* of Verrill's Checklist of 1870, dredged at Halifax, Nova Scotia, by the United States Fish Commission, is not Stimpson's species but *R. Molleri.*

Genus LASÆA Leach.

Lasæa (Leach) Brown, Ill. Con. Gt. Brit., 1st ed., pl. 20, figs. 17-18, 1827; 2d ed., p. 93. pl. 36, figs. 17-18, 1844; Zool. Textb., p. 451, 1833; Conch. Textb., p. 128, 1833. Type *Cardium rubrum* Montagu; Gray, Ann. Mag. N. Hist., xx., p. 272, 1847.

Lasea Gray, P. Z. S., 1847, p. 192; Moll. Gt. Brit., p. 289, 1852.

Autonoë Leach, Moll. Gt. Brit., p. 288, 1852; *C. rubrum* Mtg.

Cycladina Cantraine, Bull. Acad. Brux., ii., p. 399, 1846. Type *Chama poron* Adanson = *C. Adansonii* Cantr.

Poronia Récluz, Rev. Zool., p. 166, 1843 (*Chama poron* Adans.); Philippi, Zeitschr. Mal. f. 1847, p. 72.

Anapa Gray, P. Z. S., 1847, p. 186. Type *Erycina petitiana* Récluz (= *Lasæa rubra* Mtg.).

Kellia (sp.) Turton, Dithyra Brit., p. 57, 1822; Forbes and Hanley, Brit. Moll., ii., p. 94.
Bornia (sp.) Philippi, Moll. Sicil., p. 14, 1836; Deshayes, Moll. Algerie, 1, Atlas, p. 103, pl. 43, figs. 8-11 (*B. seminulum* Phil.).

The diphthong in the second syllable was used by Brown, a particular follower and friend of Leach, in the original publication, so there seems no reason to doubt that it should be retained.

Lasæa is remarkable for having gills in which the inner lamina is both direct and reflected, while the outer one is represented by the direct portion only. The hepatic and generative glands are included within the general mass of the body.

The known species are nestlers, adhering by a byssus to the rugosities of calcareous algæ, barnacles, etc., and the young are long retained within the parent shell. All the species vary from a purplish red to a pale-greenish yellow and show a coarse epidermis under the microscope. The hinge shows a great crudeness and, as it were, an amorphous constitution. Hardly any two individuals will show exactly the same development and form of the teeth. Normally there are in the left valve two laminæ diverging from the subumbonal region, where there is a minute pustular " cardinal." In the right valve a similar " cardinal" and on each side of it a pair of laminæ between which the single lamina of the opposite valve is received. The so-called cardinal exists in less than half the specimens examined, sometimes in one valve of a pair and not in the other. The laminæ are irregular, and part of them often missing. The resilium is enormous in proportion to the size of the shell, its ventral surface with, in fully developed specimens, a thick, chalky layer which might perhaps be regarded as a lithodesma. The resilium is inserted along the ventral margin of the hinge-plate or laminary platform.

The individual variation of these little shells is so great as to lend some countenance to the old supposition that there is but one widely distributed species in the genus. On the " new school" basis twenty-five or thirty species must exist in British waters alone. I am inclined to believe that there are two species, one Indo-pacific and Antarctic, the other common to the eastern North Pacific, Florida, Bermuda, and European waters. There is great difficulty in finding any constant differential characters, if they exist. *Lasæa rubra* (Mtg.) Brown is found in Southern California and Mexico, has very recently been discovered in south Florida at Fort Worth by Dr. Pilsbry, has long been known from Bermuda, and is a common European shell. The course indicated by these localities is one which might coincide with the ocean currents were the former passages across the American isthmus still open.

The Bermudian form has recently received a specific name from Miss Bush (*L. bermudensis* Bush, *Science,* Aug. 25, 1899, p. 251). After examination of some hundreds of specimens from some forty localities, and careful study of quite a number under a compound microscope, I have so far failed to find any constant differences between the Bermuda shell and the ordinary *L. rubra.* In a general way the former is a little rounder in form on the average than the average *rubra,* but no more so than many British specimens. The largest specimen I have seen, from the Channel Islands, is considerably larger than the largest *L. bermudensis* I have found. As in nearly all cases, however, the average specimens from southern waters will exceed in size specimens of the same species from the north unless the species is boreal. When we remember that southern Florida, as late as Miocene times, was an island, and that *Lasæa* is a species which does not appear to live on purely sandy shores like those of the Carolinas, we can understand why the species may have reached and flourished on the coral rocks of Bermuda while it failed to progress northward on the mainland.

In the separation of " species" much must be allowed for personal equation. Yet I cannot refrain from expressing the opinion that many of the more interesting and important interrelations of animals must be lost sight of if we subdivide beyond a certain limit. Some allowance must be made in any rational system for individual variation in any given habitat, and for the other set of variations which seem to depend upon geographical distribution.

Small shells like *Lasæa,* which attach themselves by a byssus to algæ, may be widely distributed by ocean currents. Differences of temperature and food cannot fail to make their mark upon the different colonies. When, in addition, we have a normal crudity and want of definition in the hinge characters throughout the genus, it would seem inadvisable to subdivide the type too minutely.

The species has not yet been recorded as fossil in America, though very probably it may be found hereafter in the Florida Pleistocene, as it has been already in that of Europe. The group has been included here in order that the treatment of the family may be as complete as practicable.

Lasæa rubra (Montagu) Brown.

The following measurements show the proportions of specimens from various localities; in each case the largest available specimen was measured, not an average one:

Channel Islands (Guernsey)	lon. 3.25,	alt. 2.75,	diam.	2.0 mm.
Wales (Lantivet)	" 4.00,	" 3.5,	"	2.5 mm.
Bermuda	" 3.33,	" 2.8,	"	1.5 mm.
Florida (Fort Worth inlet)	" 3.25,	" 3.0,	"	2.0 mm.
California (San Diego)	" 4.60,	" 4.0,	"	3.0 mm.
" (Monterey)	" 3.50,	" 3.5,	"	2.25 mm.

Genus **MYLLITA** d'Orbigny and Récluz.

Myllita d'Orb. and Récluz, Journ. de Conchyl., i., p. 292, 1850.

Mylitta Kobelt, Ill. Conchylienbuch, pl. 103, fig. 11, 1878.

Pythina sp. Tenison Wood, Hutton.

Type *M. Deshayesii* Récluz (as *Erycina,* 1844); D'Orb. and Récluz, *op. cit.,* pl. 11, figs. 12-14.

Shell equivalve, solid, surface punctate or sagrinate with concentric, radial, or divaricate sculpture; ligament external, obsolete, amphidetic; resilium strong, internal, seated in a conspicuous sulcus below the lower posterior lamina, the mesial portion with a calcareous coating; valves with a small anterior and posterior dorsal gape, but closed ventrally; hinge with a single left anterior and posterior lamina and a single left cardinal, right valve with a cardinal and double anterior and posterior laminæ, the cardinals often bifurcate; mantle completely open below between the adductors and probably covering more or less of the exterior of the valves; pallial line simple, with large adductor scars; foot strong with a conspicuous (byssal?) sulcus, the young incubated in the generative or peripheral atrium, small, vitreous, and numerous.

Five species from New Zealand, Australia, and Tasmania. The triangular pallial sinus of the original description is non-existent.

To make the description of the family more complete, the synonymy and characters of this genus are included as in some other cases.

Perrierina Bernard (Bull. du Mus. d'hist. Nat., 1897, p. 312) appears to belong in this vicinity, though in addition to the normal hinge characters it has, like *Woodia* and *Transennella,* supplementary lamellations on the hinge-line.

Family KELLIELLIDÆ.

Genus **ALVEINUS** Conrad.

Alveinus Conrad, Am. Journ. Conch., i., pp. 10, 138, 1865; Proc. Acad. Nat. Sci. Phila. for 1872, p. 53, pl. 1, fig. 6, 1872; Am. Journ. Sci., xxix., p. 467, 1885.

Lutetia Cossmann, Notes Compl., p. 13, 1894.

The type of this genus well illustrates the slipshod methods, or want of method, of Conrad. His first nude mention of the genus and species occurs in his list on page 10, where the species is called *parva,* though the generic name is masculine, but neither genus nor species is defined or figured. Subsequently, at the place where the genus and species are described (p. 138), the latter is called *minuta* instead of *parva* and, with all the other species described in the article, is said to come from Enterprise, Mississippi, though Dr. Spillman informed the Hon. T. H. Aldrich that he had not sent Conrad any fossils from Enterprise, but did send him some from the Jacksonian beds of Garland's Creek in Clarke County, whence these fossils are doubtless derived. As the name *parva* was never defined, it appears that *minutus* will be the first valid name applied to the type of this genus. This is misspelled *mimatur* in the synonymy of the species given by De Gregorio (Mon. Claib., p. 210).

This genus is closely related to *Lutetia* Deshayes, and they have been united by Cossmann, but a prolonged study leads me to a different conclusion. The differential characters are as follows:

Lutetia Deshayes: Hinge with a well-marked nymph for an external ligament; right valve with three laminæ, a posterior straight one nearly parallel with the hinge-margin, in front of which is a larger one bent at an obtuse angle just below the beak; and, lastly, a small tubercle immediately under the angle of the last. Between the posterior tooth and the nymph the hinge-plate is flat with no indication of an internal resilium in either valve. The left valve also has three teeth, a straight anterior and posterior lamina radiating from the beak, and between and below them a short lamina obtusely angular in the middle.

Alveinus Conrad: Hinge with a very feeble nymph only noticeable on the largest and most fully developed specimens, and under the beaks a deep, well-marked pit for an internal resilium. Right valve with two teeth, parallel with each other and with the hinge-line, proximally elevated and with the upper edges bent over and towards each other. Left valve with a single tooth bent like a figure seven, the proximal arm shorter and with a small projection or angular thickening on the ventral side at about the middle; above this tooth the subumbonal margin is sometimes thickened, with a groove between it and the lamina. The posterior shell margin for about a third of the circumference is prominent and is received in a groove in the corresponding margin of the right valve. This grooving is occasionally continued nearly round the shell both in *Lutetia* and *Alveinus,* at other times the margin is flattened or simple.

These differences seem to me sufficient to separate the groups, though perhaps of less than generic value.

A minutus ranges from the Claibornian (Alabama, Louisiana, Arkansas) into the Jacksonian, and, after an examination of a great many, only one valve, about twice the usual size, showed the groove for an external ligament.

Alveinus rotundus n. sp.

PLATE 45, FIGURES 25, 28.

Oligocene marl of the Chipola River, Calhoun County, Florida; Burns.

Shell resembling *A. minutus* Conrad, but smaller, more inflated, more elevated, more nearly equilateral, and with a proportionately heavier and more solid shell. No trace of attachment for an external ligament could be found on any of the specimens. Alt. 1.9, lon. 2, diam. 1.2 mm.

At first this species was regarded as merely a local race of *A. minutus,* but the comparison of many specimens showed the characters to be constant, and the difference of horizon in the geologic column is quite marked, so I have thought it best to treat it as a species.

The study of these minute forms is very difficult; even with a compound microscope various lights and a good series are needed to bring out the characters. A very slight amount of wear or solution suffices to materially alter the minute teeth, and the observer has to be constantly on his guard against being misled.

Genus KELLIELLA Sars.

This little genus is represented in the Jacksonian by *K. Boettgeri* O. Meyer, described in the Bulletin of the Alabama State Geological Survey, No. 1, p. 83, pl. 3, figs. 15, 15*a*, 1886. A recent species, *R. nitida* Verrill, is known from the Atlantic coast in deep water, and we may expect that other Tertiary horizons when thoroughly searched will prove to include this genus.

Genus PAULIELLA Munier Chalmas.

Paulielta (*Bernardi*) Mun. Chalm., Comptes Rendus, som., 1895, pp. liv.-lv.; Bernard, Bull. Mus. d'hist. Not., 1898, p. 84, figs. 6-7.

This remarkable little genus resembles *Lutetia* in a general way, but is characterized by having three anterior laminæ in each valve.

It was among the minute species collected by Vélain in the islands of St. Paul and Amsterdam in the Indian Ocean, but was not detected until lately, and is described as above.

Genus **TURTONIA** Alder.

Turtonia Alder, Cat. Moll. North. and Durham, p. 95, 1848; Forbes and Hanley, Brit. Moll., ii., p. 80, 1853; Verrill, Am. Journ. Sci., 3d Ser., iii., p. 286, pl. 7, fig. 4, 1872; Rep. U. S. Fish Com. for 1871-72, p. 687, 1873. Type *Venus minuta* Fabr., Fauna Grönl., p. 412, 1780.

Cyamium Jeffreys, Adams, and others; not of Philippi, 1845.

Shell ovate, smooth, closed, with an elongated external combined resilium and ligament; margins entire; hinge with, in the right valve, two stout cardinals, prolonged into slightly prominent laminæ anteriorly, in the left valve one stout and one slender arched laminar cardinal and an obscure lateral lamina entering a sulcus in the opposite valve; pallial line distinct, not sinuate, adductor scars ovate, distinct, surmounted by a smaller pedal scar from the retractors.

This genus is entirely distinct from Philippi's *Cyamium*, with which it has frequently been confounded. It has no internal ligament and the teeth are of a different character. The hinge is well figured by Verrill (*loc. cit.*, fig. 4, 1872), but the very large pedal scar indicated in his figure must have been abnormal, as I have not found it of any such size in a large number of specimens examined.

Cyamium Philippi (Arch. für Naturg., 1845, p. 50) is based upon a small translucent shell having somewhat the appearance of *Abra*. It has a strong internal resilium; an amphidetic, obsolete, external ligament; two strongly bifid cardinals in the right valve, and in the left three smaller simple cardinals. The pallial line is obscure but apparently simple, and the teeth recall those of *Cooperella* rather than of the *Leptonacea*.

Turtonia minuta Fabricius.

Venus minuta Fabricius, Fauna Grönl., p. 412, 1780.

Mya purpurea Montagu, Test. Brit. Suppl., p. 21, 1808; not of Turton, Dithyra Brit., p. 54, 1822.

Turtonia minuta Alder, Cat. Moll. North. and Durham, p. 95, 1848; Stm., Sh. of N. Engl., p. 16, 1851; Verrill, Rep. U. S. Fish Com. for 1871-72, p. 687, 1873; Dall, Bull. 37, U. S. Nat. Mus., p. 48, pl. 64, fig. 142*a*, pl. 68, fig. 7.

Turtonia nitida Verrill, Am. Journ. Sci., 3d Ser., iii., p. 286, pl. 7, figs. 4, 4*a*, 1872.

Cyamium minutum Jeffreys, Brit. Conch., ii., p. 260, pl. 5, fig. 8, 1863, v., pl. 33, figs. 5, 5*a*, 1869.

Pleistocene of raised beaches near Portland, Maine, Fuller; recent, Cape Cod to Greenland, "South Carolina," Kurtz (?); Atlantic and Mediterranean coasts of Europe, and the shores of southern Alaska and the Aleutian Islands from Nunivak Island south to Sitka, Dall.

A careful examination of a good many specimens shows that there is great variation in the outline of this little species, and, as in all these groups with imperfectly developed hinge-teeth, more or less discrepancy between the hinges of different individuals. There is no constant difference between specimens from Massachusetts, Britain, and Alaska, nor even a prevailing facies which would enable one to distinguish geographical races. *T. occidentalis* Dall, from eastern Siberia, near Bering Strait, has a more rounded form and is nearly twice the size of *T. minuta*, but I am by no means sure that it is not a mere local development of the typical species. Jeffreys states that the "pallial scar is deeply sinuous or indented," which is an error, probably arising from the individual mutation of some abnormal specimen. I have never seen one in which it was not perfectly simple and entire.

This species was referred to "*Lesæa*" Leach by Möller in 1842 (Ind. Moll. Grönl.), which is an obvious *lapsus* for *Lasæa*.

Genus **MONTACUTA** Turton.

Montacuta Turton, Dithyra Brit., p. 58, 1822. First sp. *M. substriata* Mtg. (as *Ligula*) Turt., *op. cit.*, p. 59, pl. 11, figs. 9, 10.

Tellimya II., Brown, Ill. Rec. Conch. Gt. Brit., 1st ed., 1827; 2d ed., p. 106, 1844 (1st sp. *Montacuta ferruginosa* Turton).

Montacuta Thorpe, Brit. Mar. Conch., p. 51, 1844; Gray, P. Z. S., 1847, p. 192. Type *M. substriata* Mtg., Herrmannsen, Ind. Gen. Mal., ii., 1847 (same type); Gray, List of Brit. An. B. M., p. 84, 1851.

< *Montacuta* Jeffreys, Brit. Conch., ii., p. 204, 1863; Fischer, Man. de Conchyl., p. 1027, 1887; Cossmann, Cat. Illustr., ii., p. 81, 1887; Verrill, Proc. U. S. Nat. Mus., xx., p. 779, 1898.

Tellimya sp. Dall, Bull. U. S. Nat. Mus., No. 37, p. 50, 1889.

> *Decipula* (Jeffreys MS.) Friele, Vid. Selsk. for., p. 57, 1875. Type *D. ovata* Jeffreys, *loc. cit.*

Montaguia Fischer, Man., p. 1027, 1886; not Desmarets, 1825.

Turton's first species of *Montacuta* * (*substriata*) has been regarded as the

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* The form *Montacuta* is that proposed by Turton. Desmarets three years later used the form *Montagua* for a Crustacean. Three years later still, in 1828, Fleming named a Nudibranch *Montagua;* and in 1855 Bate applied the same name to a Crustacean. In 1882 Scudder suggested that Turton's genus should be spelled *Montaguia,* which was approved of by Fischer (1887) and acted on by Locard (1898).

