Q
11
U563
CRLSSI

SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
Bulletin 90

A MONOGRAPH OF THE MOLLUSCAN FAUNA OF THE ORTHAULAX PUGNAX ZONE OF THE OLIGOCENE OF TAMPA, FLORIDA

BY

WILLIAM HEALEY DALL
Curator, Division of Mollusks, United States National Museum

WASHINGTON
GOVERNMENT PRINTING OFFICE
1915

BULLETIN OF THE UNITED STATES NATIONAL MUSEUM.

ISSUED JANUARY 21, 1915.

II

ADVERTISEMENT.

The scientific publications of the United States National Museum consist of two series, the *Proceedings* and the *Bulletins*.

The *Proceedings*, the first volume of which was issued in 1878, are intended primarily as a medium for the publication of original, and usually brief, papers based on the collections of the National Museum, presenting newly acquired facts in zoology, geology, and anthropology, including descriptions of new forms of animals and revisions of limited groups. One or two volumes are issued annually and distributed to libraries and scientific organizations. A limited number of copies of each paper, in pamphlet form, is distributed to specialists and others interested in the different subjects as soon as printed. The date of publication is printed on each paper, and these dates are also recorded in the tables of contents of the volume.

The *Bulletins*, the first of which was issued in 1875, consist of a series of separate publications comprising chiefly monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, and catalogues of type-specimens, special collections, etc. The majority of the volumes are octavos, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable.

Since 1902 a series of octavo volumes containing papers relating to the botanical collections of the Museum, and known as the *Contributions from the National Herbarium*, has been published as bulletins.

The present work forms No. 90 of the *Bulletin* series.

RICHARD RATHBUN,
Assistant Secretary, Smithsonian Institution,
In charge of the United States National Museum.

WASHINGTON, D. C., *November 25, 1914.*

TABLE OF CONTENTS.

MONOGRAPH OF THE MOLLUSCAN FAUNA OF THE ORTHAULAX PUGNAX ZONE OF THE OLIGOCENE OF TAMPA, FLORIDA.

By William Healey Dall,

Curator, Division of Mollusks, United States National Museum.

INTRODUCTION.

In the vicinity of Tampa Bay, Florida, and especially on the northwestern shores of the bay, near Ballast Point, are found certain limestones more or less mingled with layers of clay, marl, and chert, with residual sands and so-called "fuller's earth." A particular stratum which crops out near high-water mark at Ballast Point is extremely fossiliferous. In the cherty portions the calcareous matter of the fossils has disappeared through solution, and they are represented chiefly by molds, from which casts may be made with gutta-percha or other plastic material, so that the character of the fossils can be determined. In the marly or clayey parts of this deposit the fossils have also largely disappeared, but natural casts in pure silex have replaced them. In the portions of the bed which retain the character of limestone the fossils remain more or less intact, but are difficult to work out on account of the hard, tough character of the matrix. Rock excavated by dredges in deepening the channel off Ballast Point, much of which has been dumped on the adjacent beaches, is of the same character as the limestone above tide marks in which the fossils remain calcareous. In that portion of the bed in which silicification has been most active, besides the shells exquisitely reproduced in silica, either translucent or of various shades of brown, also occur silicified corals, some of them in masses of considerable size. These have a geodic form in many cases, the exterior of the coral head being reproduced, often with great perfection of detail, while the interior is hollow, with its walls covered with brilliant crystals of quartz, often presenting a remarkable coloration in various shades of brown, red, blue, or yellow. These having attracted the attention of visitors, were for years collected by dealers in local curios for sale to tourists. The layers

from which they came were known to collectors and later to visiting geologists as "the Silex Beds," a place-name they have retained to the present time.

The process of silicification is still going on. When the writer visited the locality in 1886 and on various subsequent occasions, hoping that the limestone matrix might be removed by acid, a test was made which showed that in cases where part of a fossil shell projecting from a limestone pebble between tides, where the water was gradually dissolving the limestone and exposing the fossil, the still-imbedded portion of the shell retained its limy character, while the exposed portion had been completely replaced by silex.

The interest which these fossils possess is not limited to their aesthetic beauty, nor their position as characteristic of one horizon in the series illustrating the evolution of life on the globe, but is of extreme importance as furnishing a key to the little-understood succession of the Tertiary beds which fringe the islands of the West Indies and the encircling continental shores of Mexico, Central America, and northern South America. The Tertiary column of the coastal plain of our Gulf States being fairly well elucidated, the relative position of the deposits to the south can be determined, if any one of them can be satisfactorily connected with a given horizon in the North American series. Such a connection is afforded by the fauna of the silex beds of Tampa.

GEOLOGICAL EXPLORATION OF THE BEDS.

The first account of these beds in geological literature was printed in the American Journal of Science in 1846[1] by Prof. John H. Allen. His account is accurate and graphic, representing the characteristic features of the deposit and its fossils as well as could be done to-day, though without any attempt to determine their place in the geological column. He states that even at that time the chalcedonized fossils were well known to mineralogists. Later in the same year T. A. Conrad published an account of his researches into Floridian geology[2] made during a visit in 1842. He described the bed and the fossils at length and refers them to the upper part of the Eocene. He traced the formation correctly to the falls of the Hillsborough River, 9 miles above Tampa, and again recognizes it "a few miles up the Manatee River in the bed of a rivulet." He points out that at Ballast point, near Fort Brooke, the beds containing silicified material underlie a stratum of limestone which in turn is covered by a thin layer of Pleistocene marl and shells. In the second part of his paper he describes and figures nine species of invertebrates, including a *Balanus* and two species of Foraminifera from these beds.

[1] Amer. Journ. Sci., ser. 2, vol. 1, pp. 38–42, Jan., 1846.
[2] Idem., ser. 2, vol. 2, pp. 41–48, 399–400. July and Nov., 1846.

Somewhat later Ballast Point was visited by Prof. J. W. Bailey, United States Army, who was interested in Foraminifera and published[1] an account in 1850 of material which he supposed to be an infusorial earth from this locality. This has since been determined to be merely a part of the marl, which contains a certain number of diatoms and Foraminifera and not a separate deposit. Thirty-six years later an exploration of southern Florida was suggested by Mr. Joseph Willcox, of Philadelphia, and financed by the Wagner Free Institute of Science and the Academy of Natural Sciences of that city. The party was led by Mr. Willcox and included Prof. Angelo Heilprin and Mr. Charles H. Brock, besides the master and crew of a small sailing vessel on which the trip was made. A hasty visit to Ballast Point enabled Professor Heilprin to make a collection of the silicified fossils and some notes on the geology, which were afterward published in the Transactions of the Wagner Institute[2] as part of an interesting report on the expedition.

The silex bed was referred by Professor Heilprin to the "Middle Atlantic Miocene" and correlated with part of his "Virginian series," in part the "Yorktown epoch" of Dana (pp. 121, 127). He described and figured the new forms and enumerated 47 species from that horizon and pointed out the identity of 6 of them with species collected from the Santo Domingo Tertiary by W. M. Gabb. He pointed out the probable identity of Conrad's *Nummulites floridana* with the European *Orbitolites complanata* of Lamarck, a surmise which has since been agreed to by Doctor Bagg. Curiously enough the layer called the *Cerithium* Rock, by Heilprin, which he thought to be below the horizon of the silex beds, but which has since proved to be part of the "Tampa limestone" overlying the silex beds,[3] he placed as forming the "transition ground" between the Miocene and Oligocene.

The researches of the Wagner expedition having aroused interest, the present writer was directed by the authorities of the United States Geological Survey to proceed to Florida in the winter of 1886–87 to obtain further information.

At the invitation of Mr. Willcox who intended to go over the same ground again we joined forces, and to his familiarity with the region much of the resulting success was due.

The conclusions drawn from the observations made on this trip were published by the writer in the Neocene Correlation Paper[4] of the survey, together with much collateral information derived from investigations in other parts of Florida. Collections at Ballast Point

[1] Smiths. Contr. Knowl., vol. 2, No. 8, p. 19, 1850.

[2] Trans. Wagner Inst., vol. 1, pp. 10–11, 105–127, June, 1889.

[3] A limestone underlying the silicious zone is reached by artesian wells, but this was inaccessible to Heilprin and seems by its fauna identical with the silex beds.

[4] U. S. Geol. Survey, Bull. No. 84, 1892, pp. 111–123.

yielded 128 species unknown to science, which were described and figured in the Transactions of the Wagner Institute,[1] together with other Floridian fossils.