The present writer can see no good reason why the word should not be retained as type for more than half a century and was specifically named as such by Gray and Herrmannsen in 1847. Its characters are as follows:

Gills on each side with only the direct and reflected inner lamina developed; hepatic glands arborescent, projecting from the ordinary body wall.

Shell small, more or less transversely ovate, posterior end usually shorter; anterior part of the hinge provided, in the right valve, with a narrow lamina having a minute cardinal hook at the proximal end; the left valve with a similar lamina on which the hook is less prominent or even absent; external ligament obsolete, amphidetic, leaving no traces on the shell; resilium strong, internal, posterior, seated on nymphs of which the right one is usually less strong; the ventral surface of the resilium, in the larger species, with a thin calcareous deposit, often wholly absent and never forming a developed lithodesma; the distal portions of the laminæ sometimes obsolete.

Sections:

I. *Montacuta* s. s. Type *M. substriata* Mtg.

II. *Decipula* Jeffreys. Type *D. ovata* Jeffreys.

Teeth obsolete in the left valve; nymphs not developed.

III. *Orobitella* Dall. Type *M. floridana* Dall.

Laminæ obsolete but cardinal hooks persistent, the sockets of the resilium elevated.

An examination of the specimens of *Decipula ovata* in the Jeffreys collection shows that they differ from typical *Montacuta* by the obsolescence of the teeth of the left valve, while the resilium is inserted directly on the shell without the intervention of a nymph. I am unable to decide whether, as Jeffreys supposed, the *Tellimya ovalis* of G. O. Sars (Moll. Reg. Arct. Norv., p. 341, pl. 34, figs. 1*a-c*, 1878) is the same shell or not, as Professor Sars's figure of the hinge of his shell is quite different from the actual hinge of Jeffreys's specimens. These are from Osterfiord, Norway, and the Fosse de Cap Breton. The great difficulty encountered in getting at the characters of the hinge in these minute shells renders it likely that the differences are due to misinterpretation, and that from its deep-water habitat *Decipula* has become somewhat degenerate and has been derived from *Montacuta*, of which it may be regarded as a section.

Turton originally wrote it, though the form is not in accord with modern methods. It is at any rate in general use, and was probably proposed by Turton from the point of view that *Montagu* is itself a corrupt derivative from *mons* and *acutus*. I find that some members of the Montagu family used the form Montacute as their surname.

Between species like *M. substriata,* in which the hinge of both valves is fully developed, and those in which the cardinal hook or lamina is obsolete, or the differentiated left lamina is represented only by a bevelled inflection of the cardinal margin, there is really only a difference of degree, and a difference which may perhaps be of only specific value, and even I am inclined to suspect sometimes exhibited by individuals within the species. After a careful study of all the material at my command, recent and fossil, I find the following species among others should be referred to *Montacuta* as restricted: *M. substriata* Mtg., *M. Vöringi* Friele (N. Atlantic), *M. ferruginosa* Mtg., *M. floridana* Dall (West Florida), *M.* (*Decipula*) *ovata* Jeffreys (not *Montacuta ovata* Jeffreys, which is a *Rochefortia*), and *M. chipolana* Dall, of the Oligocene. All the species referred by Verrill and Bush ("Revision of Deep-water Mollusks," Part i., 1898) to *Montacuta* will under the present arrangement be referred to *Rochefortia.*

Montacuta claiborniana n. sp.

Plate 45, Figure 21.

Eocene sands of Claiborne, Alabama; Burns.

Shell small, thin, polished, smooth, nearly equilateral, very slightly arcuate, moderately inflated; beaks low, dorsal margin thin, evenly arcuate, passing distally into the rounded ends, of which the anterior is shorter and less high; base slightly arcuated; in the left valve the posterior dorsal margin above the scar of the internal ligament is somewhat reflected, the single minute cardinal is under the beak with a slight fold extending forward. Lon. 1.7, alt. 1.2, diam. 1.0 mm.

A single small valve was obtained from Claiborne shell sand. Though doubtless immature, it is described as being the only representative of the genus in this horizon, *M. Dalli* Cossmann being, under the present arrangement, referred to *Bornia.*

? Montacuta chipolana n. sp.

Plate 44, Figure 4.

Oligocene of the Chipola beds of Calhoun County, Florida, on the Chipola River, and in the lower bed at Alum Bluff; Dall and Burns.

Shell small, very inequilateral, the posterior side very short, dorsal and ventral margins nearly parallel, straight, passing evenly into the bluntly rounded ends; the young have the posterior end proportionately less short and the anterior end narrower; external surface polished, smooth except for faint incremental lines, shell inflated; beaks low, the subtriangular prodissoconch conspicuous; hinge with a stout, conspicuous left cardinal and a more slender prominent right cardinal; thickening of the margin over the resilium feebly developed in both valves, the anterior lamina obsolete in both; scar of the resilium large, short, scars of the adductors and pallial line normal. Lon. of a medium-sized specimen 8.5, alt. 5, diam. 4 mm. A broken specimen still measures 10 mm. in length.

This species forms the next term in a series of which in *M. ferruginosa* the laminæ are partially obsolete in front, and in *M. substriata* they are distinctly developed though small. It recalls *Sportella Whitfieldi,* but has a thinner shell and much more delicate hinge. Species of this type nearly bridge the conchological gap between *Montacuta* and *Sportella.*

? **Montacuta actinophora** n. sp.

Plate 44, Figure 2.

Upper Oligocene sands of Oak Grove, Santa Rosa County, Florida; Burns.

Shell small, rather compressed, subquadrate, the anterior end much the longer; basal and dorsal margins subparallel, anterior end evenly rounded; posterior end short, sloping above, rounded below; beaks small, low, the nepionic shell conspicuous; outer surface marked with somewhat irregular incremental lines, smooth near the beaks, elsewhere closely, evenly, sharply, radially striate, an obscure ridge extending from the beaks backward and downward; hinge-plate narrow, in the right valve with one prominent slender cardinal tooth directed obliquely forward in front of a narrow elongate sulcus for the resilium obliquely directed backward below the dorsal margin; in the left valve on each side of the sulcus is a rather obscure lamina, the anterior most prominent and longer, the posterior fitting under the posterior dorsal margin of the opposite valve, the anterior into a socket above the right cardinal; interior of the valves smooth or faintly radially striate, the muscular impressions large and rather low down, the pallial line simple and wide. Lon. 11, alt. 7.6, diam. 4.5 mm.

This is an elegant shell which has the external aspect of *Scintilla* but a different hinge. The teeth differ from those of typical *Montacuta* in the shortness of the shank of the cardinal "hook" and in the presence of a posterior lamina in the left valve, but traces of the latter may be found in several of the other species. But for the absence of any evidence of an external ligament this species might be referred to *Sportella.*

Montacuta mariana n. sp.

Plate 45, Figure 18.

Miocene of St. Mary's River and Plum Point, Maryland; Harris and the State Geological Survey.

Shell small, ovate, moderately convex, sculptured chiefly by incremental lines and faint concentric wrinkles; beaks conspicuous, showing the prodissoconch, but not high, nearly central; the dorsal margin sloping almost equally each way from the beaks, the ends rounded, the base evenly arcuate; hinge with a single small subtrigonal anterior lamina in each valve, a small oblique submarginal sulcus in each valve behind the beaks; interior of the valves smooth, muscular impressions faint but normal. Lon. 4, alt. 3.25, diam. 1.5 mm.

This species is smaller and more rounded than most of the Montacutas and is apparently rather common in the St. Mary's Miocene.

Montacuta petropolitana n. sp.

Plate 45, Figure 6.

Shell subtrigonal, rounded, moderately convex, inequilateral, the anterior side longer; external surface nearly smooth with faint incremental lines and a few minute sparsely distributed obscure granulations which may or may not be a specific characteristic; hinge with, in each valve, the anterior cardinal tooth well developed, obliquely bent forward, and the anterior lamina absent, as in the last species; the posterior thickening over the resilium is small and short, or more or less obsolete; pit for the resilium elongated, narrow, and distinct, hinge-plate flattish; surface of the shell internally smooth or faintly radially striated, the scars obscurely impressed. Lon. 5.75, alt. 4.5, diam. 2.3 mm.

Two valves were obtained by Burns in the marl at Petersburg, Virginia.

This species is puzzling and might easily be regarded as a *Sportella,* but differs by having the slender cardinal bent back obliquely instead of projecting in a straight line at right angles to the plane of the shell margin. It is also less parallel-sided than most *Sportellas,* and the general aspect is more that of *Montacuta.* From *Sportella petropolitana,* the most similar species known from Petersburg, it is distinguishable at once by its less equilateral and more trigonal shell, and the absence of the ligamentary nymphs.

Montacuta sagrinata n. sp.

PLATE 44, FIGURE 6.

Miocene of York River, Virginia; Harris.

Shell small, rounded, subequilateral, moderately inflated, thin, sculptured with incremental lines and fine broken concentric ridges more or less irregular and sometimes almost granular, with an obscure vertical constriction from the beaks (which may be an individual feature); posterior end higher and more rounded, anterior end more pointed; a single small, projecting short lamina in front of the beaks in the right valve with a rather long oblique sulcus for the resilium behind; interior mostly smooth or radially striate. Lon. 7.5, alt. 6.0, diam. 3.75 mm. A second broken valve was proportionally a good deal more elongate.

This species at first sight recalled *Aligena lineata,* which has an extremely similar surface, but the gap between the resilium and the tooth is less marked and the aspect of the shell is decidedly more like *Montacuta* than *Aligena.* If it belongs to the latter genus it is certainly not one of the described species. The beaks are decidedly lower and the shell in front of them less impressed than in any of the numerous specimens of *Aligena* I have examined.

Montacuta (Orobitella) floridana Dall.

Montacuta floridana Dall, Proc. U. S. Nat. Mus., xxi., 1899, p. 893, pl. 87, fig. 10.

Pliocene of the Caloosahatchie beds, Florida; Pleistocene of North Creek, near Osprey, Florida, Dall; living on the coast of West Florida, Simpson.

Shell subovate, inequilateral, posterior end shorter, white, inflated; beaks low, polished; sculpture of concentric lines growing gradually stronger downward and forward until on the lower anterior third they form low, stout, evenly distributed, concentrically striated lamellæ, while remaining feebler on the posterior part of the shell; base nearly straight, dorsal margin arcuated, ends evenly rounded; hinge with a prominent slender cardinal in each valve, the laminæ obsolete; sockets of the resilium thickened and raised above the inner surface of the valve. Lon. 16, alt. 10, diam. 9.5 mm.

This is probably the largest species of the genus and the anterior laminæ have entirely vanished. There is no radial sculpture visible, but under strong magnification a few fine striations can be made out on the anterior slope, which are faintly reflected on the inner anterior margin.

A broken valve of a species not unlike *M. floridana,* but less rounded and inflated, was obtained by Harris from the Miocene of the York River, Virginia, but it is too imperfect for description.

Genus ALIGENA H. C. Lea.

Aligena H. C. Lea, Trans. Am. Phil. Soc., 2d Ser., ix., p. 238, 1845. Type *A. striata* Lea, *op. cit.*, pl. 34, fig. 13 (not *Haligenes* Guenther, *Pisces*, 1859).

Laubrièreia Cossmann, Cat. Ill. bas. Paris, ii., p. 76, 1887. Type *Erycina emarginata* (Desh.), *op. cit.*, pl. 4, fig. 13.

Kelliopsis Verrill and Bush, Proc. U. S. Nat. Mus., xx., p. 783, 1898. Type *Montacuta elevata* Stm., *op. cit.*, p. 784, pl. 93, figs. 2-4, pl. 94, figs. 7-8.

Amphidesma (sp.) Conrad, Fos. Medial Tert., p. 65, 1845.

Abra (sp.) Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 574, 1863.

The genus as described by Lea included two species; the second, *A. levis* * (Lea, fig. 14), is apparently a species of *Fulcrella,* but agrees less well with Lea's generic diagnosis than the first species here cited as the type. The characteristic of this group is the possession of a rounded triangular inflated shell with only a single small anterior tooth under the beaks, separated by a gap from the surface of attachment, under the posterior dorsal margin, of an elongate internal resilium carrying a lithodesma. The pallial line is simple, and the cardinal of the left valve more feeble than the other. *Spaniodon* Reuss (Sitzb. K. K. Akad. Wien., vol. 55, p. 134, 1867, type *S. nitidus* Reuss, *loc. cit.*), from the Miocene of Galicia, must, from the figures, be closely related to *Aligena.*

Aligena æquata Conrad.

PLATE 24, FIGURES 8, 8*a*, 8*b*.

Amphidesma æquata Conrad, Proc. Acad. Nat. Sci. Phila., i., p. 307, 1843; Fos. Med. Tert., p. 65, pl. 36, fig. 5, 1845; Tuomey and Holmes, Pleioc. Fos. S. Car., p. 95, pl. 23, fig. 5, 1856.

Aligena striata H. C. Lea, Trans. Am. Phil. Soc., 2d Ser., ix., p. 238, pl. 34, fig. 13, 1845.

Abra æquata Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 574, 1863.

Kellia (sp.) Orbigny, Prodr., iii., p. 115, 1852.

Aligena æquata Dall, Trans. Wagner Inst., iii., p. 919, pl. 24, fig. 8, 1898.

Miocene of St. Mary's County, Maryland; Petersburg, Virginia; Natural Well and Magnolia, Duplin County, and Wilmington, North Carolina, and of the Peedee River, South Carolina; Pliocene of the Caloosahatchie beds, Florida.

This shell is quite variable in its outline, occasionally being ovate-oblong,

* This was referred to *Kellia* by d'Orbigny (Prodr., iii., p. 115, No. 2153, 1852), who, as there was already a *Kellia lævis,* changed the specific name to *sublævis.*

but the typical form is rounded triangular. When quite young it is smooth or merely concentrically striated, but later on develops the prominent concentric laminæ. Occasional specimens are found in which the laminæ fail to develop, forming the variety *nuda,* Dall.

Aligena pustulosa Dall.

PLATE 33, FIGURES 18, 22.

Aligena pustulosa Dall, Trans. Wagner Inst., iii., p. 928, pl. 33, fig. 18, 1898.

Upper Oligocene of the Chipola beds, Chipola River, and of the Alum Bluff sands at Oak Grove, Santa Rosa County, Florida; Burns.

Shell small, thin, subtrigonal, moderately inflated, subequilateral, with small, pointed, inconspicuous beaks; valves with a well-marked carina extending downward and forward to the anterior angle of the basal margin, in front of which keel the surface is slightly impressed; surface sculptured with feeble incremental lines, along which are irregularly distributed small, pointed pustular elevations; beaks anteriorly twisted with a minute obscure tooth below them on the cardinal margin; ligamentary sulcus long and well marked; scars and pallial line much as in *Diplodonta;* margin entire, inner surface faintly radially striated. Alt. 6, lat. 5.2, diam. 4 mm.

The peculiar surface sculpture distinguishes this species at once from the other species. The Chipola specimen is not in very good condition, but shows rather stronger and closer concentric sculpture than the Oak Grove specimens.

Aligena lineata n. sp.

PLATE 44, FIGURE 23.

Oligocene of the Alum Bluff sands at Oak Grove, Santa Rosa County, Florida; Burns.

Shell small, thin, inequilateral, moderately convex, the anterior side longer, rounded, the posterior side higher, shorter, bluntly rounded, the beaks rather elevated, the base evenly arcuate; sculpture of fine, rather irregular elevated lines, not developed into laminæ, stronger near the anterior slope and feebler near the posterior slope; hinge and other characters of the interior much as in the last species. Alt. 7, lat. 8, diam. 4 mm.

This species is distinguished by its more elongated form and less elevated concentric sculpture from *A. æquata,* to which of all the species it is most nearly allied.

Aligena minor n. sp.

PLATE 44, FIGURE 8.

Miocene of the Natural Well, Duplin County, North Carolina; Burns.

Shell small, ovate, oblique, very inequilateral, posterior end shorter and smaller, anterior end produced; beaks small; surface of the valves moderately convex, smooth except for incremental inconspicuous concentric lines; interior polished, faintly radially striate, adductor scars rather large, ligamentary sulcus short, the cardinal tooth strong and prominent. Alt. 3.2, lat. 4, diam. 3 mm.

This little shell by its oblique form and strong cardinal tooth is easily separated from the rather quadrate smooth young shells of *A. æquata* which are found in the same bed. It appears to be rather scarce, as only five valves were obtained from a large amount of the marl.

Aligena elevata Stimpson.

Montacuta bidentata Gould, Inv. Mass., p. 59, 1841; not of Turton. Wheatley, Cat., p. 5, 1842; De Kay, N. Y. Moll., p. 232, 1843.

Montacuta elevata Stimpson, Shells of N. E., p. 16, 1851; Binney's Gould's Inv. Mass., p. 86, fig. 396, 1870; Tryon, Am. Mar. Con., p. 172, pl. 33, fig. 440, 1873; Verrill, Inv. An. Vineyard Sd., pp. 394, 688, 1874.

Cyamium elevatum H. and A. Adams, Gen. Rec. Moll., ii., p. 477, 1858.

Tellimya elevata Dall, Bull. U. S. Nat. Mus., No. 37, p. 50, pl. 68, fig. 6, 1889.

Kelliopsis elevata Verrill and Bush, Proc. U. S. Nat. Mus., xx., p. 784, pl. 93, figs. 2-4; pl. 94, figs. 7, 8, 1898.

Pleistocene of Pt. Shirley, Boston Harbor, Dall; recent on the coast of New England, especially south of Cape Cod, and south to New Jersey; Wheatley.