In the Neocene volume the information in regard to the relations of the silex beds and associated strata, gathered through five years' investigations in various parts of the peninsula, were correlated and the whole subject reviewed. It was shown that the so-called Miocene of Florida was divisible into two groups separated not only by a marked change in the character of the deposit, but by a surprisingly sharp distinction in the character of the faunas, the essentially subtropical fauna of the lower group being replaced in the upper one by a fauna characteristic of much colder water. These two groups were tentatively considered under the terms Older and Newer Miocene, respectively, and the various zones or horizons disposed as in the following table.[2] The colloquial term "Silex bed" was replaced by the name "Orthaulax bed" from the most characteristic fossil. The superincumbent limestone was named the "Tampa limestone," and the series of beds above the lower part of the Chattahoochee limestone of Langdon and including the Alum Bluff beds[3] was associated under the designation of the "Tampa Group."

Table of 1892.

[The horizons are arranged in ascending order from the lower line.]

------ Cold Water fauna.	Newer Miocene		----------
Chesapeake Group.			Ecphora bed (Alum Bluff.)
------ Warm Water fauna.	Older Miocene.		----------
Tampa Group.	Alum Bluff beds.	Sands and clays.	
	Tampa beds.	Chert of Hillsboro' River.	
		Tampa limestone.	
	Chipola beds.	? "Infusorial earth."	
		White Beach sand rock.	
		Sopchoppy limestone.	
		Chipola marls.	
		Orthaulax bed.	
Chattahoochee Group.	Ocheesee beds.	? "Cerithium rock" Tampa.	
		Chattahoochee limestone.	
		Water bearing sands.	
	Hawthorne beds.	Phosphatic oolite.	
		Ferruginous gravels.	
		Greenish clays.	

A more thorough study of the fauna led to the recognition of the correlation of the above-mentioned "Older Miocene," including the

[1] Trans Wagner Inst., vol. 3, 1890–1903.
[2] Bull. U. S. Geol. Survey, No. 84, 1892.
[3] Afterwards proved to include the local equivalent of the Oak Grove sands.

Vicksburg Group, with the Oligocene (Aquitanian) of European geologists. This was announced in 1896,[1] and the determination has since been fully confirmed by the vertebrate fossils studied by Osborn and other paleontologists.

With the conclusion of the discussion of the molluscan fossils of the Florida Tertiary in 1903—work to which the explorations of many members of the United States Geological Survey contributed material, especially Capt. Frank Burns—a review of the available evidence was prepared and published in the last fasciculus of that work.[2] The arrangement of the several zones or horizons as then understood was as follows, in descending order:

1. Oak Grove sands.
2. Chipola marls.
3. Tampa limestone.
4. Orthaulax bed.
5. Chattahoochee Group.
6. Ocala nummulitic limestone.
7. Peninsular limestone.

Taking these in ascending order it may be pointed out that the researches of Col. Thomas L. Casey at Vicksburg, Mississippi,[3] confirmed the opinion previously held by those geologists who had explored the typical locality, that the Vicksburg Group as it was called by Conrad (who realized that it was not faunally homogeneous[4]) comprises at least two faunal horizons, the upper a marl containing abundant Orbitoides (*Lepidocyclina*), and the lower a limestone in which Orbitoides is absent or very rare. He writes (p. 515):

> The lower Vicksburgian consists of alternate thin strata of gray sands, sandy clays, and variably, but usually loosely compacted white or gray limestones. The upper consists of a much thinner bed of more or less red brown marl, often indurated into nodular masses, or subindurated and without trace of limestone, having rarely, however, thin layers of glauconitic sands and comminuted shells, in which entire specimens when found are generally much distorted by pressure. The faunas of these two beds differ very markedly, and there are probably not half of the species of either common to the two.[5]

There can be no question that we have here two faunal horizons though the stratigraphy may show no unconformity. There is very little doubt that the particular species supposed by Conrad to be

[1] Proc. U. S. Nat. Mus., vol. 19, No. 1110, p. 303, 1896.

[2] Trans. Wagner Inst., vol. 3, pp. 1541–1620, 1903.

[3] Proc. Acad. Nat. Sci. Phila. for 1901, pp. 513–518.

[4] Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 1, pp. 207–208, 1849. In this article Conrad indicates four conspicuous species which he states are found only in the lower part of the bluff and not in the upper fossiliferous stratum.

[5] Unpublished lists of the fossils collected by Dr. T. W. Vaughan, with close attention to the stratigraphy at Vicksburg Bluff, and kindly furnished for use in the present memoir show that there are of 123 well-determined species 38 peculiar to the upper bed, 27 peculiar to the lower bed, and 58 species found in both beds. The fauna described by Conrad in 1848 comprised species from both horizons indiscriminately.

characteristic of his "Group" are not confined to the two horizons represented in it, and can not, therefore, serve as tests of identity or difference of faunal epochs.

The name Peninsular limestone was proposed by the writer in 1903[1] for the Orbitoidal limestone, which forms the mass of the Floridian plateau and in which artesian wells have been sunk through a distance of over 1,500 feet without reaching its lowest limit. The statement is as follows:

> The Orbitoidal limestone which forms the mass of the Floridian plateau, and which has been, in this work and in the literature, generally called the "Vicksburg limestone," may really form a different horizon altogether from the typical Vicksburgian and be intermediate between the latter and the Nummulitic Ocala limestone. In order to promote clearness and avoid confusion, it is probably advisable to adopt a distinct name for the Orbitoidal phase or formation for which I would suggest the term Peninsular limestone. This is intended not as a permanent formation name, but as a general term for the fundamental plateau limestone of Florida, in which a close and thorough study in the future may result in the discrimination of more than one horizon or zone.

An examination of all the molluscan fossils in the collection of the United States National Museum which have been obtained by the United States Geological Survey from the Peninsular limestone shows that of 19 species 13 are are peculiar to it and 4 are identical with typical Vicksburg species. The limestone, except in its upper portion where it merges into the Ocala or Nummulitic phase, is very poor in fossils, except foraminifera, and only two or three of the molluscan fossils are at all common; practically all of the conspicuous shells of the upper horizon at Vicksburg have dropped out, a few of them to reappear in the Ocala. The foraminifera have not hitherto had the careful study they need, but are now in the hands of Dr. Joseph A. Cushman for that purpose. There are two widely distributed and rather common Echinoids, *Pygorhynchus gouldii* Bouvé, and *Oligopygus haldermani* (Conrad) Twitchell, neither of which has been reported from Vicksburg. Dr. T. W. Vaughan, after extensive explorations between the Mississippi and Savannah Rivers and in northern Florida, is of the opinion that the Peninsular limestone "can not be separated stratigraphically from Vicksburgian limestones to the east and north," and that "no stratigraphic line can be drawn between it and the overlying Ocala limestone." This is very probable, but the distinctions sought to be drawn by the writer are faunal or paleontological, not stratigraphic, since experience has shown that only by their contained faunas can the different and relative ages of these excessively similar successive limestones be finally determined. In the present case the Ocala phase or zone affords 59 species of mollusks, of which 25 are peculiar to it (as far as

[1] Trans. Wagner Inst., vol. 3, p. 1554.

our present knowledge goes), 13 identical with species found at Vicksburg, and 15 (including in this case foraminifera) are inherited from the Peninsular limestone, which was followed by the Ocala with continuous sedimentation but with the changes of fauna above indicated.

The Ocala or Nummulitic limestone of Heilprin was first discovered by Mr. Joseph Willcox and discriminated from the Peninsular limestone, of which it seems to form a culminating phase, by Prof. Angelo Heilprin. The stratum, though thin, is, according to Doctor Vaughan's observations, quite widely spread, and is everywhere characterized by a specially abundant content of foraminifera, particularly the Nummulites and Miliolites. The former are not absolutely confined to the Ocala phase, but elsewhere are relatively rare, indicating perhaps the slowness with which the Nummulitic fauna of southern Europe and northern Africa was able to make its way westward, following the Orbitoides or Lepidocyclinas and Orbitolites. The last mentioned have been able to persist to the present time, having been dredged by the peck in the Gulf of Mexico by the expeditions of the United States Bureau of Fisheries.

The Chattahoochee group, of which the typical locality is at New Chattahoochee Landing near the railway bridge over the river of the same name, was named by Langdon in 1887, who, by misidentification of fossils, was led to describe it as of Miocene age. The fossils are not numerous and as a rule are poorly preserved.

The Orthaulax bed has been sufficiently described above, as has the overlying limestone named in 1892 by the writer, the Tampa limestone, which though apparently conformable with the former has so far failed to yield to collectors some of the most characteristic fossils, such as *Orthaulax* and *Fasciolaria Tallorita*, and contains numerous others, especially Cerites, which have not yet been found in the Orthaulax bed.

The White Beach limestone of Little Sarasota Bay[1] has a fauna in many respects similar to that of the Orthaulax bed, and yet the identifiable species are not sufficiently numerous to decide whether it may be regarded as its exact equivalent or not. The question is complicated by the presence in the White Beach fauna of several large and conspicuous species not known from the Orthaulax bed, especially the *Conus demiurgus*, a large *Cypraea*, a *Mytilus*, and others.

The Tampa limestone (which includes Heilprin's "*Cerithium* rock") lies immediately over the Orthaulax bed at Ballast Point, but owing to its being at or nearly at the surface has been recognized over a wider area.[2] It is largely free from silex, the fossils are mostly represented by external molds, and it was referred with the Orthaulax bed to the Middle Miocene by Heilprin. The Jack-

[1] Trans. Wagner Inst., vol. 3, p. 1568.
[2] Idem., p. 1570.

sonboro limestone[1] of Screven County, Georgia, has a number of identical species, among which certain Cerites and species of *Strombus* are noticeable. Only one species so far is known to survive into the Chipola marl, though with a better knowledge of the fauna others would doubtless be identified.

The Chipola marls[2] were first observed in the lower stratum at Alum Bluff, Florida, by Langdon, who supposed them to be Miocene, but richer and better preserved deposits were later discovered by Capt. Frank Burns, of the United States Geological Survey, on the banks of the Chipola River a few miles away. These were later more fully explored by the present writer and Mr. Joseph Stanley Brown, of the survey, and their relation to the other adjacent elements of the Tertiary column of the Gulf coastal plain accurately determined.[3] About 50 per cent of the species in the Chipola beds are peculiar to them; of the others the larger proportion are common to the Tampa *Orthaulax* bed, while in the subsequent Oak Grove sands about 24 per cent of the Chipola species survive. A species of *Orthaulax* different from those of Santo Domingo and the Tampa silex beds is found in the Chipola, after which the genus disappears from our Tertiary.

The Oligocene marl of Bowden, Jamaica,[4] formerly supposed to be Miocene, is naturally more nearly related to the Oligocene of Haiti and Santo Domingo, but contains many Chipola species. It is certain that Gabb's collection from Santo Domingo contains material from more than one horizon. One of the zones, however, must be contemporaneous with the Orthaulax bed since the characteristic species occur in both. Part of the rest is doubtless younger and may even prove Pliocene, a confusion which can only be cleared up by further stratigraphical study. The Bowden fauna does not contain *Orthaulax*, though it has many Chipola species, and its relations are probably with the series between the Chipola marls and the Oak Grove sands.

The Oak Grove sands[5] were discovered at Oak Grove, Santa Rosa County, Florida, by Mr. L. C. Johnson, of the United States Geological Survey, and later explored by Prof. E. A. Smith and Captain Burns. They contain a well preserved and very interesting fauna, which begins to show traces of the influences which formed the subsequent true Miocene. Subsequent explorations by Mr. T. H. Aldrich, and Dr. T. Wayland Vaughan of the United States Geological Survey, have brought to light on Shoal River at no great distance certain fossiliferous marls, which contain an analogous fauna, probably of little difference in age. From Alum Bluff on

[1] Dall and Harris, Bull. U. S. Geol .Survey, No. 84, p. 73, 1892.
[2] Trans. Wagner Inst., vol. 3, p. 1574.
[3] Bull. Geol. Soc. Amer., vol. 5, pp. 147–170, 1894.
[4] Trans. Wagner Inst., vol. 3, p. 1580.
[5] Idem., p. 1588.

the Chattahoochee River a stratum visible, but not there fossiliferous, is continuously traceable to Rock Bluff, where it contains characteristic Oak Grove species, so that the position of the latter in the Tertiary column is definitely fixed.

About 24 per cent of the Oak Grove fauna is identical with that of the Chipola marl, but characteristic species like Orthaulax have vanished. The sweeping nature of the change caused by the Miocene invasion of cold water is shown by the fact that of the Oak Grove species less than 1 per cent survive in the fauna of the superincumbent Miocene beds.

The premonition of Miocene conditions is shown, however, in the Oak Grove fauna by the appearance of a large *Lyropecten* and some few other analogous species.

After the Miocene a recurrence of warmer conditions brought back in the Pliocene of Florida a good many of the species which had been exiled by the inflow of cold Miocene waters.

The above summary of our knowledge at the time of publication in 1903 indicates the relations of the Orthaulax bed to adjacent Tertiary faunas as understood at that period.

The next important attempt to classify the Florida Tertiary beds which are associated with the Orthaulax bed is found in the Report on the Geology of Florida with special reference to the Stratigraphy, by George C. Matson and F. C. Clapp.[1] In this report the attempt is made to consider the peninsular part of Florida as an inherent part of the coastal plain and to explain its geological history as dependent on the orogeny of the continental region. In the work of the present writer the present peninsula of Florida is regarded as independent of the Eocene continental border, to which it became attached only after the close of the Miocene, and as related to a group of late Eocene or Oligocene islands separated by a wide strait both from the continent and from Cuba and having its own genetic history, which in Tertiary time only in the very widest and least effective sense depended on the continental movements.

The present writer has shown by railway levels that the peninsular part of Florida is marked by two principal northerly and southerly low ridges with a shallow basin between them; a fact obvious from the distribution of rivers and lakes on any detailed map; and by the location of the fossiliferous strata, that the whole peninsula has a gentle tilt from east to west, thereby causing the encircling deposits about the original islets to dip under the Gulf of Mexico on the western shore of the peninsula. Consequently he feels unable to accept without some evidence the hypothesis that the central basin is an eroded anticlinal arch. Such evidence has not been made public.

While exploring in Florida I learned that wells sunk in the western ridge reached rock only at a depth corresponding roughly with

[1] Florida State Geol. Survey, 2nd Ann. Rept., 1908–9, pp. 25–161, Jan., 1910.

the surface of the lowland limestone at the foot of the ridge; and that water was struck only at a further depth corresponding to the water level in the lowlands. This may indicate that the ridge corresponds rather to dune formation, or residual material left after solution in adjacent low areas, than to any real orogenic fold. While minor folding of a gentle character was observed by me along the banks of the Caloosahatchie River between Lake Okeechobee and the Gulf of Mexico, nothing indicating a major fold corresponding to the western ridge (which reaches in places a height of nearly or quite 200 feet) was detected.

The limestone characterized by a great abundance of *Orbitoides* (Lepidocyclina) which is the fundamental rock of peninsular Florida, and which has (p. 6) been shown to be, faunally, measurably distinct from the two horizons at Vicksburg included by Conrad in his Vicksburg Group, as indicated previously was named by me the Peninsular limestone. Messrs. Matson and Clapp considered it desirable to unite certain limestones of western Florida, which they called "Marianna limestone," with the Peninsular limestone which they believed might be newer than the Marianna, with the continuously deposited Nummulitic or Ocala limestone which is believed to be at least the latest faunal phase of the Peninuslar limestone; and presumably also with the two typical Vicksburg horizons of Conrad—in one group, which "to avoid further confusion" they proposed to call the Vicksburg Group.

There is no doubt of the relationship faunally of these several strata, but if we combine them into one group without indicating by any subordinate names the individual characteristics of the several zones referred to, it would seem that clearness would rather be lost than gained.

The different points of view outlined above account for the different results arrived at by the respective authors.

The column as devised by Messrs. Matson and Clapp is as follows:

MIOCENE.

Jacksonville formation. — Choctawhatchee marl.

Unconformity.

OLIGOCENE.

Apalachicola Group.

Believed to be contemporaneous.
- Alum Bluff formation.
- Chattahoochee formation.
- Hawthorne formation.
- Tampa formation.

Unconformity.

Vicksburg Group.
- Ocala limestone.
- Peninsular limestone.
- Marianna limestone.

The Ocala limestone is described as light gray to white, but the material from Ocala when weathered is of a warm yellow. Probably it differs in different places and with the degree of weathering. It is characterized by its profuse foraminiferal fauna and vertebrate remains.