This is a well-characterized species from which we learn that the resilium carries a lithodesma, which is lost in the fossil species. Usually the ligament is invisible externally, but in some specimens a little fissure over it allows it to be seen. The thickened edge to which the resilium is attached has been spoken of as "tooth-like," but it is only the nymph-like thickening produced where the strain requires special strength in the shell and not otherwise like a tooth.

The only other species of the group which has been described from the American Tertiary, as far as I have been able to discover, is *Aligena Sharpei* O. Meyer (Proc. Acad. Nat. Sci. Phila. for 1888, p. 171, fig'd), which came from some point on the west shore of Chesapeake Bay, not precisely determined, but probably from the Miocene.

Superfamily LUCINACEA.

Family DIPLODONTIDÆ.

Genus DIPLODONTA Brown.

Diplodonta Brown, Ital. Tertiär. geb., p. ix., 1831. Type *Venus lupinus* Brocchi; not *Diplodon* Spix, 1827.

Mysia Brown, Zool. Textb., p. 454, pl. 90, fig. 6, 1833; Sby. Man., p. 197, 1842; not of Leach in Lam., 1818, nor of Brown, Ill. Conch. Gt. Brit., 1st ed., pl. 17, figs. 1, 2, 1827; not *Mysea* Billborg, Insecta, 1820.

Mysia Conrad, Fos. Medial Tert., p. 30, 1838; not of Leach.

Egeria Lea, Contr. Geol., p. 49, 1833, *ex parte;* not of Roissy, 1805.

Sphærella Conrad, Fos. Medial Tert., p. 17, 1838. Type *S. subvexa* Conrad, *op. cit.,* pl. 10, fig. 2.

?Felania Récluz, Journ. de Conchyl., ii., p. 69, 1851. Type *Venus diaphana* Gmelin (*Le Felan* Adanson).

Glocomene Leach, Moll. Gt. Brit., p. 313, 1852.

Cycladicama Val., Voy. au Pôle Sud., v., p. 116, 1854; Fischer, Journ. de Conchyl., viii., p. 377, 1860. Type *C. luciniformis* Val., *op. cit.,* pl. 3, fig. 3.

Mittrea Gray, Fig. Moll. An., v., p. 35, 1857; sole ex. *Diplodonta brasiliensis* Mittre, Journ. de Conchyl., i., p. 240, 1850.

Diplodonta + *Mysia* Cossmann, Cat. Ill., ii., p. 21, 1887.

This genus dates from the Cretaceous, and, considering the simplicity of its characters, seems to have received less attention than it deserves from modern writers. I have shown elsewhere that *Mysia* Leach is based on *Lucinopsis undata,* and that to the true *Diplodonta* Leach applied the name of *Glocomene.*

Conrad, Brown, and other writers have used *Mysia* for this genus so frequently that much confusion has resulted.

Egeria Lea was preoccupied when used by him and also contained representatives of several genera, a few of which belong to *Diplodonta.* Gray (Fig. Moll. An., v., p. 18, 1857) and Woodward (Man., p. 474) figure a bivalve from the Philippines, perhaps a *Joannisiella,* which has two siphonal openings and a compressed foot of the ordinary type, under the name of *Mysia,* and therefore separated the true Diplodontas, which have only an anal siphonal aperture and long Lucinoid foot, under the name of *Mittrea,* with *Diplodonta brasiliensis* Mittré as the type. This error has been transferred to Fischer's Manual by inadvertence.

An examination of a specimen of *Felania diaphana* (Gmel.) Récluz discloses some errors in his description of its characters. There is both a ligament and a resilium present, contrary to Récluz's impression, and the statement that there is a pallial sinus is erroneous. It is true that a little behind the middle of the shell there is a roughly quadrate polished patch or area extending upward, much as figured by Récluz (J. de Conchyl., ii., pl. 2, fig. 11), but a careful examination of this area shows that it is not due to a sinus in the pallial line (which passes regularly below it, as in *Diplodonta,* without any flexuosity), but to the attachment to the shell of a localized area of the mantle above the pallial line. According to Mittré, there is a single (anal) opening, not produced into a siphon, as in *Ungulina,* and therefore nothing which would require the attachment of siphonal retractor muscles to the valve. *Felania,* however, differs from *Diplodonta* in possessing a lunule, small but sharply circumscribed, and until more is known will best be kept separate. Both *Diplodonta* and *Ungulina* agree in having usually an amphidetic extension of the ligament as well as an internal resilium, united in the former but divided in the latter. The resilium is small and nearly external in *Diplodonta,* large and internal in *Felania* and *Ungulina,* marginally in contact with the ligament in *Felania,* but subvertical and separated in *Ungulina.* The teeth are essentially the same in all three, but more rugose and irregular in *Ungulina.* Many of the species commonly referred to *Felania* do not agree in character with the type of that group, but form a section of *Diplodonta.* I have seen no species which could be referred to *Felania* in the strict sense except the two named by Récluz. It will be necessary to examine the anatomy of *Felania* before it can be definitely settled whether it will form a distinct genus or merely a subgenus of *Diplodonta.* H. and A. Adams refer to the foot of *D. lupinus* as compressed, but this is probably due to an erroneous observation of Clark on a young *D. rotunda,* since *D. lupinus* is a fossil unknown in the recent state. *Cycladicama* Val. appears to be a synonym of *Diplodonta* proper.

Sphærella Conrad is founded on a single species, *S. subvexa* Conr., from the Miocene of Virginia, which has some distinctive characters, the most important of which are, (1) the unusual position of the posterior adductor scar, which is placed low down, its upper end hardly rising above the ventral end of the anterior scar; and (2) the form of the right posterior cardinal tooth, which is much more transverse and larger than in ordinary *Diplodonta.* Conrad referred many globose species of *Diplodonta* to *Sphærella,* but I have seen but one other American species which presents the distinctive characters of *Sphærella.* Among recent forms there are a few, of which *Diplodonta senegalensis* Reeve is the most conspicuous, which have low-set posterior adductors, but this species has the ordinary teeth of *Diplodonta.* It is evident, therefore, that *Sphærella* can be regarded at most as a section of *Diplodonta,* closely allied to the typical forms of that genus.

The genus may be divided as follows:

Section *Diplodonta* s. s. Type *D. lupinus* Brocchi, Miocene of Italy.

Shell rotund, equilateral, externally concentrically striated or smooth, with inconspicuous epidermis; two cardinal teeth in each valve, of which the right posterior and left anterior are distally sulcate or bifid; no lateral teeth; the hinge-plate when developed is usually excavated distally; there is no circumscribed lunule or escutcheon; the adductor scars are subequal, continuous with the pallial line, and close to the hinge-plate; the margin is entire, the pallial line simple, the pallial area often radiately striate; anatomically the genus is separated from *Lucinidæ* by its double gills and absence of siphon, and from *Cryptodontidæ* by its generative and digestive glands being contained within the general mass of the body. The excavation of the hinge-plate by which Fischer would separate *Felania* from *Diplodonta* appears to be merely a specific character, as is the turgidity of the shell, which varies widely among the typical Diplodontas.

Glocomene, Cycladicama, and *Mittrea* are synonyms.

Section *Felaniella* Dall, 1899. Type *Felania usta* Gould, Japan.

Shell like *Diplodonta,* but heavy, compressed, externally smooth, with a conspicuous, usually dark epidermis, and less equilateral valves.

To this group belong the shells referred to *Felania* by Carpenter and others from the Pacific, *D. apicalis* Phil. from the Mediterranean, etc.

Section *Sphærella* Conrad. Type *S. subvexa* Conr.

Shell large, concentrically striate, an impressed line above the anterior cardinal suggesting a minute lunule; the right posterior cardinal wide, undulated above; the posterior adductor scar distant from the hinge-plate.

A single species known from the Miocene, and one (*D. Verrilli* Dall, = *D. turgida* V. and S., 1881, not Conrad, 1848) from the Atlantic coast in deep water.

Section *Phlyctiderma* Dall, 1899. Type *D. semiaspera* Phil., Cuba * (1836).

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* The shell from Japan, called by Dunker and others *D. semiaspera,* is a distinct species, and will probably have to take the name of *D. japonica* Pilsbry. Philippi's type was from Havana and may be the same as *D. semireticulata* Orb. (1845). All three belong to the section.

Shell like *Diplodonta*, but with the concentric sculpture more or less broken up into reticulations or pustules.

This section includes several living and some fossil species of the Western Hemisphere. The Cretaceous genus, *Tenea* Conrad, which has been referred to this family, belongs to the *Veneridæ,* and *Linearia* Conrad, also included by Zittel (Traité de Pal., p. 93) among the synonyms of *Diplodonta,* belongs in the *Tellinidæ.*

Diplodonta hopkinsensis Clark.

D. hopkinsensis Clark, Bull. U. S. Geol. Surv., No. 141, p. 79, pl. xxii., figs. 1 *a-d,* 1895.
Diplodonta sp. Harris, Bull. Pal., ii., p. 257, pl. 13, fig. 7, 1897.

Hatchetigbee Bluff, Alabama, Harris; Wood's Bluff, Alabama, L. C. Johnson; Thomasville, Alabama, Burns; Evergreen, Virginia, Clark.

This appears to be the common species of the Chickasawan (or Lignitic) Eocene, which also contains the following species:

Diplodonta ungulina Conrad.

Astarte ungulina Conr., Am. Journ. Sci., xxiii., p. 342, 1833; Proc. Acad. Nat. Sci. Phila. for 1857, p. 166, 1858.
Egeria rotunda Lea, Contr. Geol., p. 50, pl. 1, fig. 17, 1833.
Mysia astartiformis Conr., Journ. Acad. Nat. Sci. Phila., 2d Ser., iv., p. 296, 1860; Am. Journ. Conch., i., p. 147, pl. 11, fig. 15, 1865.
Mysia deltoidea Conr., Journ. Acad. Nat. Sci. Phila., 2d Ser., iv., p. 296, 1860; Am. Journ. Conch., i., p. 147, pl. 11, fig. 10, 1865.
Egeria nana Gregorio, Mon. Claib., p. 208, 1890; not of Lea.

Chickasawan Eocene of Wood's Bluff, Alabama, L. C. Johnson; Claiborne sands at Claiborne, Alabama, Clarksville and localities in Clarke County, Alabama; and Glass Bayou, lower bed, near Vicksburg, Mississippi.

This fine species is abundant at Claiborne and presents the appearance of a precursor of the Miocene *D. acclinis.* The *Egeria nana* of Lea is often represented in collections by the young of this species, but is a small species of *Felaniella,* not unlike one from the Oligocene of Bowden which will be described later. It recalls *Goodallia* in form as suggested by Cossmann, but has the dentition of *Diplodonta.*

Diplodonta turgida Conrad.

Sphærella turgida Conr., Journ. Acad. Nat. Sci. Phila., 2d Ser., i., p. 124, pl. xii., fig. 23, 1848; Am. Journ. Conch., i., p. 9, 1865.
Sphærella bulla Conr., Am. Journ. Conch., i., p. 138, pl. 10, fig. 9, 1865.

Sphærella anteproducta Harris, Proc. Acad. Nat. Sci. Phila. for 1895, p. 50, pl. 2, fig. 4.
Sphærella sp. Harris, Bull. Pal., ii., p. 257, pl. 13, fig. 6, 1897.
Not *Diplodonta turgida* Verrill and Smith, 1881, = *D. Verrilli* Dall.

Lower Claibornian of Texas, Harris; Claiborne sands at Claiborne, Alabama, Johnson; Wahtubbee Hills, Clarke County, Mississippi, Burns; Red Bluff, Wayne County, Mississippi, Burns and Aldrich; Oligocene of Vicksburg, Mississippi, Conrad.

This remarkable globular species is not a *Sphærella,* but simply a turgid *Diplodonta.* It ranges from the Chickasawan upward to the Vicksburgian and without any marked change. Specimens labelled by Professor Harris do not seem to me to differ from the ordinary *turgida* except as individuals differ in any large series.

Diplodonta inflata Lea.

Egeria inflata Lea, Contr. to Geol., p. 50, pl. 1, fig. 18, 1833.
Mysia levis Conr., Am. Journ. Conch., i., p. 147, 1865.
Sphærella levis Conr., Am. Journ. Conch., i., p. 9, 1865.
Lucina (*Sphærella*) *inflata* var. *paruminflata* Gregorio, Mon. Claib., p. 207, pl. 29, figs. 15-17, 1890.

Claiborne sands of Claiborne, Alabama; Johnson.

This species is not very happily named, as it is never markedly inflated; it appears to be rather rare in the sands.

The *Sphærella oregona* Conrad of the Smithsonian Eocene Checklist, said to be from the Eocene of Oregon, appears to be undescribed or figured. The *Mysia polita* Gabb, from the Eocene of Martinez, California (Pal. Cal., i., p. 178, pl. 30, fig. 256, 1864), is probably a *Diplodonta.*

Diplodonta? eburnea Conrad (as *Loripes*, Journ. Acad. Nat. Sci. Phila., 2d Ser., i., p. 124, pl. xii., fig. 23, 1848) appears to be of doubtful affinities. It is from the Vicksburgian. There is in the National Museum a pair of valves of *Diplodonta* from the Jacksonian of Jackson, Mississippi, which are not unlike Conrad's very poor figure, though they do not nearly attain the size he assigns to it. These agree as far as can be determined with the species called *parilis* by Conrad from the basal Miocene of the New Jersey marls.

Each fauna seems to have a representative of each of the several types of *Diplodonta.* Thus in the Oligocene of Bowden we have *D. capuloides* Gabb (1873), corresponding to the *turgida* type of the Eocene; *D. subquadrata*

Gabb,* corresponding to the more compressed Eocene forms like *unguliua;* a *Felaniella* the analogue of *D. nana* of the Eocene, and a *Phlyctiderma* of which the Eocene analogue, if any, has not yet been recognized. The same is the case with the Miocene, Pliocene, and recent faunas.

Diplodonta (Felaniella) minor n. sp.

PLATE 44, FIGURE 17.

Oligocene marl of Bowden, Jamaica; Henderson and Simpson.

Shell small, moderately convex, smooth, polished, oblique, inequilateral, the lower anterior side produced, the posterior side shorter, rounded; margins simple, pallial line and adductor scars normal, the right anterior cardinal submarginal, rather long; the posterior cardinal short, vertical, deeply bifid, the beaks low and pointed, both the left cardinals short, the anterior bifid. Alt. 4.5, lat. 3.8, diam. 2.5 mm.

This is very similar to the Claibornian *D. nana* and to the young of the Mediterranean *D. apicalis* Philippi.

Diplodonta (Phlyctiderma) puncturella n. sp.

PLATE 45, FIGURE 26.

Oligocene marl of Bowden, Jamaica, Henderson and Simpson; recent, Jamaica, United States Fish Commission.

Shell small, thin, rounded, moderately convex, with inconspicuous beaks, outline nearly circular, the beaks smooth, but the rest of the external surface closely minutely punctate all over, other characters as in typical *Diplodonta,* like *D. capuloides,* but less turgid. Alt. 6.7, lat. 6.5, diam. 4.0 mm.

The punctation of the surface is very close and regular, not pustulose, like most of the species of this section.

Diplodonta alta Dall.

PLATE 11, FIGURES *9a, 9b;* PLATE 44, FIGURE 19.

Diplodonta alta Dall, Trans. Wagner Inst., iii., p. 189, pl. 11, figs. *9a-b,* 1890

Chipola Oligocene of the Chipola River, the lower bed at Alum Bluff, and the Ballast Point silex beds of Tampa, Florida; also in the Alum Bluff beds at Oak Grove, Santa Rosa County, Florida; Dall and Burns.

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* Geol. St. Domingo, 1873, p. 252; not of Carpenter, P. Z. S., 1855, p. 230. This species, since Gabb's name is preoccupied, may be called *D. Gabbi.*

Shell large, thin, concentrically striated, beaks small, not elevated; anterior end short, rounded, posterior end longer, larger, more arcuate above, the lower portion near the base produced; groove for the ligament very narrow; hinge-plate narrow, slightly excavated; teeth and adductors normal; margin simple. Alt. 27, lat. 26, diam. 12.5 mm.

The specimen figured from the silex beds being defective at the posterior margin, a much finer specimen from the Chipola beds, subsequently acquired, has been figured to show the normal form of the species. A form from the sands at Oak Grove seems to be the same, but differs by the presence of a minute lunule or incised line in front of the beaks as in *Sphærella,* the adductor scars, however, are normal. As the Oak Grove specimens are all young, I prefer to regard them as a variety of *D. alta* until more information is available.

Diplodonta radiata n. sp.

PLATE 44, FIGURE 11.

Oligocene sands of Oak Grove, Santa Rosa County, Florida; Burns.

Shell large, very thin, finely concentrically sculptured with minutely wrinkled silky striæ; anterior end shorter and narrower, slightly produced below, posterior end wider, rounded; hinge-plate narrow, channelled in front, cardinals small, short, normal; ligamentary groove very short, beaks low, inconspicuous; adductor scars and pallial line normal; pallial area smooth, with, towards the base, numerous obscure liræ which appear on the basal margin as short elevated lines with abrupt terminations, somewhat as in *Propeamusium.* Alt. 18, lat. 20, diam. 10 mm.

This is a peculiar species and, so far as the liræ are concerned, appears to be unique. They are entirely distinct from the radiating striæ not uncommon on the pallial area of Lucinoid bivalves, being most elevated at their distal termination, and found in both the young and mature shells.

Diplodonta shilohensis Dall.

Mysia parilis Conrad, Am. Journ. Conch., ii., p. 71, pl. 4, fig. 1, 1866; Whitfield, Mio. Moll. N. J., p. 61, pl. 9, figs. 9-13, 1895.