The "Tampa formation" is believed by Messrs. Matson and Clapp to be "contemporaneous" with the Hawthorne and Chattahoochee formations. Whatever may be the case with the two latter, judged by their type localities which have furnished few fossils, the character of the faunas of the different zones of their Tampa formation precludes contemporaneity in the ordinary sense of the word, and the sedimentation shows that the deposition was serial and not contemporaneous. Doubtless the three so-called "formations" form a group in which the faunas are more nearly related to each other than to the groups above and below, and this general relation is perhaps what the authors intended to express by the term "contemporaneous."

The "Alum Bluff formation" of Messrs. Matson and Clapp, as they state,[1] is a different group from that named the Alum Bluff beds by Dall in 1892. These authors include in it the Chipola marl at the base of the bluff, which faunally is more nearly related to the Tampa Group than to the Oak Grove sands which form paleontologically the characteristic unit of Dall's Alum Bluff beds. The latter were specifically intended to include the strata between the Chipola marl and the Chesapeake (of Dall) or Choctawhatchee Miocene of Matson and Clapp.

The stratum stratigraphically continuous from Alum Bluff (where it bears no fossils) to Rock Bluff, where it contains *Pecten sayanus*, *Turritella alcida*, and one or two other species characteristic of the Oak Grove sands, is the representative in Dall's Alum Bluff beds of the sands referred to. The strata between it and the Chipola marl at the foot of the bluff are probably closely related to the marl, though there are very few recognizable fossils. The Oak Grove sands are faunally contrasted with the Chipola marl by the absence of *Orthaulax* and many other tropical or warm-water forms which occur abundantly in the Chipola fauna, and by the precursors of the Miocene which they contain, such as *Pecten sayanus*. The Oak Grove sands are of course Oligocene and more nearly related by their fauna to the subjacent Oligocene faunas than to anything which succeeds the sands. But in any grouping of the upper Oligocene faunas that of the Oak Grove sands and the Shoal River fauna reported by Vaughan stands contrasted with those which precede them, though not so markedly as with the succeeding Miocene.

It may be advisable, considering the misconceptions which have appeared in the writings of some foreign geologists, to put on record

[1] Florida State Geol. Survey, 2nd Ann. Report, 1908–9, p. 91.

here what has been repeatedly stated before by the writer, but apparently not clearly understood by them.

The Miocene to which reference is made in all my discussions of this subject is the Chesapeake Miocene of America, which has been shown by me[1] to have as a European analogue the Helvetian of northern Europe, Belgium, north Germany, and Denmark rather than the Molasse of Switzerland, the warm-water Miocene of southern France, and the Vienna Basin.

This Chesapeake Miocene has been recognized on the North American continent as far south as Lake Worth and in Key Vaca, Florida, and Galveston, Texas, in all these cases from artesian borings. Farther south than this we have no evidence of its existence. In most cases where exploration has been made, as at Panama and the Tehuantepec Isthmus, faunas determined as Pliocene immediately succeed those of the upper Oligocene, leading to the inference that the land stood higher in the Middle American region during the Miocene than during the periods preceding or following that epoch. Whether the subtropical Mediterranean Miocene has any analogue above the sea in this general region, including the Antilles, is doubtful. If it exists it may possibly be found in the beds of Santo Domingo or Costa Rica, where the problems of the stratigraphical relations of reported fossils still remain to be elucidated.

The Jacksonville formation is agreed to represent the typical Miocene of the Chesapeake Group in eastern Florida. In the western part of the State, where it has been given the name of the Choctawhatchee marl, it contains the same fossils in a better state of preservation.

This summary of the report of Messrs. Matson and Clapp is necessarily so brief as to do scant justice to the large amount of additional detail which it brings to our knowledge and the profuse elucidation of the geology which it contains.

The latest publication bearing on the present monograph which has been considered by the writer is the monumental volume by Dr. Bailey Willis, entitled "Index to the Stratigraphy of North America."[2] This portion "has been compiled by T. W. Vaughan from the literature and from the unpublished results of G. C. Matson and E. W. Berry in western Florida," etc. The portion relating to the beds immediately adjacent, above or below the Orthaulax zone, is quoted from the second annual report of the Florida Geological Survey by Matson and Clapp, above referred to.

Doctor Vaughan[3] adds the following paragraph of general interest:

Sediments of upper Oligocene age extend westward from western Florida to the Mississippi River. The Apalachicola Group or marine upper Oligocene

[1] Maryland Geol. Survey, Miocene, 1904, pp. cxxxix–clv.
[2] U. S. Geological Survey, Professional Paper No. 71, 1912, pp. 731–745.
[3] Idem., pp. 744–745.

has been identified by means of fossils in Alabama at Roberts, and probably at Wallace. In wells at Mobile, fossils characteristic of the Alum Bluff formation were encountered between depths of 1,250 and 1,550 feet; below these is limestone correlated with the Chattahoochee formation. The marine upper Oligocene is not known west of Mobile, the sediments becoming estuarine in character as the axis of the Mississippi embayment is approached. The unpublished results of the recent field work of Matson and the parallel paleobotanical studies of Berry have shown that the leaf-bearing clays and sandstones near Chicoria, Wayne County, 5 miles south of Florence, Rankin County, and Raglan, near McCallum, Perry County, Mississippi, are of upper Oligocene age. The exposure at Raglan (the Hattiesburg clays of L. C. Johnson) appears to represent the top of the Alum Bluff of Florida, while the one near Florence is stratigraphically lower, and perhaps belongs to the upper part of the Vicksburg Group. The exposure of interbedded sandstone, semiquartzitic sandstone, and clay at Grand Gulf, Mississippi, is, according to the available evidence, to be referred to the upper part of the lower Oligocene, and is the Mississippi representative of the Catahoula formation of Louisiana at the type-locality. These estuarine or fresh-water deposits of clay and sandstone represent the basal portion of the Grand Gulf Group of Hilgard, which, according to his definition, included the sandstone and clays lying between the Vicksburg below and the Lafayette above, but which is now known to be a series of formations, including those of lower and upper Oligocene, Miocene, and Pliocene age, with perhaps some Pleistocene. * * * The detailed tracing of the boundaries between the successive formations is now in progress by G. C. Matson.

Having summarized briefly the more important publications bearing on the subject up to the present time, it remains to sketch the succession indicated by paleontological research as far as it has reached at the time of writing.

It is generally agreed that in the miscellaneous series of clays, marls, sandstones, limestones, cherts, and gravels of which the Florida Tertiary rocks are composed the only safe and definite guide to their time relations as a whole is furnished by their contained fossils. For limited areas the sediments may afford a guide, but, over the region in general, reliance can not be placed on lithologic characters unsupported by paleontological evidence.

About 1890, at a conference called by Major Powell, then Director of the United States Geological Survey, to discuss the meaning and use of the term "formation" in a geological sense, after a long discussion in which each geologist of the survey then present took part, the conclusion arrived at was that a "formation" was "a lithologic unit." However, it may be in older geological epochs, it has long been recognized in Europe that in this sense there are no "formations" in the Tertiary, with very rare exceptions; and that even these exceptions correlated by their faunas form groups which usually are not lithologically identical. The minor divisions are therefore generally designated by some characteristic fossil as "zones" of such and such a species, and faunally related aggregations of such divisions are designated as "beds" or "groups."

To arrive at just conclusions in such divisions it is of course necessary to have a pretty thorough knowledge of the fauna of each zone or horizon; otherwise the really characteristic species of each zone may not be recognized.

The same facts are true of the Tertiary of the coastal plain of the southeastern United States, but hitherto the number of monographic studies of particular faunas has been very small compared with those which still remain to be investigated, and no exhaustive arrangement of our marine Tertiary column can be reasonably expected for many years to come. It was in view of these facts that in the tentative summary of our southeastern marine Tertiary, published in 1898,[1] the writer followed the method approved by the International Geological Congress of 1889 and already adopted by Marsh and other students of American vertebrate paleontology, by referring to the subdivisions as "series," "groups," and "beds" and, as far as possible, avoiding the indefinite and frequently misleading term "formation."

Some progress has been made since that time, and the European method is beginning to be appreciated, though delayed by the paucity of workers in the field of Tertiary invertebrate paleontology, and the consequent insufficiency of our knowledge of the greater number of our invertebrate Tertiary faunas.