Not *Mysia parilis* Conr., Journ. Acad. Nat. Sci. Phila., 2d Ser., iv., p. 278, pl. 46, fig. 16, 1860; nor *Mysia parilis* Conr., Am. Journ. Conch., i., p. 153, 1865.

Basal Miocene of New Jersey, at Shiloh and Jericho, Cumberland County; Conrad and Burns.

The nomenclature of this species illustrates one of the peculiarities of Conrad's work to which I have often had occasion to refer. The first *Diplodonta* which received the name of *parilis* from Conrad was a species from the Astoria beds of Oregon which figured under the generic name of *Loripes* in 1848 and was referred first to the Miocene and afterwards to the Eocene in 1865 under the generic name of *Mysia*. In 1860, however, he had described a distinct species from the Cretaceous of Alabama as *Mysia parilis*. It turned out to belong to the *Veneridæ*, and Conrad proposed a genus *Tenea* for it in 1870, while Gabb in 1876 showed that he had described the same shell in 1860 as *Mysia gibbosa*, while Conrad as early as 1853 had named it *Lucina pinguis*. Whitfield thinks *Tenea* practically identical with *Thetis* Sowerby, but at all events it has a high angular pallial sinus and cannot be a *Diplodonta*. In addition to the above complications, in 1866 Conrad described a true *Diplodonta* from the Miocene of Shiloh, New Jersey, as *Mysia parilis*. This has no connection with the Oregon shell and requires a new name, which I have given it as above.

This species is rotund and turgid and clearly distinct from the later Miocene species about to be discussed. There is a very closely related if not identical form in the Jacksonian Eocene of Mississippi.

Diplodonta nucleiformis Wagner.

Mysia nucleiformis Wagner, Journ. Acad. Nat. Sci. Phila., viii., p. 52, pl. 1, fig. 4, 1838.
Loripes elevata Conrad, Fos. Med. Tert., p. 73, pl. 41, fig. 8, 1845.
Cytherea sphærica H. C. Lea, Trans. Am. Phil. Soc., 2d Ser., ix., p. 241, pl. 34, fig. 22, 1845.
Diplodonta elevata Conrad, Proc. Acad. Nat. Sci. Phila., ix., p. 166, 1858.
Mysia carolinensis Conrad, in Kerr, Rep. Geol. N. Car., App., p. 21, pl. 4, fig. 5, 1875.

Miocene of Petersburg and York River, Virginia; of the Meherrin and Neuse River, of the Natural Well and Magnolia, Duplin County, North Carolina, and in the Oligocene Oak Grove sands, Florida; Wagner, Lea, Conrad, and Burns.

This is a smooth, moderate sized, globose species without any very distinctive characters, but smaller, less turgid, and transverse than *D. shilohensis*, and more solid and circular than the following species.

Diplodonta yorkensis n. sp.

PLATE 43, FIGURE 5.

Miocene of the York River, Virginia, near Yorktown; Harris.

Shell thin, oblong, varying to rounded, sculptured only by incremental lines, slightly varying in strength; beaks low, inconspicuous; ligament short, teeth short and small, hinge-line narrow, briefly excavated in front; muscular and pallial impressions normal. Alt. 8, lat. 10.5, diam. 5 mm.

This species differs from the preceding by its very thin shell, less turgid and globose; the shorter and most rounded specimens are considerably less inflated than in the *nucleiformis*, which does not seem to attain so large a size.

Diplodonta acclinis Conrad.

PLATE 28, FIGURES 2, 13.

Lucina acclinis Conrad, Fos. Tert. Form., p. 21, pl. 6, fig. 2, 1832; Whitfield, Mio. Moll. N. J., p. 62, pl. x., figs. 5, 6, 1895.

Mysia americana Conrad, Fos. Medial Tert., p. 30, pl. 16, f. 2, 1838 (not *Lucina americana* Defrance, 1823); Proc. Nat. Inst., ii., p. 185, 1842; Meek, Mioc. Checkl., p. 8, 1864.

Diplodonta acclinis Conrad, Proc. Acad. Nat. Sci. Phila., ix., p. 166, 1858; Dall, Trans. Wagner Inst., iii., p. 923, 1898.

Basal Miocene of Shiloh, Cumberland County, New Jersey; Miocene of Jones Wharf, Maryland, Greensboro', Maryland, York River, Virginia, Wilmington and various localities in Duplin County, North Carolina; Pliocene of Tilly's Lake, Waccamaw River, South Carolina, of Walton County, Florida, and of the Caloosahatchie River; Burns, Harris, Stanton, and Dall.

This is the finest and most conspicuous species of the Miocene; if it possessed, when living, a strong, polished epidermis it would probably have found a place in the section *Felaniella*, to which its form and minor characters show some resemblance.

Diplodonta (Sphærella) subvexa (Conrad).

Sphærella subvexa Conrad, Fos. Medial Tert., p. 18, pl. 10, fig. 2, 1838; Proc. Acad. Nat. Sci. Phila. for 1863, p. 577.

Erycina subconvexa Orbigny, Prodr., iii., p. 115, 1852.

Miocene of the James River near Smithfield, Virginia, Conrad; and of the Nansemond River near Suffolk, Virginia, Burns.

This fine species has been discussed in connection with the section *Sphærella*. It appears to be rare. Our largest specimen measures, alt. 36, lat. 40, diam. 30 mm.

The *Sphærella oregona* Conr., of the "Smithsonian Checklist of Eocene Fossils of North America" (p. 6, 1866) appears to be a nude name, at least I have not been able to find any diagnosis of it in the literature, and it has not been figured.

Diplodonta Leana Dall.

Psammocola lucinoides H. C. Lea, Trans. Am. Phil. Soc., 2d Ser., ix., p. 239, pl. 34, fig. 16, 1845.

Not *Diplodonta lucinoides* Desh. (as *Venus*), Coq, Fos. de Paris, i., p. 146, pl. 23, figs. 12-13, 1824.

Miocene of Petersburg, Virginia; Lea and Burns.

This resembles *D. shilohensis* Dall, but is thinner, less inflated, with the lower posterior margin more prominently rounded. *D. caloosaënsis* when adult is much larger, and the young, when of the same length as *D. Leana*, are of a rounded triangular form, conspicuously different from the regularly subovate outline of *D. Leana*. *D. nucleiformis* is a smaller, more cup-like shell with proportionately more prominent beaks.

Diplodonta punctata Say.

Amphidesma punctata Say, Journ. Acad. Nat. Sci. Phila., i., p. 308, 1822.

Lucina venezuelensis Dunker, Zeitschr. Mal., v., p. 184, 1848.

Lucina janeirensis Reeve, Conch. Icon. *Lucina*, pl. 8, fig. 43, June, 1850.

Lucina subglobosa C. B. Adams, Proc. Boston Soc. Nat. Hist., ii., p. 298, 1847 (name only).

Diplodonta braziliensis Mittré, Journ. de Conchyl., i., p. 240, pl. xii., figs. 7-9, Aug., 1850 (not *Lucina braziliensis* Phil.).

Diplodonta venezuelensis Dunker, Novit. Conch. Moll. Mar., p. 3, pl. iv., figs. 7-9, 1858; Dall, Bull. Mus. Comp. Zool., ix., p. 136, 1881.

?*Diplodonta orbella* Gabb, Journ. Acad. Nat. Sci. Phila., 2d Ser., viii., p. 376, 1881; not of Gould.

Mysia pellucida Heilprin, The Bermuda Ids., pp. 179, 190, pl. 17, fig. 3, Oct., 1889.

Pliocene of Costa Rica? Gabb; Pleistocene of South Carolina and Florida, Burns and Dall; living from Cape Hatteras, North Carolina, south to Rio Janeiro, and at Bermuda.

This species is easily distinguished by its squarish orbicular form with somewhat attenuated anterior end, and especially by the microscopic sculpture, which exhibits short radiating striulæ, minutely punctate where well developed, and succeeding one another over a large part of the surface. This style of sculpture appears to be peculiar to this particular species, which thus tends to bridge the gap between *Diplodonta* proper and *Phlyctiderma*. It is not equally well shown, however, on all specimens.

Diplodonta (Phlyctiderma) punctulata H. C. Lea.

Lucina punctulata H. C. Lea, Trans. Am. Phil. Soc., 2d Ser., ix., p. 240, pl. 34, fig. 18, 1845.

Miocene of Petersburg, Virginia; Lea.

I have not been able to obtain additional specimens of this species, but it undoubtedly belongs here. The punctations are microscopic, and cover the whole surface, unlike the pustules of *D. semiaspera.* The species superficially resembles *D. puncturella,* but is larger. The type specimen is still in the collection of the Academy of Natural Sciences, where I have examined it.

Diplodonta (Phlyctiderma) semiaspera Philippi.

Diplodonta semiaspera Phil., Wiegm. Arch., i., p. 225, pl. vii., fig. 2 *a-d,* 1836.

Lucina granulosa C. B. Adams, Proc. Boston Soc. Nat. Hist., ii., p. 9, 1845; Contr. Conch., p. 245, 1852.

Lucina semireticulata Orb., Voy. Am. Mér., p. 585, pl. 84, figs. 7-9, 1846.

Diplodonta semiaspera Dall, Bull. 37, U. S. Nat. Mus., p. 52, 1889.

Pliocene of the Caloosahatchie beds, Florida, Dall; living in moderate depths of water from Cape Hatteras, North Carolina, south to Rio Janeiro.

Diplodonta caloosaensis n. sp.

Plate 44, Figure 16.

Pliocene of the Caloosahatchie beds, Florida, Dall; and of the Waccamaw River, South Carolina, Johnson.

Shell large, moderately inflated, sculptured with somewhat irregularly prominent incremental lines; beaks low, pointed, inconspicuous; anterior end shorter, smaller, evenly rounded into the evenly arcuate base; posterior end squarish, longer, larger, more inflated; in the young the form is even more inequilateral and sometimes rounded trigonal with the anterior end attenuated; hinge-line short, with hardly any hinge-plate; ligamentary groove sharp, but the nymph not prominent; teeth and scars normal. Alt. 25, lat. 27, diam. 17 mm.

This species is larger and less equilateral than *D. Leana;* specimens of the same size are less inflated. It resembles *D. punctata* Say, which is a smaller shell, but has not the microscopic surface sculpture.

Diplodonta soror C. B. Adams.

Lucina soror C. B. Adams, Contr. Conch., p. 247, 1852.

Lucina kiawahensis Holmes, Post-Pl. Fos. S. Car., p. 29, pl. 6, fig. 5, 1858.

Pleistocene of the Kiahwah (Ashley) River and of Simmons Bluff, Wadmalaw Sound, South Carolina; living at Jamaica in the Antilles and on the coast of Texas.

This is a well-characterized species, notable for its microscopic shagreening on the posterior slope and the compression or subrostration of the same part of the shell. It is abundant at Simmons Bluff, and specimens of the same size are absolutely identical with specimens of *soror* named by and received from Professor Adams.

The *D. orbella* Gould, a recent species of the Pacific coast, has been erroneously referred to *Sphærella* by Conrad, and the name has been incorrectly used for a Pliocene species of Costa Rica by Gabb. *Venus ascia* H. C. Lea (1845), from the Miocene of Petersburg, Virginia, has the aspect of a much dilapidated *Felaniella,* but the type valve is so poor that its systematic position cannot be decisively fixed.

PLATE XXXVI.

Fig. 1. *Corbula* (*Bothrocorbula*) *radiatula* Dall, outside of left valve; lon. 12.5 mm.; p. 851.

Fig. 2. The same, interior of left valve; lon. 12.5 mm.; p. 851.

Fig. 3. The same, interior of right valve; lon. 12.5 mm.; p. 851.

Fig. 4. *Teredina bowdeniana* Dall, left valve with portions of tube attached; lon. 6.5 mm.; p. 822.

Fig. 5. *Martesia* (*Aspidopholas*) *ovalis* Say, with a portion (edges broken) of the enveloping protoplax; lon. 12 mm.; p. 820.

Fig. 6. *Corbula* (*Aloidis*) *extenuota* Dall; lon. 7 mm.; p. 844.

Fig. 7. *Anisodonta americana* Dall; from the Caloosahatchie Pliocene; lon. 6 mm.; p. 1133.

Fig. 8. *Corbula* (*Cuneocorbula*) *sericea* Dall; lon. 5.5 mm.; p. 848.

Fig. 9. *Corbula* (*Bathrocorbula*) *Willcoxii* Dall, interior of right valve, showing depressed lunule; lon. 16.2 mm.; p. 851.

Fig. 10. *Corbula* (*Cuneocorbula*) *sphenia* Dall; lon. 17.5 mm.; p. 847.

Fig. 11. *Corbula* (*Cuneocorbula*) *seminella* Dall; lon. 4.7 mm.; p. 848.

Fig. 12. *Corbula* (*Bothrocorbula*) *synarmostes* Dall, exterior of left valve; lon. 14 mm.; p. 850.

Fig. 13. The same, interior of right valve; lon. 12.5 mm.; p. 850.

Fig. 14. *Corbula* (*Cuneocorbula*) *sarda* Dall; lon. 12 mm.; p. 847.

Fig. 15. *Corbula* (*Aloidis*) *heterogenea* Guppy, interior of right valve; lon. 7.5 mm.; p. 850.

Fig. 16. *Corbula* (*Aloidis*) *caloosæ* Dall; lon. 11.5 mm.; p. 853.

Fig. 17. *Corbula* (*Cuneocorbula*) *nucleata* Dall; lon. 5.15 mm.; p. 855.

Fig. 18. *Corbula* (*Cuneocorbula*) *Whitfieldi* Dall; lon. 6 mm.; p. 849.

Fig. 19. *Corbula* (*Aloidis*) *milium* Dall; lon. 2.7 mm.; p. 845.

Fig. 20. *Crassatellites clarkensis* Dall; Eocene of Wahtubbee, Clarke County, Mississippi; dorsal view; lon. 29 mm.

Fig. 21. The same, showing hinge of left valve; lon. 23.5 mm.

Fig. 22. *Callista pittsburgensis* Dall; Tejon Eocene of Pittsburg, Oregon; lon. 26 mm.

Fig. 23. *Semele carinata* Conrad; Oligocene of Oak Grove, Florida; lon. 16.5 mm.; p. 988.

Fig. 24. *Crassatellites clarkensis* Dall; Eocene; hinge of right valve; lon. of fragment 17 mm.

Fig. 25. The same, side view of perfect right valve; lon. 43 mm.

Fig. 26. *Semele carinata* Conrad, exterior of valve, figured above; lon. 16.5 mm.; p. 988.

PLATE XXXVI.

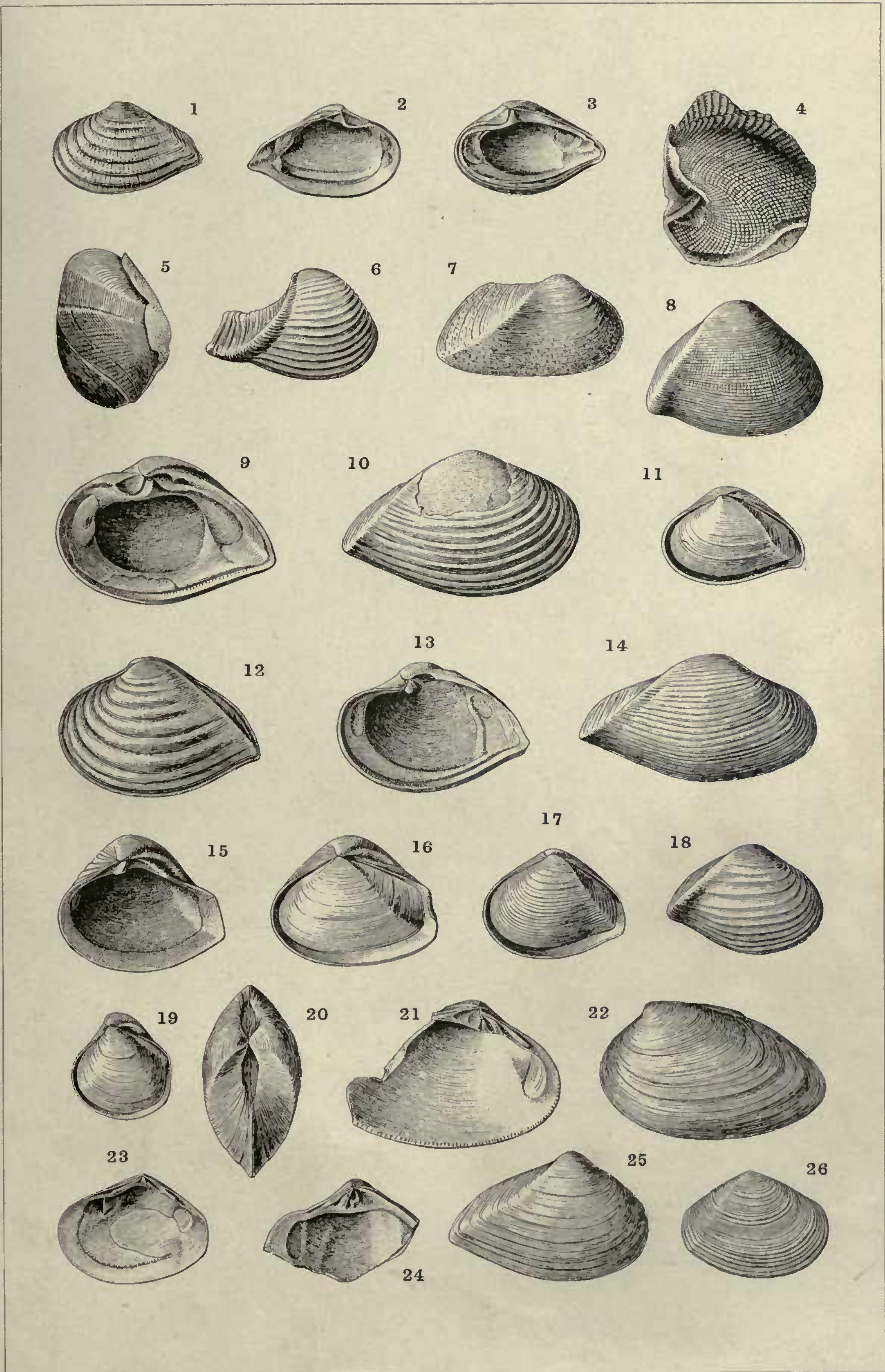


PLATE XXXVII.

Fig. 1. *Semele Leana* Dall; Caloosahatchie beds; lon. 54 mm.; p. 992.

Fig. 2. *Semele Leana* Dall, umbonal view; p. 992.

Fig. 3. *Semele chipolana* Dall, Chipola beds; lon. 54 mm.; p. 986.

Fig. 4. *Semele perlamellosa* Heilprin; Caloosahatchie Pliocene; lon. 54 mm; p. 992.

Fig. 5. The same, umbonal view; p. 992.

Fig. 6. *Crassatellites melinus* Conrad, variety *meridionalis* Dall; Miocene of Alum Bluff, Florida; lon. 69 mm.

Fig. 7. *Tellina segregata* Dall, left valve; Ballast Point, Tampa Bay, silex beds; lon. 17 mm.; p. 1019.

Fig. 8. The same, dorsal view; p. 1019.

Fig. 9. *Macoma Lyelli* Dall, internal cast, showing impression of right valve; Miocene of Gay Head, Martha's Vineyard, Massachusetts; lon. 43 mm.; p. 1049.

Fig. 10. The same, umbonal view of another internal cast; lon. 39 mm.; p. 1049.

Fig. 11. The same, internal cast showing impression of right valve of same specimen as figure 9 represents; lon. 43 mm.; p. 1049.

Fig. 12. *Clementia Grayi* Dall; Oligocene of Oak Grove sands; lon. 64 mm.

Fig. 13. *Crassatellites melinus* Conrad, variety *meridionalis* Dall; Miocene of Alum Bluff, Florida; same specimen as Figure 6, viewed dorsally; lon. 69 mm.

Fig. 14. *Pecten Parmeleei* Dall; Pliocene of San Diego, California; alt. 45 mm.; p. 708.

Fig. 14a. The same, enlarged view of secondary sculpture.

PLATE XXXVII.

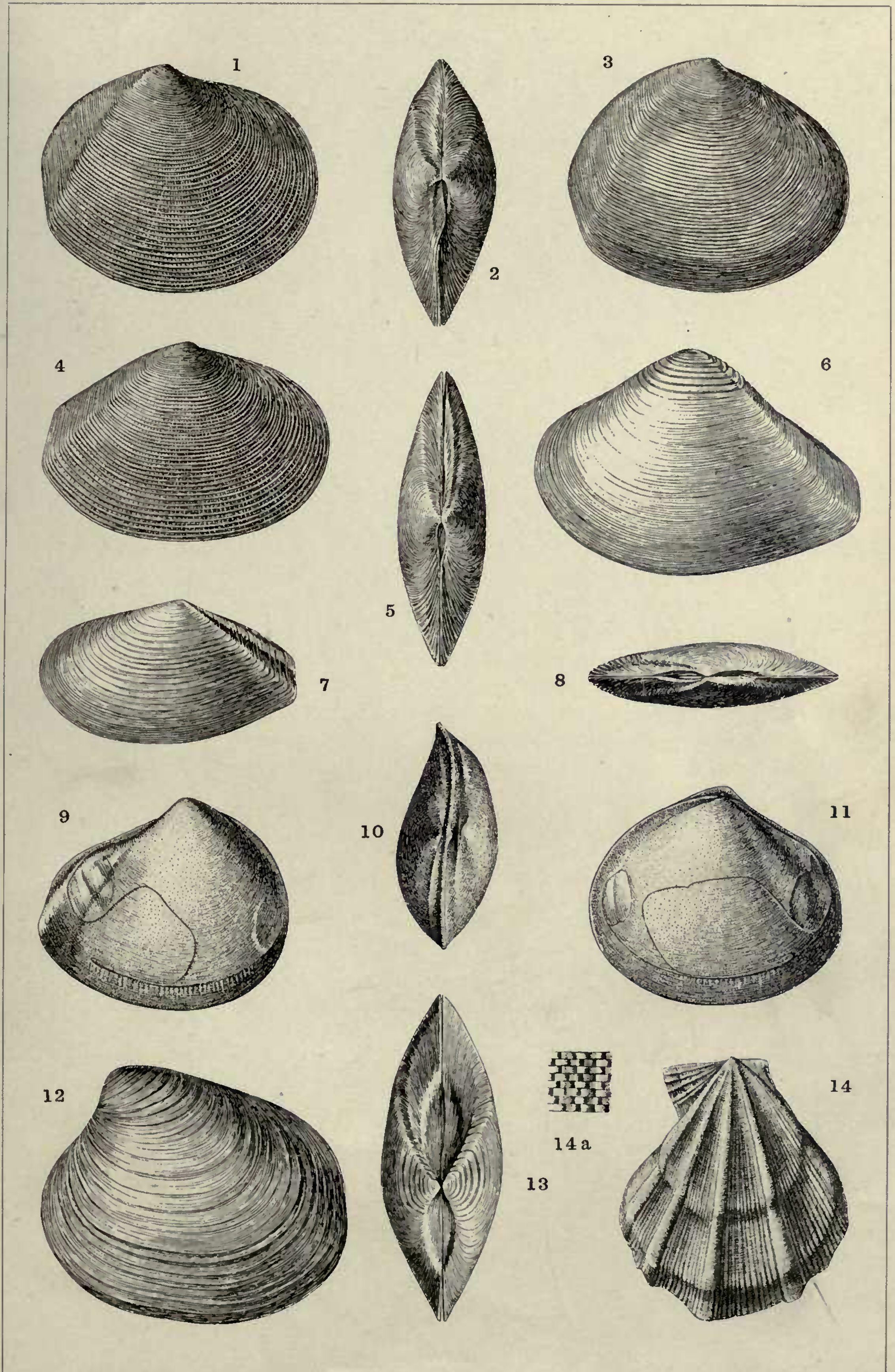


PLATE XXXVIII.

Fig. 1. *Venus halidona* Dall, right valve, enlarged to bring out sculpture; Ballast Point, Tampa Bay, Florida, silex beds; lon. 37 mm.

Fig. 1a. The same, umbonal view.

Fig. 2. *Venus tarquinia* Dall, = *V. magnifica* Heilprin non Sowerby, left valve, enlarged slightly; lon. 49 mm.; Ballast Point silex beds.

Fig. 2a. The same, umbonal view.

Fig. 3. *Tellina* (*Merisca*) *halidona* Dall; Ballast Point silex beds; lon. 14.5 mm.; p. 1021.

Fig. 3a. The same, inside view; p. 1021.

Fig. 4. *Arca umbonata* Lamarck; from above; Ballast Point silex beds; lon. 36.0 mm.; p. 620.

Fig. 4a. The same, inside view of left valve; p. 620.

Fig. 5. *Leda flexuosa* Heilprin, type specimen; lon. 14.25 mm.; p. 589.

Fig. 5a. The same, dorsal view.

Fig. 6. *Semele silicata* Dall; Ballast Point silex beds; lon. 23.0 mm.; p. 987.

Fig. 7. *Cyrena pompholyx* Dall, interior view of right valve; from the Ballast Point silex beds; lon. 43 mm.

Fig. 8. The same, external view.

Fig. 9. *Cardita serricosta* Heilprin, interior view of a silicious pseudomorph, natural size; Ballast Point silex beds.

PLATE XXXVIII.

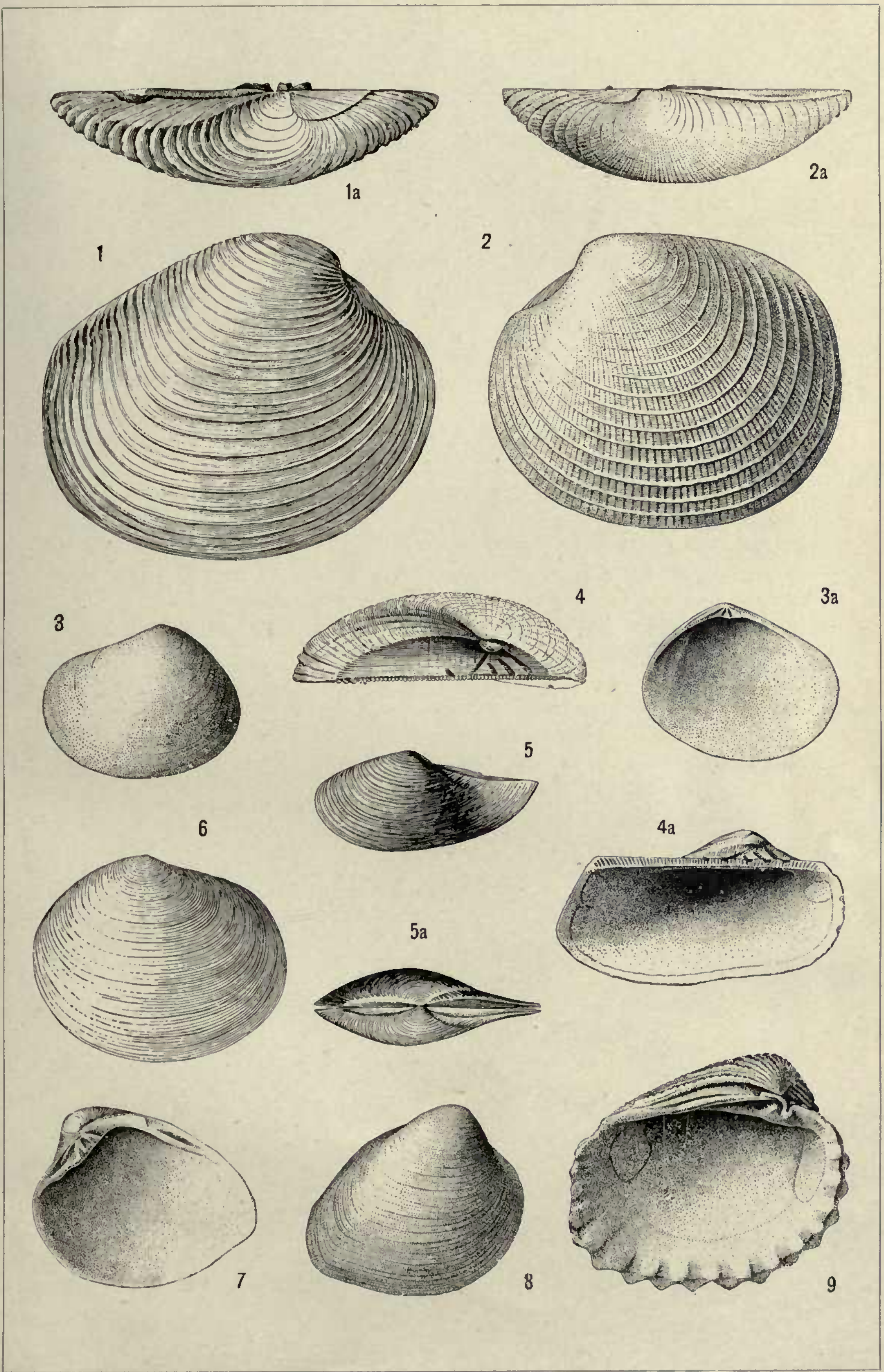


PLATE XXXIX.

Fig. 1. *Cypræa chilona* Dall, from above; Chipola horizon at Alum Bluff, Florida; lon. 50 mm.

Fig. 2. *Solarium cupola* Heilprin, basal view; Eocene of Wood's Bluff, Alabama; diam. 18 mm.; p. 326.

Fig. 3. *Cypræa chilona* Dall (Fig. 1), basal view; lon. 44 mm.; laterally defective.

Fig. 4. *Helix (Plagioptycha) direpta* Dall, basal view; diam. 15 mm.; p. 10.

Fig. 5. *Helix (Plagioptycha) direpta* Dall; Ballast Point silex beds; a perfect specimen figured to supply the deficiencies of the original figures; alt. 13 mm.; p. 10.

Fig. 6. *Arca Wogneriana* Dall; Caloosahatchie beds; a specimen with unusually produced wings; lon. 12.7 mm.; p. 619.

Fig. 7. The same, viewed from above.

Fig. 8. *Solen amphistemma* Dall; Oligocene sands of Oak Grove, Florida; interior of right valve; lon. 112 mm.; p. 952.

Fig. 9. *Crassatellites densus* Dall; Oak Grove sands; interior of right valve; lon. 59 mm.

Fig. 10. The same; another specimen viewed from above.

Fig. 11. The same; another specimen showing variation in form.

Fig. 12. The same; a specimen having what is probably the most normal form of the species.

PLATE XXXIX.

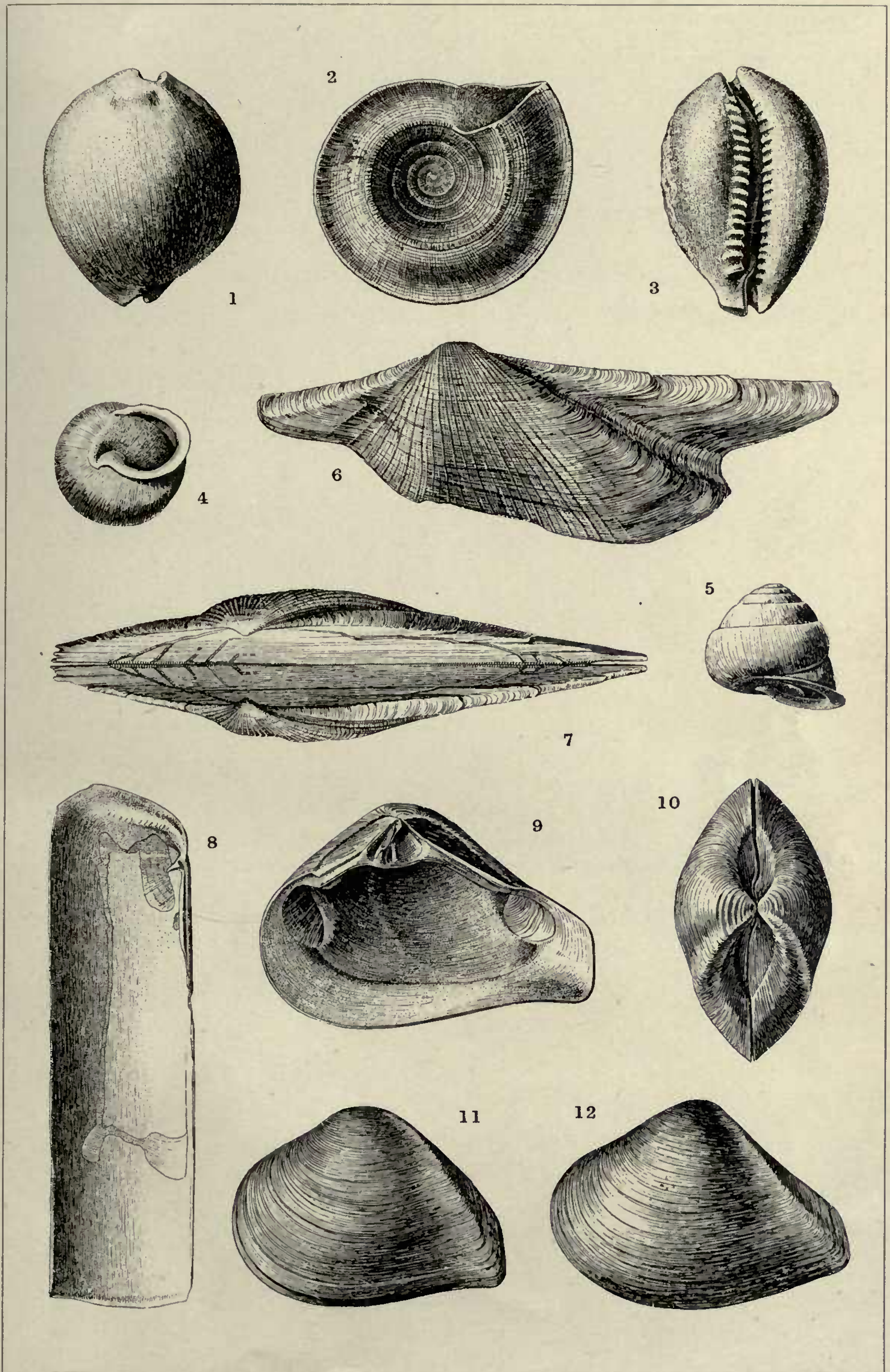


PLATE XL.

= N. shumardi Dall. Prof Paper U.S.G.S. No 59, p 102–103

Fig. 1. *Nucula* (*Acila*) *decisa* Conrad; Pittsburg, Oregon; outside view; lon. 24.6 mm.; p. 573.

Fig. 2. *Lucina plesiolopha* Dall; Oligocene of Oak Grove, Florida; interior of left valve; alt. 15.5 mm.

Fig. 3. *Nucula* (*Acila*) *decisa* Conrad, interior; lon. 24.6 mm.; p. 573.

Fig. 4. *Nucula* (*Acila*) *cardata* Dall; Miocene of Oregon; lon. 16.0 mm.; p. 573.