The fauna represented in the silex beds at Ballast Point, Tampa Bay, Florida, which is the subject of this monograph, contains two species of the remarkable genus *Orthaulax* Gabb; one of these is rare and was the type of the genus, named by Gabb *O. inornata*, from Santo Domingo specimens. The other, more abundant, is the *O. pugnax* of Heilprin. The genus first appears, so far as now known, in this horizon, and both species are reported from the White Beach limestone, Little Sarasota Bay, Florida; at least one or both have been obtained from the lower part of the Oligocene beds in the Canal Zone, Panama, and from the West Indian islands of Antigua and Anguilla; while the genus was recognized by Dr. T. W. Vaughan at Consolazion del Sur, Pinar del Rio, Cuba, and at Original Pond, Thomas County, Georgia. The writer also obtained *O. pugnax* at Bainbridge, Georgia, as did also Doctor Vaughan.

The importance of these fossils in linking the Oligocene of the West Indian, Isthmian, and Caribbean with that of the continent is obvious. I have therefore designated the zone so represented as the *Orthaulax pugnax* zone, with the typical locality at Ballast Point, Tampa Bay, Florida, the only locality where the fauna has been exhaustively studied.

It is somewhat remarkable that *Orbitolites floridana* is excessively rare in this zone, while extremely abundant in the zone above.

[1] Eighteenth Ann. Rept. U. S. Geol. Survey, pp. 323–348.

This genus of Foraminifera appears to replace *Lepidocyclina* (better known as *Orbitoides* in this country) in these two horizons.

The molluscan fauna of the limestone immediately above the silex beds has not been thoroughly studied, but it is notable for the number of *Cerites* contained in it and for the profusion of *Orbitolites floridanus* Conrad (? *complanatus* Lamarck), and it seems allowable to apply the name of the latter species as a designation of this zone, with the type-locality at Ballast Point.

The fauna represented in the lower bed at Alum Bluff, on the Chattahoochee River, Florida, and in the Chipola marl has been fully though not exhaustively treated in the writer's work on the Tertiary Fauna of Florida.[1] It is a remarkably rich and beautifully preserved fauna, containing one species of *Orthaulax* (*O. gabbi* Dall), the last representative of the genus in our Tertiary. It is also notable for the abundance of a bivalve, *Cardium cestum* Dall, the name of which I have selected to designate the zone typified by the fauna of the Chipola marl at the locality on the Chipola River near Bailey's Ferry, Calhoun County, Florida.

These three zones form a natural faunal group, characterized by a large proportion of common species, by indications of uniform climatic conditions bordering on the tropical, and by the presence of peculiar genera not existing in the faunas succeeding to them.

The next superior zone, of which the fauna is fairly well known, though in part unpublished, is that referred to by the writer in 1892, as represented by the Alum Bluff beds and the sands at Oak Grove, Santa Rosa County, Florida. This horizon is conspicuously distinguished by the greenish or grayish color of the matrix as compared with the yellow or orange of the zone below, by the disappearance of *Orthaulax* and many of the more distinctively tropical forms from the fauna (though a fair proportion of Chipola forms still remain), and by the appearance in the fauna of a certain number of types prefiguring the cold-water fauna which accompanied the deposition of subsequent beds of Miocene age.

The type-locality is at Alum Bluff where the strata lie above the marl of the Chipola type at the base of the bluff, and contain few if any fossils, while the Miocene lies directly above them. But the horizon was traced continuously to Rock Bluff by the writer and Mr. J. Stanley Brown of the United States Geological Survey in 1893.

At Rock Bluff it contains characteristic littoral species which connect the fauna unmistakably with that of the Oak Grove sands which contains a large number of well-preserved species belonging in deeper water. One of the most characteristic of these, *Scapharca dodona* Dall, is present in large numbers and may be used to designate the zone.

[1] Trans. Wagner Inst., vol. 3, 1890–1903.

Doctor Vaughan has gathered data at several other localities indicating the presence of a fauna allied to or perhaps identical in some cases with that found at Oak Grove; a notable instance is the outcrop at Shoal River, Florida.

As a group (which may later be enlarged) these faunas should be separated from those included with the Orthaulax zone, in the writer's opinion, for the reasons above given. It is entirely possible, and more or less probable, that with such intensive study as has been given to the Tertiary of the Paris basin in France, numerous other faunas or subfaunas may eventually be given a place in the column of the Florida Tertiary, but with such a vast field, so few workers, and the topographic difficulties presented by most of the region, progress must necessarily be slow.

The following list presents in descending order the names of the zones as now indicated with the designations used by the writer in United States Geological Survey Bulletin 84, 1892, page 157.

Zone of—	Designations of 1892.
Scapharca dodona	Alum Bluff beds.
Cardium cestum	Chipola marl.
Orbitolites floridanus	Tampa limestone.
Orthaulax pugnax	Orthaulax bed.

RELATIONS OF THE FAUNA OF THE ORTHAULAX PUGNAX ZONE.

The number of species and varieties of mollusks now known from the zone is 312. Of these nearly two-thirds are peculiar to the zone and have chiefly been obtained from the silicious layer. Of the total molluscan fauna 219 species were new to science when first explored by the United States Geological Survey, and 95 of these are described in this monograph. Of the previously known species 15 were named by Conrad and 29 by Heilprin, while 36 were first described from other horizons by various writers. There are 9 species distinct from the others but represented by specimens too imperfect to serve as the basis of descriptions.

Of the species enumerated one seems undistinguishable from a form of the same genus (*Xenophora*) which occurs in the upper Cretaceous (Ripley horizon) of the Gulf States and appears to survive into the recent fauna of the West Indies.

Four species go back as far as the Claiborne Sands, 6 are found in the Jackson Eocene, and 7 in the Vicksburg. Eight come up from the Lepidocyclina zone, 4 have been recognized in the scanty fauna known from the Nummulitic zone, and one or two from the very imperfectly explored Chattahoochee fauna. Eight are known from the Tertiary of Santo Domingo, several of which are very characteristic of the zone. The two characteristic species of *Orthaulax*

occur in the lower Oligocene of the Panama Canal Zone, and at least one of them has been obtained in Santo Domingo, Antigua, and Anguilla.

Above the Orthaulax zone we find 51 of its species surviving in the Cardium cestum zone, but only 14 reach the zone of Scapharca dodona.

Fifteen occur in extra-Floridian Miocene beds, but only 3 in the Floridian Miocene; 11 are found in the Pliocene of south Florida, 5 in the Florida Pleistocene, while 23 survive in the recent fauna.

SOURCES OF MATERIAL.

Specimens were long distributed by tourists as curios. The first material which was available for this monograph was that collected by Professor Heilprin in 1888. In the following year the present writer made a large collection, and subsequently the locality was visited by Capt. Frank Burns for the same purpose. Mr. Joseph Willcox, Mr. James Shepard and Miss Shepard, Mr. F. W. Crosby, and Mr. W. O. Crosby kindly contributed valuable specimens. Mr. E. J. Post, of Tampa, has made a practice of collecting at Ballast Point for a long time. An excellent series was purchased from him, and he most kindly allowed the study of the material he had on hand at a later time to make the present paper more complete. Some specimens were also contributed by Mr. L. G. Newman and Mr. La Penotière.

ACKNOWLEDGMENTS.

The present writer desires to express his obligations to many members of the United States Geological Survey for unpublished material and notes on the geology, especially to Dr. T. Wayland Vaughan and Mr. George C. Matson, whose contributions have been of great importance.

The Director of the Survey has kindly permitted the use of the drawings made by Survey artists.

To Mr. Joseph Willcox and the Wagner Free Institute of Science, Philadelphia, thanks are due for assistance on numerous occasions and especially for permission to use here some of the figures drawn by J. C. McConnell to illustrate the third volume of the Transactions of the Institute. To the Academy of Natural Sciences we owe the opportunity of consulting the types of species described by Professor Heilprin and W. M. Gabb.

To several kind correspondents in Florida, especially Mr. E. J. Post, are due thanks for specimens lent for examination or contributed to the National collection.

This paper is published by permission of the Director of the United States Geological Survey.

Dr. T. Wayland Vaughan has kindly consented to give the following brief list of the corals of the Orthaulax zone, identified by him, the report on which is now awaiting publication.

LIST OF SPECIES.

Corals from the "silex bed" of the Tampa formation.

By Dr. T. Wayland Vaughan.