Fig. 5. *Lucina plesiolopha* Dall, exterior; alt. 15.5 mm.

Fig. 6. *Nucula Shaleri* Dall; Miocene of Gay Head, Martha's Vineyard, Massachusetts; lon. 16.5 mm.; p. 575.

Fig. 7. *Cardium druidicum* Dall; Oak Grove sands; exterior of left valve; lon. 25 mm.; p. 1094.

Fig. 8. *Cardium chipolanum* Dall; Chipola marl; exterior of right valve; alt. 36 mm.; p. 1098.

Fig. 9. *Cardium taphrium* Dall, exterior of left valve; Oak Grove sands; lon. 35 mm.; p. 1098.

Fig. 10. *Cardium* (*Fragum*) *arestum* Dall; Caloosahatchie beds; alt. 27 mm.; p. 1102.

Fig. 11. The same from behind; alt. 27 mm.

Fig. 12. *Cardium* (*Triganiocardia*) *alicula* Dall, a worn pseudomorph from the Ballast Point silex beds; alt. 13 mm.; p. 1103.

Fig. 12b. *Astyris turgidula* Dall; Ballast Point, Tampa Bay, silex beds; alt. 13 mm.

Fig. 13. *Cardium ctenolium* Dall; Oak Grove sands; alt. 20 mm.; p. 1081.

Fig. 14. *Cardium pansatrum* Dall; Oak Grove sands; lon. 12.3 mm.; p. 1093.

Fig. 15. *Cardium* (*Hemicardium*) *apateticum* Dall; Oak Grove sands; outside of left valve; alt. 10.5 mm.; p. 1105.

Fig. 16. *Cardita* sp.; Oak Grove sands; lon. 20.5 mm.; young shell.

PLATE XL.

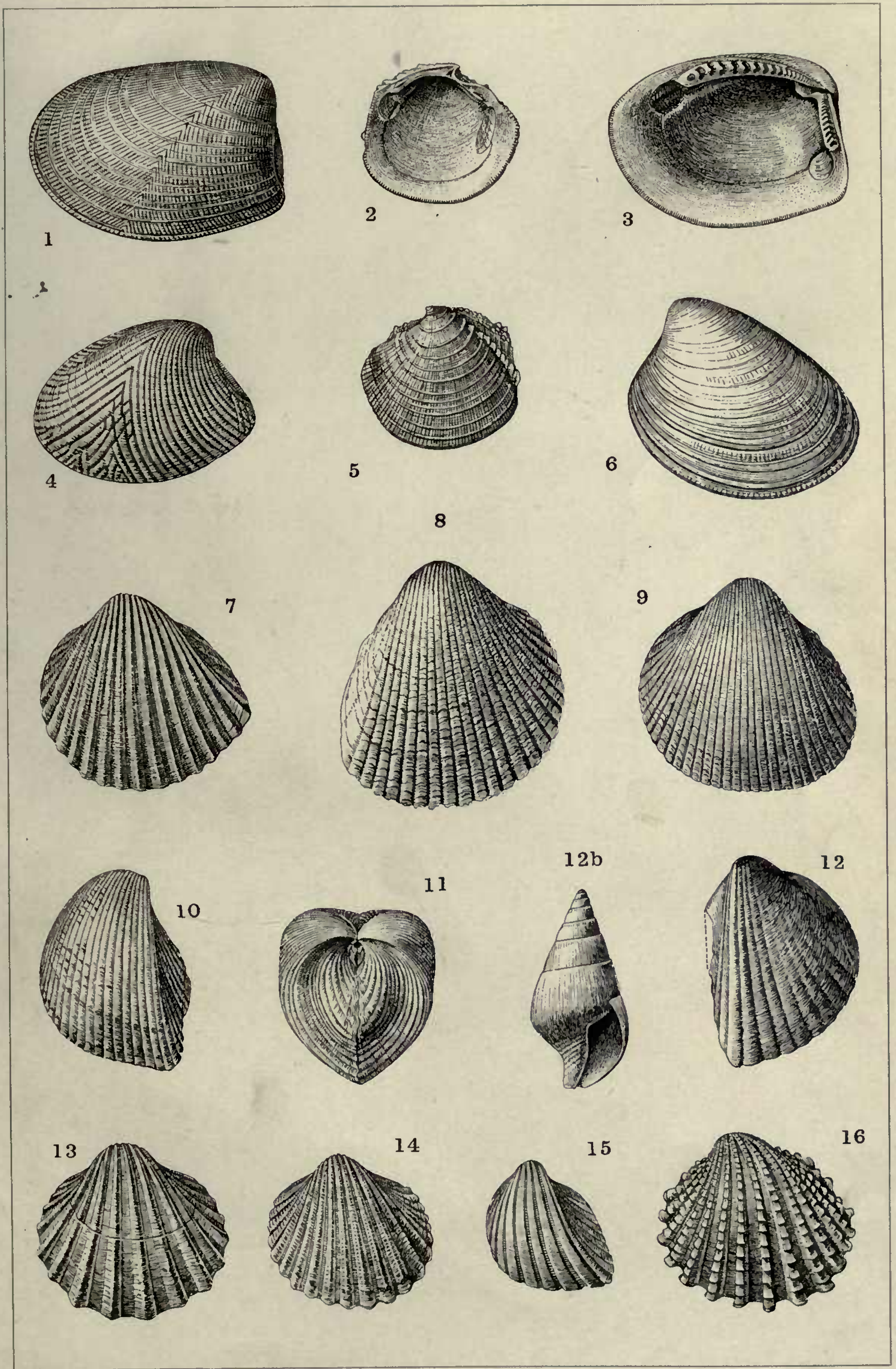


PLATE XLI.

Fig. 1. *Scala (Sthenorhytis) Mazyckii* Dall, basal view; Miocene of Cainhoy, South Carolina; diam. 28 mm. See *The Nautilus,* vol. ix., p. 111, February, 1896.

Fig. 2. The same, front view.

Fig. 3. *Ancillaria chipolana* Dall; Oligocene marl of the Chipola River, Florida; alt. 25 mm.

Fig. 4. *Pleurotoma boadicea* Dall; Oligocene sands of Oak Grove, Florida; alt. 25 mm.

Fig. 5. *Chama Willcoxi* Dall, interior of attached valve; Pliocene of Shell Creek, Florida; lon. 85 mm.

Fig. 6. The same, with both valves in place.

Fig. 7. The same, interior of upper valve; lon. 85 mm.

Fig. 8. *Scala ranellina* Dall, basal view; Eocene of the Zeuglodon bed (Jacksonian), near Cocoa P. O., Alabama; diam. 23 mm. See *The Nautilus,* vol. ix., p. 111, February, 1896.

Fig. 9. The same, front view; alt. (decollated) 33 mm.

Fig. 10. *Astyris perfervida* Dall; Oligocene sands of Oak Grove, Florida; alt. 18 mm.

Fig. 11. *Terebra psilis* Dall; Oligocene sands of Oak Grove, Florida; alt. 16.5 mm.

PLATE XLI.

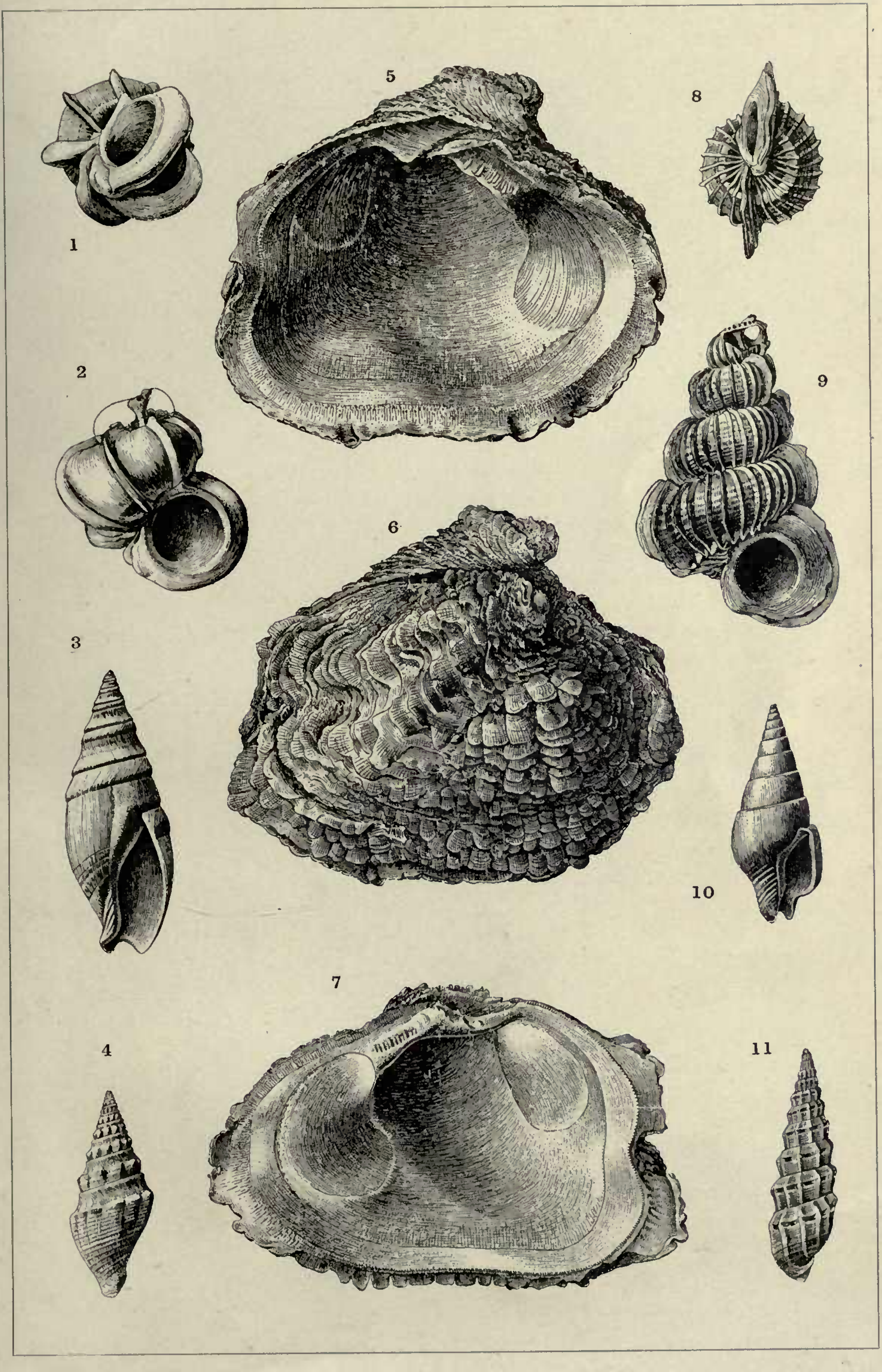


PLATE XLII.

Fig. 1. *Verticordia (Haliris) mississippiensis* Dall; Wahtubbee Eocene of Mississippi; lon. 5.6 mm.

Fig. 2. *Venus Langdoni* Dall; Chipola marl; interior of left valve; lon. 88 mm.

Fig. 3. *Venus latilirata* Conrad; Pliocene of the Waccamaw beds, South Carolina; dorsal view; lon. 34 mm.

Fig. 4. *Venus (Anaitis) Burnsii* Dall; Oligocene of the Chipola River, Florida; form with the concentric ribs confluent; lon. 34 mm.

Fig. 5. *Venus (Anaitis) ulocyma* Dall; Miocene of Alum Bluff, Florida; adult; lon. 45 mm.

Fig. 5a. The same, young shell; lon. 18 mm.

Fig. 6. *Eunaticina caractacus* Dall; Oligocene sands of Oak Grove, Florida; alt. 7.1 mm.

Fig. 7. *Venus Langdoni* Dall, dorsal view; lon. 88 mm.

Fig. 8. *Crassatellites psychopterus* Dall; Wahtubbee Eocene of Mississippi; lon. 20.2 mm.

Fig. 9. The same; external view of the same valve.

Fig. 10. *Venus (Anomalocardia) caloosana* Dall; Pliocene of the Caloosahatchie marls, Florida; lon. 21 mm.

Fig. 11. *Venus (Anaitis) Burnsii* Dall; Chipola beds; form with the concentric ribs distinct.

Fig. 12. *Venus Langdoni* Dall; Chipola beds; view of exterior of left valve; *a*, shows one of the concentric lamellæ complete, the others are more or less defective through chipping; lon. 88 mm.

Fig. 13. *Verticordia eocenensis* Langdon; Wahtubbee Eocene of Clarke County, Mississippi; internal view of left valve; lon. 4 mm.

Fig. 14. The same, external view of the same valve.

PLATE XLII.

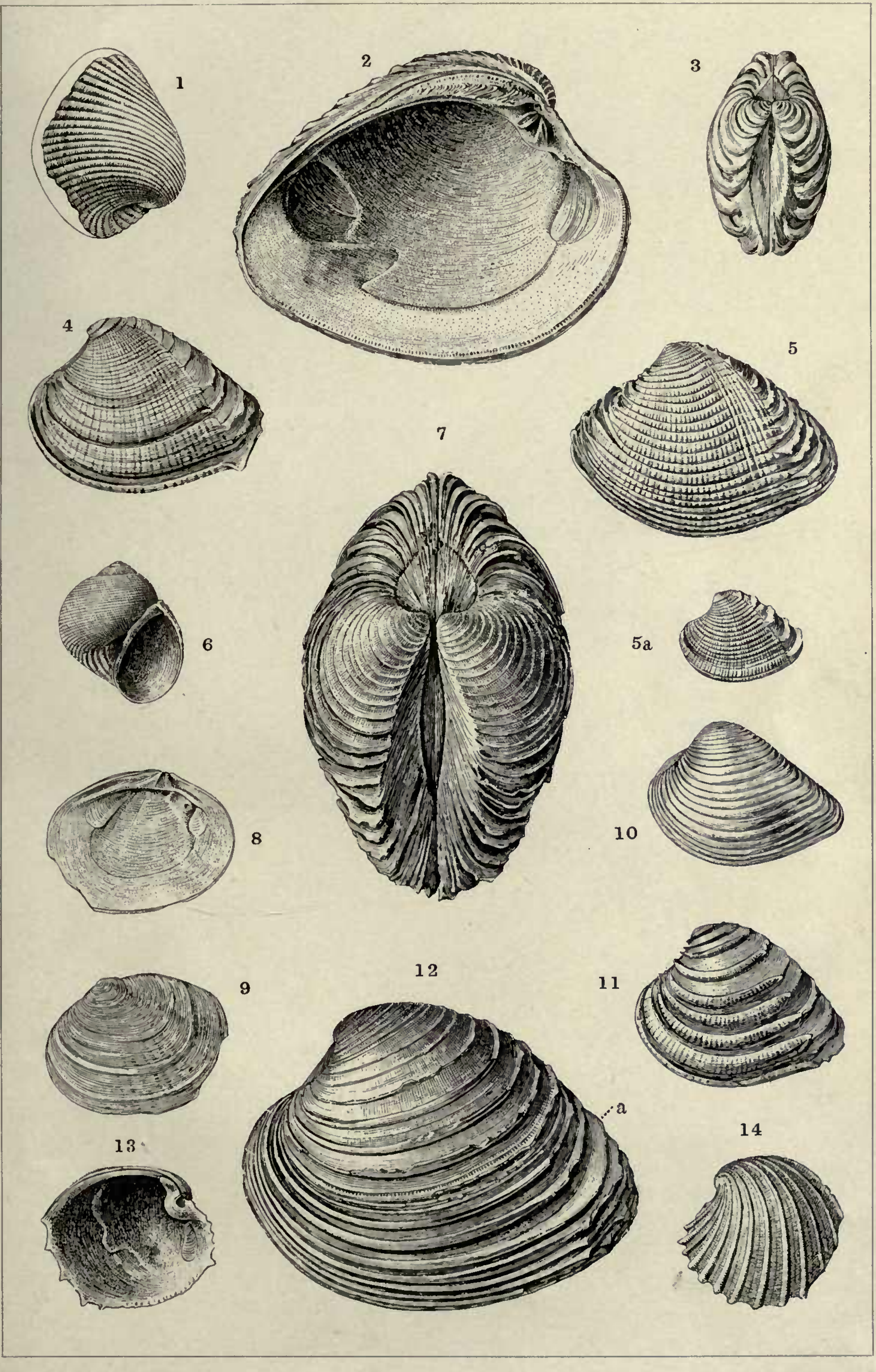


PLATE XLIII.

Fig. 1. *Petricola Harrisii* Dall; 22.5 mm.; Miocene of Virginia; p. 1060.

Fig. 2. *Semele mutica,* var. *scintillata* Dall; 8.0 mm.; Oligocene of Florida; p. 988.

Fig. 3. *Astarte protracta* O. Meyer, young; lon. 6.5 mm.; Claiborne sands, Claiborne, Alabama.

Fig. 4. *Semele alumensis* Dall; 8.5 mm.; Alum Bluff Miocene; p. 989.

Fig. 5. *Diplodonta yorkensis* Dall, view of interior and profile of teeth; 11.0 mm.; Miocene of Virginia; p. 1185.

Fig. 6. *Semele Smithii* Dall, restored from fragments; 26.0 mm.; Chipolan; p. 987.

Fig. 7. *Pteropurpura Postii* Dall, Proc. U. S. Nat. Mus., xviii., p. 44, 1895; Tampa silex beds; Oligocene; alt. 38 mm.

Fig. 8. *Velorita floridana* Dall; 80 mm.; Tampa silex beds; Oligocene; showing hinge as worked out.

Fig. 9. *Trapezium claibornense* Dall; 7.0 mm.; Claibornian; outside view.

Fig. 10. The same, view of the interior.

Fig. 11. *Rochefortia Stantoni* Dall; 3.76 mm.; Miocene of North Carolina; p. 1160.

Fig. 12. *Semele mutica* Dall, typical form; 9.5 mm.; p. 988.

Fig. 13. *Velorita floridana* Dall, profile of type specimen; 80.0 mm.

Fig. 14. *Pleurotoma Lapenotierei* Dall; Tampa silex beds at Ballast Point; 27.0 mm.

Fig. 15. *Meretrix* (*Callista*) *pittsburgensis* Dall, view from above; 36.0 mm.; Eocene of Pittsburg, Oregon.

Fig. 16. *Semele mutica,* var. *Stearnsii* Dall; 11.0 mm.; Chipolan Oligocene; p. 988.

PLATE XLIII.

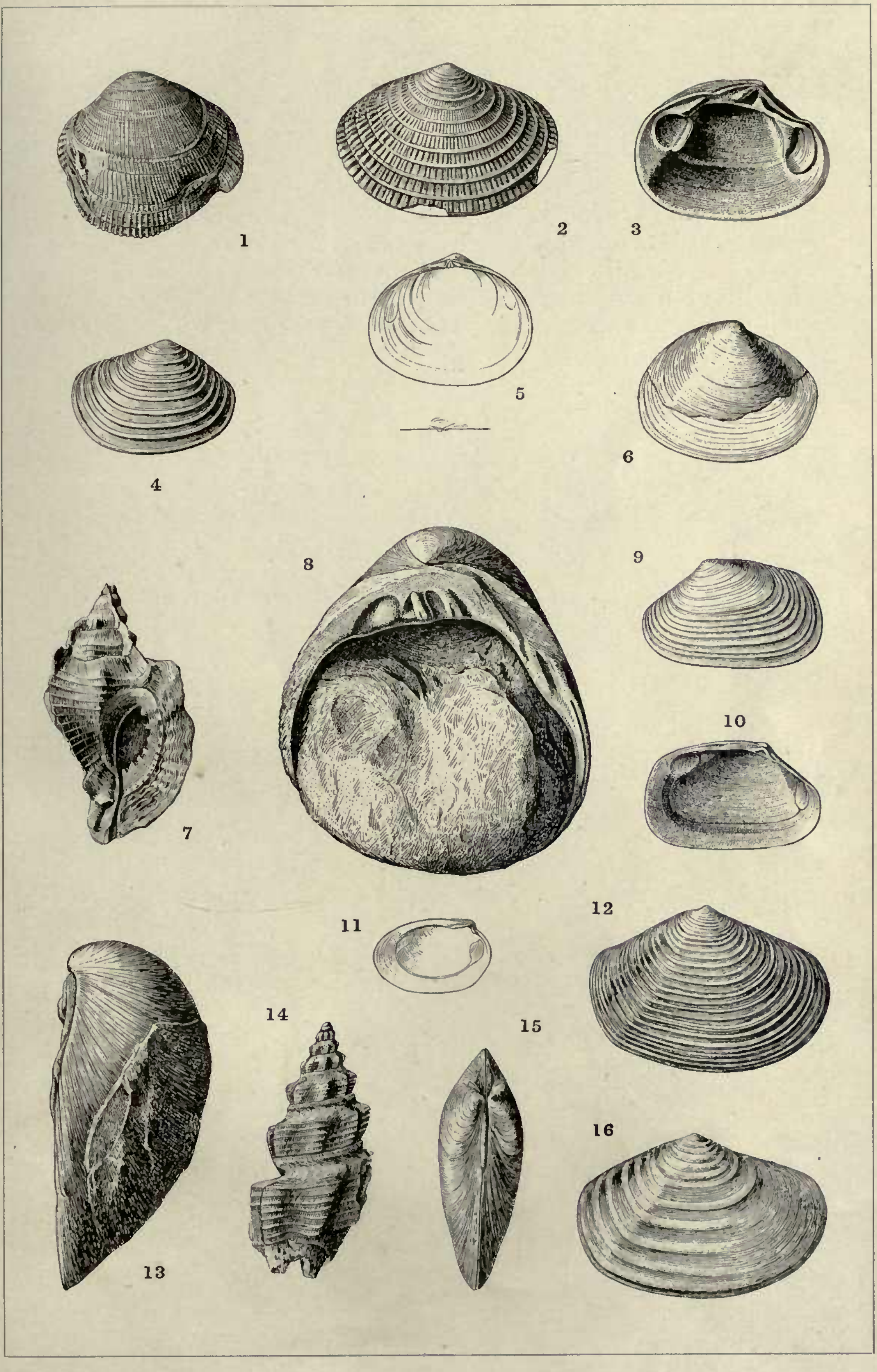


PLATE XLIV.

Fig. 1. *Sportella yorkensis* Dall; 7.0 mm.; Miocene of Virginia; p. 1130.

Fig. 2. *Montacuta actinophora* Dall; 11.0 mm.; Oligocene of Florida; p. 1172.

Fig. 3. *Erycina carolinensis* Dall; 7.0 mm.; Miocene of North Carolina; p. 1145.

Fig. 4. *Montacuta chipolana* Dall; 8.5 mm.; Oligocene of Florida; p. 1171.

Fig. 5. *Semelina cythereoidea* Dall; 5.0 mm.; Oligocene of Florida; p. 994.

Fig. 6. *Montacuta sagrinata* Dall; 7.5 mm.; Miocene of Virginia; p. 1174.

Fig. 7. *Erycina plicatula* Dall; 9.5 mm.; Claibornian; adult with feeble sculpture; p. 1143.

Fig. 8. *Aligena minor* Dall; 3.0 mm.; Miocene of North Carolina; p. 1177.

Fig. 9. *Sportella lubrica* Dall; 5.0 mm.; Oligocene of Florida; p. 1127.

Fig. 10. *Sportella pelex* Dall; 7.3 mm.; Miocene of Virginia; p. 1131.

Fig. 11. *Diplodonta radiata* Dall, interior of left valve and profile of teeth; 19.0 mm.; Oligocene of Florida; p. 1184.

Fig. 12. *Erycina plicatula* Dall; 6.0 mm.; young shell with strong sculpture; p. 1143.

Fig. 13. *Sportella unicarinata* Dall; 5.5 mm.; exterior of adolescent valve, showing carina and prominent prodissoconch; Oligocene of Florida; p. 1127.

Fig. 14. *Petricola calvertensis* Dall; 17.5 mm.; Miocene of Maryland; p. 1060.

Fig. 15. *Erycina chipolana* Dall; 4.1 mm.; Oligocene of Florida; p. 1144.

Fig. 16. *Diplodonta caloosaënsis* Dall; 27.0 mm.; Pliocene of Florida; p. 1188.

Fig. 17. *Diplodonta (Felaniella) minor* Dall, interior of right valve and profile of teeth; 4.5 mm.; Oligocene of Bowden, Jamaica; p. 1183.

Fig. 18. *Sportella obolus* Dall, interior of right valve and profile of teeth; 4.5 mm.; Oligocene of Florida; p. 1126.

Fig. 19. *Diplodonta alta* Dall; 27.0 mm.; Chipolan Oligocene; p. 1183.

Fig. 20. *Donax chipolana* Dall; 9.5 mm.; Chipolan Oligocene; p. 966.

Fig. 21. *Erycina (Pseudopythina) americana* Dall; 16.0 mm.; Miocene of Maryland; p. 1146.

Fig. 22. *Erycina carolinensis* Dall; 13.25 mm.; Pliocene of South Carolina; p. 1145.

Fig. 23. *Aligena lineata* Dall; 7.5 mm.; Oligocene of Oak Grove, Florida; p. 1176.

Fig. 24. *Sportella lioconcha* Dall; 14.0 mm.; Oligocene of Oak Grove, Florida; p. 1128.

Fig. 25. *Erycina (Pseudopythina) americana* Dall, 16.0 mm.; interior; Miocene of Maryland; p. 1146.

PLATE XLIV.

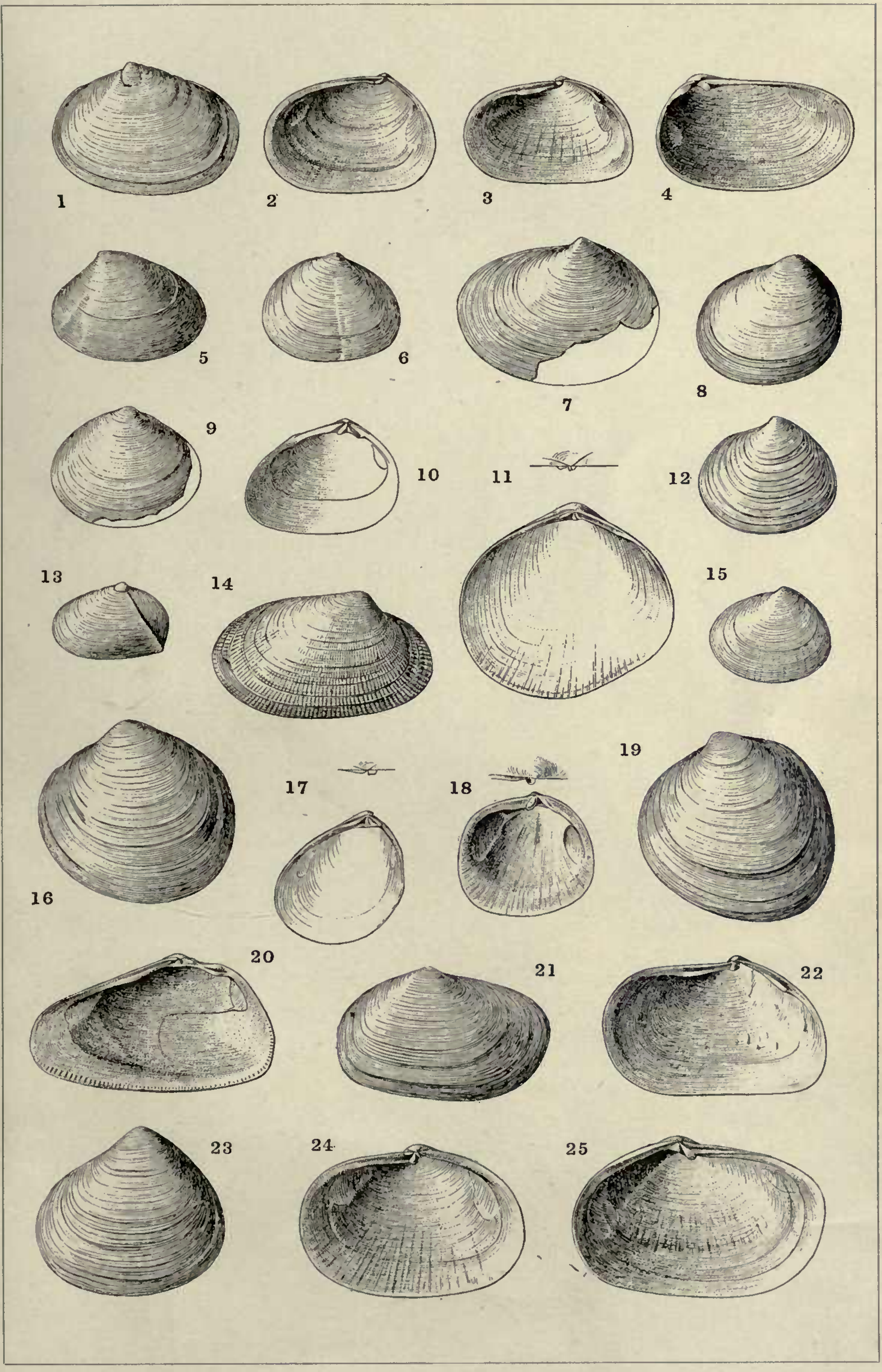


PLATE XLV.

These figures are from camera lucida drawings of the type specimens by W. H. Dall.

Fig. 1. *Erycina fabulina* Dall; 5.0 mm.; Oak Grove, Florida; Oligocene; p. 1145.

Fig. 2. *Bornia floridana* Dall; 7.3 mm.; Oak Grove, Florida; Oligocene; p. 1150.

Fig. 3. *Erycina undosa* Dall; 3.5 mm.; Chipolan Oligocene; p. 1144.

Fig. 4. *Hindsiella carolinensis* Dall; 5.5 mm.; Miocene of North Carolina; p. 1138.

Fig. 5. *Rochefortia Stimpsoni* Dall; 6.0 mm.; Miocene of North Carolina; p. 1160.

Fig. 6. *Montacuta petropolitana* Dall; 5.75 mm.; Miocene of Petersburg, Virginia; p. 1173.

Fig. 7. *Rochefortia planulata* Stimpson; 4.1 mm.; Pliocene of Florida; p. 1161.

Fig. 8. *Hindsiella nephritica* Dall; 4.75 mm.; Oligocene of Florida; p. 1137.

Fig. 9. *Hindsiella acuta* Dall; 6.0 mm.; Miocene of North Carolina; p. 1138.

Fig. 10. *Sportella petropolitana* Dall; 5.75 mm.; Miocene of Petersburg, Virginia; p. 1130.

Fig. 11. *Bornia rota* Dall; 4.2 mm.; Miocene of North Carolina; p. 1151.

Fig. 12. *Hindsiella donacia* Dall; 5.66 mm.; Claibornian; p. 1136.

Fig. 13. *Sportella recessa* Glenn; 5.0 mm.; Miocene of Maryland; p. 1131.

Fig. 14. *Erycina curtidens* Dall; 3.66 mm.; interior of right valve; Oligocene of Florida; p. 1145.

Fig. 15. The same, showing hinge of a left valve; p. 1145.

Fig. 16. *Bornia dodona* Dall; 5.25 mm.; Oligocene of Oak Grove, Florida; p. 1150.

Fig. 17. *Erycina chipolana* Dall; 4.1 mm.; Oligocene of Florida; p. 1144.

Fig. 18. *Montacuta mariana* Dall; 4.0 mm.; Miocene of Maryland; p. 1173.

Fig. 19. *Erycina marylandica* Glenn; 3.05 mm.; Miocene of Maryland; p. 1146.

Fig. 20. *Anisodonta* (*Fulcrella*) *carolina* Dall; 5.0 mm.; Miocene of North Carolina; p. 1133.

Fig. 21. *Montacuta claiborniana* Dall; 4.5 mm.; Eocene of Alabama; p. 1171.

Fig. 22. *Erycina protracta* Dall; 8.35 mm.; Pliocene of South Carolina; p. 1146.

Fig. 23. *Dicranodesma calvertensis* Glenn, interior of right valve; 4.75 mm.; Miocene of Maryland; p. 1157.

Fig. 24. The same, interior of left valve; 4.75 mm.; p. 1157.

Fig. 25. *Alveinus rotundus* Dall, interior of left valve; 1.9 mm.; Chipolan Oligocene, Florida; p. 1167.

Fig. 26. *Diplodonta puncturella* Dall, interior of left valve and profile of teeth; 6.0 mm.; Oligocene of Bowden, Jamaica; p. 1183.

Fig. 27. *Solecardia* (*Spaniorinus*) *Cossmanni* Dall, interior of right valve; 8.0 mm.; Miocene of Virginia; p. 1125.

Fig. 27a. The same, hinge of left valve; p. 1125.

Fig. 28. *Alveinus rotundus* Dall, interior of right valve, showing hinge; 1.9 mm.; Chipolan Oligocene of Florida; p. 1167.

PLATE XLV.

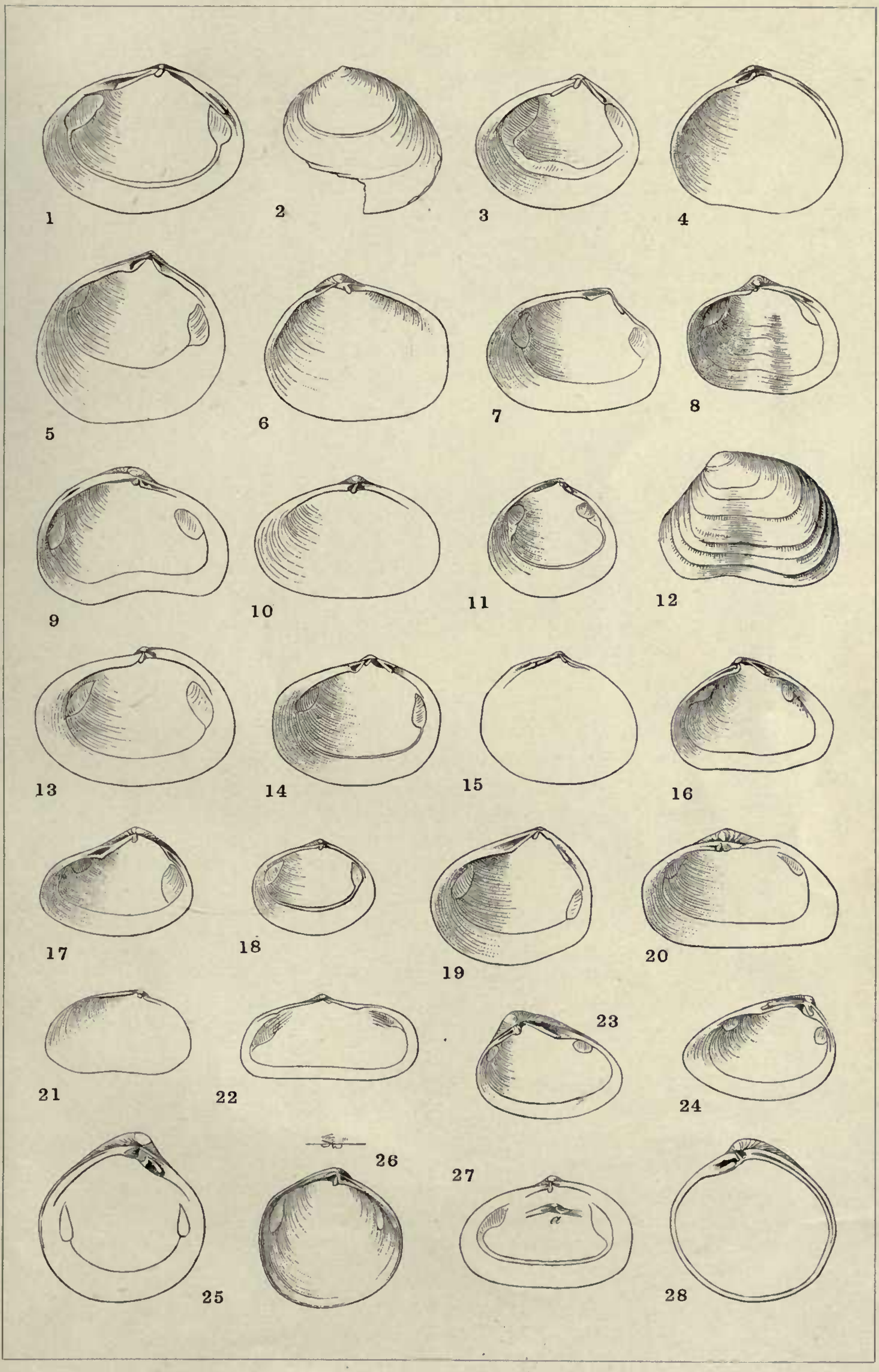


PLATE XLVI.