Antillia? willcoxi (Dana).
Stylophora silicensis Vaughan.*
Galaxea excelsa Vaughan.
Orbicella cellulosa (Duncan).*
cavernosa var. *tampaensis* Vaughan.*
cavernosa var. *silicensis* Vaughan.*
Cyphastrea tampae Vaughan.*
Macandra tampaensis Vaughan.
Syzygophyllia? tampae Vaughan.
Siderastrea silicensis Vaughan* (at Tampa brickyard).
Endopachys tampae Vaughan.
Acropora tampaensis Vaughan.
Goniopora tampaensis Vaughan.
ballistensis Vaughan.
matsoni Vaughan.
Porites willcoxi Vaughan.
Alveopora tampae Vaughan.

The species marked * are widely distributed in the Chattahoochee formation of southern Georgia and northern Florida.

Molluscan Fauna of the silex beds.[1]

MOLLUSCA.

Land and Freshwater Species.

Cepolis (*Plagioptycha*) *latebrosa* Dall.
Cepolis (*Plagioptycha*) *instrumosa* Dall.
Cepolis (*Plagioptycha*) *directa* Dall.
Pleurodonte haruspica Dall.
Pleurodonte crusta Dall.
Pleurodonte cunctator Dall.
Pleurodonte diespiter Dall.
Polygyra adamnis Dall.
Bulimulus (*Hyperaulax*) *floridanus* Conrad.
Bulimulus (*Hyperaulax*) *heilprinianus* Dall.
Bulimulus (*Hyperaulax*) *americanus* Heilprin.
Bulimulus (*Hyperaulax*) *americanus* var. *partulinus* Dall.
Bulimulus (*Hyperaulax*) *americanus* var. *laxus* Dall.
* *Bulimulus* (*Hyperaulax*) *tampae* Dall.[1]
* *Bulimulus* (*Hyperaulax*) *ballistae* Dall.
Bulimulus (*Hyperaulax*) *stearnsii* Dall.
* *Bulimulus* (*Hyperaulax*) *tortilla* Dall.
* *Bulimulus* (*Hyperaulax*) *remolina* Dall.
Cerion (*Eostrophia*) *anodonta* Dall.
Cerion (*Eostrophia*) *anodonta* var. *floridanum* Dall.
* *Microcerion floridanum* Dall.
* *Pupoides pilsbryi* Dall.
Urocoptis floridana Dall.
* *Planorbis tampaënsis* Dall.

[1] Those preceded by an asterisk (*) are new species.

Planorbis (*Torquis*) *willcoxii* Dall.
* *Planorbis* (*Torquis*) *elisus* Dall.
* *Spiraxis tampae* Dall.

MARINE GASTROPODS.

* *Actcon tampae* Dall.
Acteocina wetherillii Lea.
* *Acteocina squarrosa* Dall.
Retusa vaginata Dall.
Scaphander primus Aldrich.
Bullaria petrosa Conrad.
* *Bullaria* (*Haminea?*) *sulcobasis* Dall.
Terebra (*Oxymeris*) *dislocata* Dall.
Terebra (*Oxymeris*) *tantula* Conrad.
Conus planiceps Heilprin.
* *Conus illiolus* Dall.
* *Conus designatus* Dall.
* *Turris albida* Perry.
Turris vibex Dall.
Turris (*Sureula*) *servata* Conrad.
* *Drillia condominia* Dall.
Drillia lapenotieri Dall.
* *Drillia severina* Dall.
Drillia ostrearum Stearns.
* *Drillia sella* Dall.
* *Drillia eupora* Dall.
* *Drillia bclotheca* Dall.
* *Drillia spica* Dall.
* *Drillia tecla* Dall.
* *Drillia smilia* Dall.
* *Drillia cupatoria* Dall.
* *Drillia tama* Dall.
* *Drillia glyphostoma* Dall.
* *Drillia* (*Cymatosyrinx*) *silfa* Dall.
Drillia (*Cymatosyrinx*) *newmani* Dall.
* *Mangilia illiota* Dall.
Mangilia sp. indet.
* *Cancellaria* (*Bivctopsia*) *subthomasiæ* Dall.
* *Cancellaria* (*Bivctopsia*) *depressa* Dall.
Cancellaria (*Sveltia*) sp. indet.
* *Oliva posti* Dall.
Olivella lata Dall.
* *Olivella eutorta* Dall.
* *Olivella colleta* Dall.
Ancilla shepardi Dall.
* *Marginella mollitor* Dall.
* *Marginella infecta* Dall.
Marginella bellula Dall.
Marginella inepta Dall.
Marginella elegantula Dall.
Marginella ballista Dall.
Marginella tampae Dall.
Marginella limatula Conrad.
* *Marginella gregaria* Dall.
Marginella bella Conrad.
* *Marginella impagina* Dall.
* *Marginella posti* Dall.
* *Marginella intensa* Dall.
* *Marginella myrina* Dall.
Marginella newmani Dall.
Lyria pulchella Sowerby.
Lyria heilprini Dall.
Lyria musicina Heilprin.
* *Lyria silicata* Dall.
Mitra silicata Dall.
* *Mitra syra* Dall.
* *Mitra myra* Dall.
* *Strigatella americana* Dall.
Conomitra staminea Conrad.
Xancus polygonatus Heilprin.
Vasum subcapitellum Heilprin.
Vasum cygonatum Dall.
* *Fasciolaria petrosa* Dall.
Latirus floridanus Heilprin.
Latirus multilineatus Dall.
Latirus rugatus Dall.
Latirus callimorphus Dall.
Fusinus ballista Dall.
Fusinus quinquespinus Dall.
Fusinus nexilis Dall.
Busycon tampaënsis Dall.
Busycon spiniger var. *nodulatum* Conrad.
Busycon spiniger var. *perizonatum* Dall.
Busycon stellatum Dall.
Melongena sculpturata Dall.
Melongena sculpturata var. *turricula* Dall.
Solenosteira inornata Dall.
Cantharus pauper Dall.
Phos sp. indet.
Phos sp. indet.
* *Alectrion ursula* Dall.
* *Alectrion ethelinda* Dall.
* *Alectrion gardnerae* Dall.
* *Anachis eutheria* Dall.
Astyris turgidula Dall.
* *Astyris eluthera* Dall.
* *Astyris dicaria* Dall.
* *Astyris acanthodes* Dall.
Murex mississippiensis Conrad.
Murex chipolanus Dall.

* *Murex scxangula* Dall.
Murex trophoniformis Heilprin.
Chicoreus larvacosta Heilprin.
Chicoreus crispangula Heilprin.
Chicoreus burnsii Whitfield.
Purpura (*Pteropurpura*) *posti* Dall.
Muricidea heilprini Cossmann.
Muricidea sp. indet.
* *Tritonalia scabrosa* Dall.
* *Typhis siphonifera* Dall.
Coralliophila magna Dall.
Rapana tampaënsis Dall.
* *Rapana biconica* Dall.
Melanella conoidea Kurtz and Stimpson.
* *Eulima bowdichi* Dall.
Pyramidella (*Longchaeus*) *crenulata* Holmes.
* *Turbonilla* (*Ptycheulima*) *ethellina* Dall.
Odostomia impressa Say.
Cyprea tumulus Heilprin.
Cyprea heilprini Dall.
* *Cyprea ballista* Dall.
Morum domingense Sowerby.
Orthaulax inornatus Gabb.
Orthaulax pugnax Heilprin.
Strombus chipolanus Dall.
* *Strombus liocyclus* Dall.
* *Bittium priscum* Dall.
* *Bittium* (*priscum* var.?) *sora* Dall.
* *Bittium adela* Dall.
Cerithium georgianum Lyell and Sowerby.
Cerithium præcursor Heilprin.
Cerithium sp. indet.
* *Cerithium plectrum* Dall.
Potamides hillsboroënsis Heilprin.
Potamides (*Lampanella*) *transecta* Dall.
Potamides (*Pyrazisinus*) *campanulatus* Heilprin.
Potamides (*Pyrazisinus*) *cornutus* Heilprin.
Potamides (*Pyrazisinus*) *acutus* Dall.
* *Cerithiopsis silicata* Dall.
Trichotropis (*Cerithioderma*) *prima* Conrad.
Modulus turbinatus Heilprin.
* *Lacuna præcursor* Dall.
Caecum solitarium O. Meyer.
Serpulorbis granifera Say.
Serpulorbis ballistae Dall.
Serpulorbis decussata Gmelin.
Petaloconchus varians Orbigny.
Petaloconchus sp. indet.
Vermicularia (*Anguinella*) *virginica* Conrad.
Siliquaria vitis Conrad.
Turritella tampae Heilprin.
Turritella tampae var. *tripartita* Dall.
* *Turritella tampae* var. *mediocon-stricta* Dall.
Turritella tampae var. *pagodaeformis* Heilprin.
Turritella megalobasis Dall.
Turritella chipolana Dall.
* *Turritella systoliata* Dall.
* *Turritella litharia* Dall.
* *Turritella atacta* Dall.
Lioplax floridana Dall.
* *Assiminea aldra* Dall.
* *Rissoina supralaevigata* Dall.
* *Amnicola adesta* Dall.
Amnicola sp.
Crucibulum constrictum Conrad.
Calyptraea trochiformis Lamarck.
Hipponix pygmaeus Lea.
Hipponix willcoxii Dall.
Xenophora conchyliophora Born.
Natica (*Cryptonatica*) *floridana* Dall.
Polinices (*Euspira*) *hemicryptus* Gabb.
Ampullina streptostoma Heilprin.
Ampullina amphora Heilprin.
Ampullina solidula Dall.
Amauropsis floridana Dall.
Sinum chipolanum Dall.
* *Sinum imperforatum* Dall.
Turbo (*Senectus*) *crenorugatus* Heilprin.
Astraea (*Lithopoma*) sp. indet.
Tegula (*Omphalius*) *exoleta* Conrad.
Calliostoma metrium Dall.
* *Calliostoma tampicum* Dall.
Margarites tampaënsis Dall.
Liotia (*Arene*) *solariella* Heilprin.
Liotia (*Arene*) *coronata* Dall.
Helicina ballista Dall.
Helicina ballista var. *tampae* Dall.
* *Helicina posti* Dall.
Nerita tampaënsis Dall.
Fissuridea chipolana Dall.
Fissurella (*Cremides*) *ceryx* Dall.
Ischnochiton tampaënsis Dall.

PELECYPODA.

* *Nucula tampae* Dall.
Leda flexuosa Heilprin.
* *Leda posti* Dall.
Yoldia frater Dall.
Arca umbonata Lamarck.
* *Arca grammatodonta* Dall.
Arca paratina Dall.
Barbatia (*Calloarca*) *marylandica* Conrad.
Barbatia (*Calloarca*) *irregularis* Dall.
Barbatia (*Calloarca*) *areula* Heilprin.
Barbatia (*Acar*) *reticulata* Gmelin.
Barbatia (*Fossularca*) *adamsi* E. A. Smith.
Scapharca hypomela Dall.
Scapharca latidentata Dall.
* *Glycymeris lamyi* Dall.
Ostrea sellaeformis var. *rugifera* Dall.
Ostrea mauriciensis Gabb?
* *Ostrea vaughani* Dall.
Pecten (*Aequipecten*) *chipolanus* Dall.
Spondylus bostrychites Guppy.
Spondylus chipolanus Dall.
Plicatula densata Conrad.
Anomia micrographmata Dall.
Modiolus silicatus Dall.
* *Modiolus blandus* Dall.
Modiolus (*Brachydontes*) *grammatus* Dall.
* *Modiolus* (*Brachydontes*) *grammatus* var. *curtulus* Dall.
* *Modiolus* (*Gregariella*) *minimus* Dall.
Modiolus (*Gregariella*) sp.
Modiolus (*Botula*) *cinnamomeus* Lamarck.
Lithophaga antillarum Orbigny.
Lithophaga nigra Orbigny.
Lithophaga nuda Dall.
Lithophaga (*Myoforceps*) *aristata* Dillwyn.
Lithophaga (*Diberus*) *bisulcata* Orbigny.
Coralliophaga elegantula Dall.
Crassatellites (*Scambula*) *deformis* Heilprin.
Venericardia serricosta Heilprin.
Venericardia himerta Dall.
Cardita (*Carditamera*) *tegca* Dall.
* *Cardita* (*Glans*) *shepardi* Dall.
Cyrena pompholyx Dall.
Villorita floridana Dall.
Chama chipolana Dall.
Chama tampaënsis Dall.
* *Codakia* (*Jagonia*) *scurra* Dall.
Codakia (*Jagonia*) sp. indet.
Myrtaea (*Eulopia*) *vermiculata* Dall.
Phacoides domingensis Dall.
Phacoides (*Here*) *wacissanus* Dall.
* *Phacoides* (*Bellucina*) *tampaënsis* Dall.
Phacoides (*Cavilucina*) *recurrens* Dall.
Phacoides (*Lucinisca*) *calhounensis* Dall.
Phacoides (*Lucinisca*) *plesiolophus* Dall.
Phacoides (*Miltha*) *hillsboroënsis* Heilprin.
Phacoides (*Miltha*) *heracleus* Dall.
Diplodonta alta Dall.
* *Diplodonta catopotium* Dall.
Diplodonta (*Phlyctiderma*) *punctur-cella* Dall.
* *Erycina indecisa* Dall.
* *Bornia tampae* Dall.
Cardium (*Trachycardium*) *delphicum* Dall.
Cardium (*Trachycardium*) *propecili-are* Dall.
Cardium (*Trachycardium*) *bowden-ense* Dall.
Cardium (*Trachycardium*) *parile* Dall.
Cardium (*Trachycardium*) sp. indet.
Cardium (*Cerastoderma*) *phlyctæna* Dall.
Cardium (*Cerastoderma*) *taphrium* Dall.
Cardium (*Trigoniocardia*) *alicula* Dall.
* *Cardium* (*Trigoniocardia*) *berberum* Dall.
Dosinia (*Dosinidia*) *chipolana* Dall.
Macrocallista (*Paradione*) *acuminata* Dall.
Callocardia (*Agriopoma*) *sincera* Dall.
* *Callocardia* (*Agriopoma*) *nux* Dall.
Antigona tarquinia Dall.
Antigona (*Artena*) *shepardi* Dall.
Antigona glyptoconcha Dall.
Chione (*Lirophora*) *ballista* Dall.
Chione (*Chamelea*) *nuciformis* Heilprin.
Chione (*Chamelea*) *spada* Dall.

Chione (Chamelca) rhodia Dall.
Anomalocardia floridana Conrad.
Venus halidona Dall.
Tellina segregata Dall.
Tellina chipolana Dall.
* *Tellina dira* Dall.
Tellina (Macaliopsis) merula Dall.
Tellina (Merisca) halidona Dall.
* *Tellina (Angulus) atossa* Dall.
Macoma irma Dall.
* *Semele sardonica* Dall.
Semele silicata Dall.
Corbula (Cuneocorbula) burnsii Dall.
Corbula (Cuneocorbula) sarda Dall.
* *Corbula (Cuneocorbula) kaghriana* Dall.
Panope whitfieldi Dall.
Gastrochæna rotunda Dall.

FORAMINIFERA.

Orbitolites floridanus Conrad.

SYSTEMATIC ARRANGEMENT.

GASTROPODA.

Order PULMONATA.

Family HELICIDAE.

Tribe BELOGONA.

Genus CEPOLIS Montfort.

Cepolis Montfort, Conch. Syst., vol. 2, p. 150, 1810. Type, *Helix cepa* Muller (Haiti).

Subgenus PLAGIOPTYCHA Pfeiffer.

Plagioptycha Pfeiffer, Mal. Blatt., 1856, p. 135.—Martens in Albers, Die Heliceen, ed. 2, p. 145, 1860. Type, *Helix loxodon* Pfeiffer (Bahamas).
Plagioptycha Pilsbry, Man. Conch., vol. 9, p. 185, 1894.

Doctor Pilsbry considers this group as nearest to the ancestral forms from which the modern subdivisions of the genus have arisen.

In Oligocene times (formerly referred to as Miocene or Old Miocene) this group was abundantly represented on the group of islands which represented the nucleus of the present Floridian peninsula. It apparently became extinct in Florida with the lowered temperature of the Miocene epoch, though still represented farther south in the Bahamas, Cuba, and Haiti by an abundance of recent species.

CEPOLIS (PLAGIOPTYCHA) LATEBROSA Dall.

Plate 2, figs. 13, 17, 19.

Helix (Jeanneretia) latebrosa Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 8, pl. 1, figs. 8, 8*a*, Aug., 1890.

Tampa silex beds, Dall and Post. Only a single specimen was obtained. U. S. Nat. Mus. No. 111944.

CEPOLIS (PLAGIOPTYCHA) INSTRUMOSA Dall.

Plate 2, figs. 6, 15.

Helix (*Jeanneretia*) *instrumosa* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 9, pl. 1, figs. 7, 8*b*, Aug., 1890.

Tampa silex beds, collected by Dall. U. S. Nat. Mus. No. 111945.