Fig. 1. *Tellina* (*Angulus*) *acosmita* Dall; Chipola Oligocene; lon. 10.5 mm.; p. 1026.

Fig. 2. *Tellina* (*Angulus*) *cutœnia* Dall; Claibornian; lon. 9.0 mm.; p. 1016.

Fig. 3. *Macoma* (*Cymatoica*) *Vendrycsi* Dall; Oligocene of Bowden. The sculpture in the figure is too regular, the concentric waves are more broken up than the artist has indicated in this figure; lon. 7.0 mm.; p. 1056.

Fig. 4. *Tellina* (*Macaliopsis*) *merula* Dall; silex beds of Ballast Point, Florida; lon. 16.0 mm.; p. 1019.

Fig. 5. *Tellina* (*Moerella*) *Hendersoni* Dall; Oligocene of Bowden; lon. 7.5 mm.; p. 1024.

Fig. 6. *Tellina* (*Angulus*) *propetenella* Dall; Miocene of York River, Virginia; lon. 10.0 mm.; p. 1033.

Fig. 7. *Tellina* (*Angulus*) *pharcida* Dall; Oligocene of Bowden; lon. 5.5 mm.; p. 1025.

Fig. 8. *Tellina* (*Macaliopsis*) *clonecta* Dall; Chipola beds; lon. 13.5 mm.; p. 1020.

Fig. 9. *Tellina* (*Moerella*) *Aldrichi* Dall; Chickasawan Eocene of Lisbon, Alabama; lon. 20.0 mm.; p. 1017.

Fig. 10. *Tellina* (*Merisca*) *acrocosmia* Dall; Oligocene of Bowden; lon. 7.0 mm.; p. 1020.

Fig. 11. *Tellina* (*Angulus*) *agria* Dall; Oligocene of Oak Grove, Florida; lon. 6.7 mm.; p. 1027.

Fig. 12. *Tellina* (*Moerella*) *Simpsoni* Dall; Oligocene of Bowden; lon. 7.0 mm.; p. 1024.

Fig. 13. *Tellina* (*Angulus*) *umbra* Dall; Miocene of Duplin County, North Carolina; lon. 12.5 mm.; p. 1033.

Fig. 14. *Tellina* (*Scissula*) *lampra* Dall; Chipola beds; lon. 8.6 mm.; p. 1028.

Fig. 15. *Macoma irma* Dall; Ballast Point silex beds, Florida; lon. 28.0 mm.; p. 1047.

Fig. 16. *Tellina* (*Moerella*) *aclonecta* Dall; Oligocene of Bowden; lon. 4.7 mm.; p. 1025.

Fig. 17. *Tellina* (*Angulus*) *dupliniana* Dall; Miocene of Duplin County, North Carolina; lon. 12.5 mm.; p. 1032.

Fig. 18. *Tellina* (*Phyllodina*) *lepidota* Dall; Oligocene of the Gatun beds, near Panama; lon. 7.5 mm.; p. 1022.

Fig. 19. *Tellina* (*Moerella*) *nucinella* Dall; Oligocene of Oak Grove, Florida; lon. 3.5 mm.; p. 1026.

Fig. 20. *Tellina* (*Angulus*) *macilenta* Dall; Miocene of Duplin County, North Carolina; lon. 16.5 mm.; p. 1034.

Fig. 21. *Isocardia floridana* Dall; Vicksburgian of Florida; umbonal view of internal cast; lon. 25.0 mm.; p. 1066.

Fig. 22. *Isocardia carolina* Dall; Miocene of Grove Wharf, Virginia; lon. 84.0 mm.; p. 1067.

Fig. 23. *Tellina* (*Merisca*) *hypolispa* Dall; Chipola beds; lon. 13.5 mm.; p. 1022.

Fig. 24. *Metis trinitaria* Dall; Oligocene of Trinidad; lon. 52.0 mm.; p. 1041.

Fig. 25. *Tellina* (*Moerella*) *suberis* Dall; Pliocene of the Caloosahatchie marls; lon. 7.0 mm.; p. 1031.

Fig. 26. *Isocardia floridana* Dall; Vicksburgian of Florida; side view of internal cast; lon. 36.0 mm.; p. 1066.

Fig. 27. *Tellina cynoglossa* Dall; Chickasawan Eocene of Wood's Bluff, Alabama; lon. 16.5 mm.; p. 1017.

PLATE XLVI.

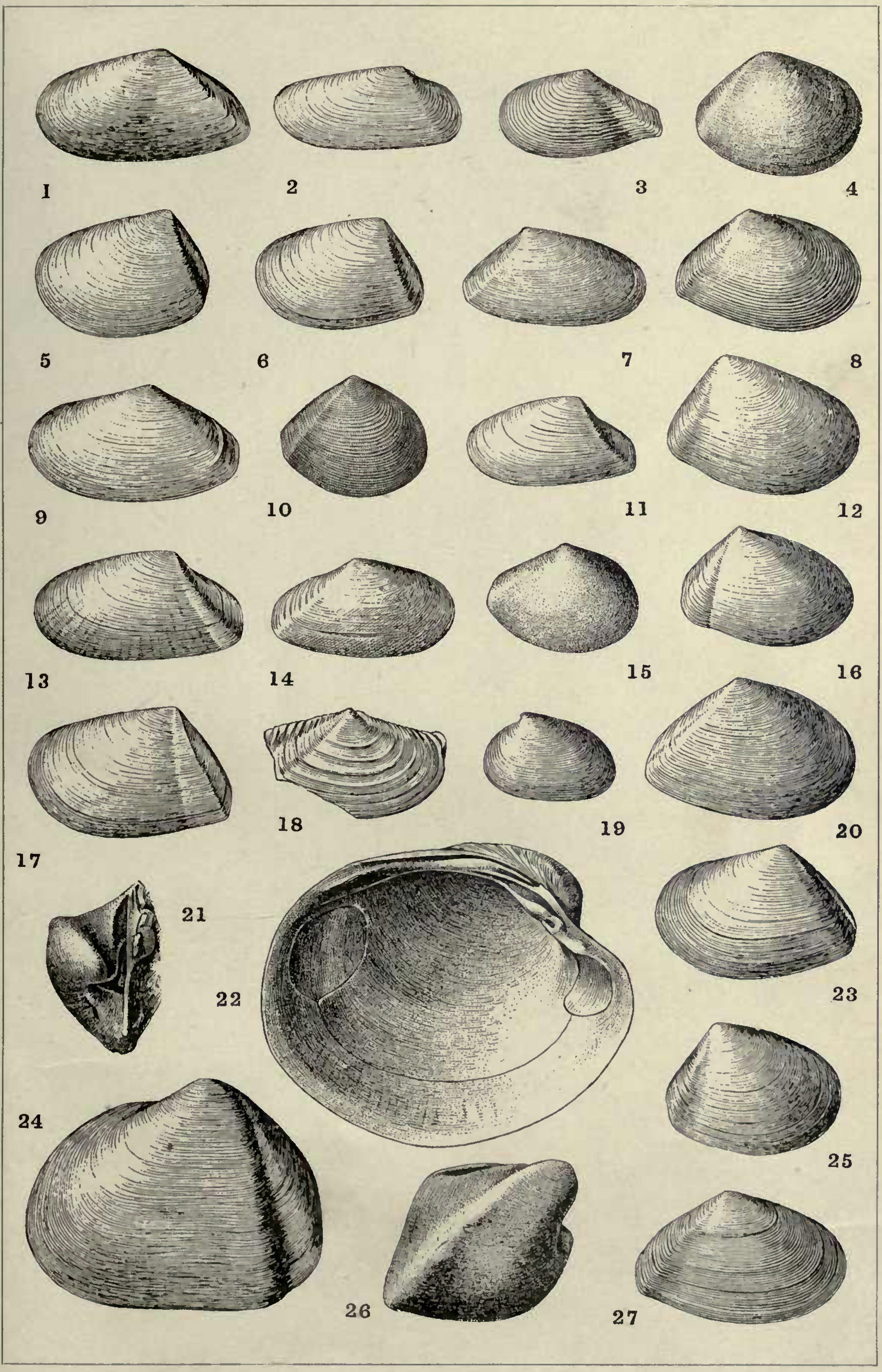


PLATE XLVII.

Fig. 1. *Tellina (Scissula) calliglypta* Dall; Pliocene of Shell Creek, Florida; lon. 13.5 mm.; p. 1036.

Fig. 2. *Tellina (Merisca) caloosana* Dall; Pliocene of the Caloosahatchie marl; lon. 8.0 mm.; p. 1030.

Fig. 3. *Macoma Conradi* Dall; Miocene of York River, Virginia; lon. 22.0 mm.; p. 1048.

Fig. 4. *Macoma Holmesii* Dall; Miocene of Duplin County, North Carolina; lon. 32.0 mm.; p. 1054.

Fig. 5. *Tellina (Angulus) pressa* Dall; Chipola beds; lon. 12.5 mm.; p. 1026.

Fig. 6. *Tellina chipolana* Dall; Chipola beds; lon. 38.0 mm.; p. 1018.

Fig. 7. *Tellina (Angulus) propetenera* Dall; Pliocene of the Caloosahatchie marls; lon. 16.0 mm.; p. 1035.

Fig. 8. *Macoma alumensis* Dall; Miocene of Alum Bluff, Florida; lon. 20.0 mm.; p. 1049.

Fig. 9. *Tellina (Eurytellina) roburina* Dall; Oligocene of Oak Grove, Florida; lon. 39.0 mm.; p. 1024.

Fig. 10. *Macoma calhounensis* Dall; Oligocene of Calhoun County, Florida (Chipola); lon. 10.5 mm.; p. 1046.

Fig. 11. *Tellina strophia* Dall; Chipola beds; lon. 27.0 mm.; p. 1019.

Fig. 12. *Tellina (Angulus) acalypta* Dall; Chipola beds; lon. 10.5 mm.; p. 1027.

Fig. 13. *Macoma (Psammacoma) tracta* Dall; Oligocene of Bowden; lon. 12.7 mm.; p. 1053.

Fig. 14. *Macoma laxa* Dall, inside view; Pliocene of the Caloosahatchie marls; lon. 23.0 mm.; p. 1050.

Fig. 15. *Tellina (Scissula) scitula* Dall; Oligocene of Bowden; lon. 8.0 mm.; p. 1028.

Fig. 16. *Tellina (Eurytellina) scapha* Dall; Miocene of Nansemond River, Virginia; lon. 30.0 mm.; p. 1030.

Fig. 17. *Tellina (Phyllodina) halistrepta* Dall; Oligocene of Bowden; lon. 9.0 mm.; p. 1023.

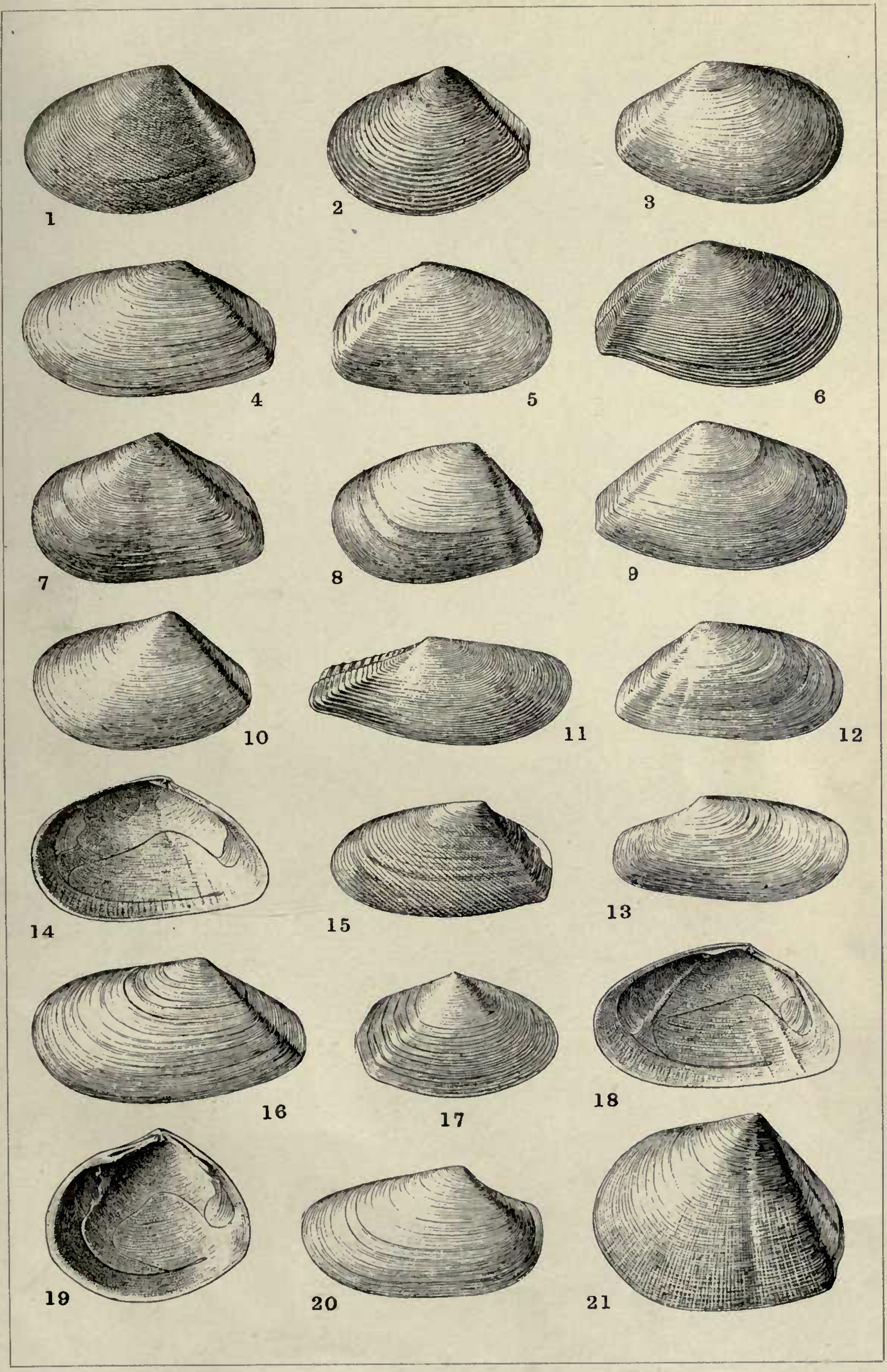
Fig. 18. *Tellina (Oudardia) Buttoni* Dall, inside view, showing radii; lon. 20.0 mm.; p. 1036.

Fig. 19. *Tellina (Merisca) dinomera* Dall, inside view; Pliocene of the Caloosahatchie; lon. 18.0 mm.; p. 1031.

Fig. 20. *Macoma (Psammacoma) olivella* Dall; Bowden Oligocene; lon. 23.0 mm.; p. 1054.

Fig. 21. *Metis chipolana* Dall; Chipola beds; lon. 44.0 mm.; p. 1042.

PLATE XLVII.



INDEX.

In this index subgenera are treated as genera and varieties treated as species. Those names now first proposed for groups or species are in italics; the numerals in italics indicate the pages where the genus or species is described or discussed at length, as contrasted with the pages where it is merely mentioned.

ADDENDUM.

To the synonymy of *Kellia*, page 1153, add:

Diplodontina Stempel, in Spengel's Zool. Jahr., Suppl. bd. iv., bd. 2, heft 1, p. 232, Dec., 1899. Type *D. tumbesiana* Stempel, *loc. cit.*, pl. 12, figs. 18, 19, 19*a*. (Chile.)

According to the figures and description, this name is an exact synonym of *Kellia.*

A *Strigilla galvestonensis* has been described by Harris from the Upper Miocene of the Galveston artesian well, in Bull. Am. Pal., i., p. 92, pl. 7, fig. 4, 1895.

FINAL NOTE.

Plates 48 and 49, to which a few references appear in the text, will be issued with Part vi. The manuscript of this memoir was submitted for publication in April, 1900, and the printing was completed November 28, 1900.