CEPOLIS (PLAGIOPTYCHA) DIREPTA Dall.

Plate 2, figs. 12, 14.

Helix (*Jeanneretia*) *direpta* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 10, pl. 1, figs. 7*a*, 7*b*, Aug., 1890; pt. 5, p. 1195, pl. 39, figs. 4, 5, Nov., 1900.

Tampa silex beds, rare. Dall and Burns. U. S. Nat. Mus. No. 130354.

Tribe EPIPHALLOGONA.

Genus PLEURODONTE Fischer de Waldheim.

Pleurodonte F. DE WALDHEIM, Tab. Syn. Zoogn., p. 129, 1808.—PILSBRY, Man. Conch., vol. 9, 1894, p. 84. Type, *Helix sinuata* Gmelin, Jamaica, West Indies.

A few of the larger species of silex bed Helicidæ show a more or less granulate surface, especially *C. haruspica* Dall, and this not being found in *Cepolis*, has led Doctor Pilsbry to suggest their affinity to *Pleurodonte* of which they may represent the progenital type.

I have felt some little hesitation in referring species to this genus, on account of the fact that the pressure of sand grains on the surface of the pseudomorph sometimes gives the effect of finely granulate sculpture, but have finally done so provisionally.

PLEURODONTE HARUSPICA Dall.

Plate 1, figs. 12, 13, 14; plate 2, fig. 11.

Helix (*Jeanneretia*) *haruspica* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 11, pl. 1, figs. 7*c*, 7*d*, Aug., 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida. Abundant but usually defective. Collected by Shepard, Post, and Dall, U. S. Nat. Mus. No. 165005.

This appears to be the largest species of the formation and, though smaller than most of the recent species, by its carinated periphery indicates its alliance with them. In perfect specimens the axis is hermetically sealed in the adult; not even a depression occurs in the umbilical region, but the young are perforate.

PLEURODONTE CRUSTA Dall.

Plate 2, figs. 8, 16.

Helix (Jeanneretia) crusta DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 9, pl. 1, figs. 4, 4*a*, 4*b*, 6*e*, 6*f*, Aug., 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida. Shepard, Newman, Dall, Burns, and Post. U. S. Nat. Mus., No. 111946.

With this species was also found the following, which from the imperfect specimens at first found was regarded as merely a variety of *P. crusta*. The latter is the most common of the species found in the silex beds and often occurs most perfectly reproduced in the translucent silex.

PLEURODONTE CUNCTATOR Dall.

Plate 4, figs. 8, 9.

Helix (Jeanneretia) crusta var. *cunctator* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 10, Aug., 1890.

Tampa silex beds at Ballast Point, Tampa Bay; also on the shores of Old Tampa Bay, an arm of Tampa Bay proper, westward from Hillsborough Bay, Florida. Collected by Shepard, Newman, Dall, and Burns. U. S. Nat. Mus. No. 111950.

PLEURODONTE DIESPITER Dall.

Plate 2, figs. 18, 20.

Helix (Jeanneretia) diespiter DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 10, pl. 1, figs. 1, 1*a*, Aug., 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Abundant but usually defective. Collected by Dall and Burns. U. S. Nat. Mus. No. 111951.

There is some doubt as to the generic relationship of this species, but on the whole it seems most closely allied to *P. crusta*.

Tribe PROTOGONA.

Genus POLYGYRA Say.

POLYGYRA ADAMNIS Dall.

Plate 2, figs. 7, 9.

Helix (Polygyra) adamnis DALL, Trans Wagner Inst., vol. 3, pt. 1, p. 12, pl. 1, figs. 5, 5*a*, Aug., 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. A single specimen collected at Ballast Point by Dall. U. S. Nat. Mus. No. 111959.

This is the earliest *Polygyra* (of the section *Dædalochila* Beck) yet reported from the Tertiary of North America.

Family BULIMULIDAE.

Genus BULIMULUS Leach.

Subgenus HYPERAULAX Pilsbry.

Hyperaulax PILSBRY, Proc. Acad. Nat. Sci., Philadelphia, for 1897, p. 10; Man. Conch., vol. 14, p. 102, 1901 (+*Bonnanius* Jousseaume, 1900). Type, *Bulimulus ridleyi* E. A. Smith. Fernando Noronha Island, Brazil.

Doctor Pilsbry regards this group as belonging to the immediate vicinity of the South American groups *Anctus* and *Odontostomus*, and as probably an early branch of the latter stock before it had divided into the modern genera above mentioned and including *Tomigerus*.

The type of the genus is a recent form from the Brazilian island of Fernando Noronha. It bears a very remarkably close resemblance to some of the silex bed species, and there can be no reasonable doubt that they are congeneric. It is a remarkable fact that the group, in the strict sense, includes as far as known only this single living species and the forms known from the silex beds. Why species should not have survived on some of the Antilles or on the mainland of South America is a mystery. The other section of the genus, *Bonnanius*, which has a conspicuously dentate aperture and short, dumpy shell, is also a denizen of the same island and represented by a single recent species.

BULIMULUS (HYPERAULAX) FLORIDANUS Conrad.

Plate 2, fig. 2.

Bulimus floridanus CONRAD, Amer. Journ. Sci., ser. 2, vol. 2, p. 399, fig. 1, Nov., 1846; Amer. Journ. Conch., vol. 1, p. 144, pl. 11, fig. 11, 1865; not of Pfeiffer, 1856.

Bulimulus longaevus ANCEY, Le Naturaliste, May, 1881, p. 414.

Bulimulus (? *Anctus*) *floridanus* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 5, pl. 1, fig. 11, Aug., 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Conrad, Dall, Burns, and other collectors. U. S. Nat. Mus. No. 165010.

The specimens have been compared with the original type of Conrad, now in the collection of the Academy of Natural Sciences at Philadelphia. Portions of Conrad's shell show traces of distinct fine sharp spiral grooves, but in the process of replacement by silica this fine almost microscopic sculpture is generally lost.

BULIMULUS (HYPERAULAX) HEILPRINIANUS Dall.

Plate 2, figs. 1, 10.

Bulimulus (? *Anctus*) *heilprinianus* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 6, pl. 1, fig. 6*b*, 10, Aug., 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Dall and Burns. U. S. Nat. Mus. No. 111962.

The groove in the figure is a little too straight, as it usually has a slight flexure corresponding to the convex surface upon which the callus lies.

BULIMULUS (HYPERAULAX) AMERICANUS (Heilprin).

Plate 2, fig. 5; plate 3, fig. 3; plate 4, figs. 12, 14.

Partula americana HEILPRIN, Trans. Wagner Inst., vol. 1, p. 115, pl. 16, fig. 60, 1887.

Bulimulus (? *Anctus*) *americanus* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 7, pl. 1, figs. 9, 9*a*, Aug., 1890 (with varieties *partulinus* and *laxus* Dall).

Tampa silex beds at Ballast Point; one specimen possibly adventitious in the overlying Orbitolite bed at the same locality. Collected by Messrs. Shepard, Willcox, Newman, Heilprin, Post, Dall, and Burns. U. S. Nat. Mus. No. 165009.

The relations of the typical form and the varieties are shown by the following measurements:

	Number of whorls.	Height.	Diameter.	Aperture.
		mm	*mm*	*mm*
Forma typica (fig. 5)	6.5	17.0	9.0	8.5
Variety *partulinus* (fig. 12)	6.0	13.5	7.5	7.0
Variety *laxus* (fig. 14)	6.0	15.5	7.2	7.5

BULIMULUS (HYPERAULAX) TAMPAE, new species.

Plate 1, fig. 3.

Shell subfusiform, of moderate size, with about six whorls; nucleus smooth, of a whorl and a half; subsequent whorls moderately convex, with a distinct, very slightly appressed suture; axial sculpture of fine, equal, regular, equally spaced, somewhat retractive threads or ridges, separated by about equal interspaces, covering the whole surface; base somewhat attenuated; umbilicus minutely perforate, overshadowed by the reflection of the pillar lip; aperture somewhat elongate, outer lip narrow behind and there hardly reflected, thicker at the beginning of the middle third, and thenceforward more broadly reflected, continuous in front and on the pillar and with a rather thick parietal callus; between the callus and the outer lip at the suture is a very narrow but deep channel. Height 13.7, maximum diameter 6 mm.

Tampa silex beds, Ballast Point, Tampa Bay, Florida.

Type from the Post collection, U. S. Nat. Mus. No. 165012.

BULIMULUS (HYPERAULAX) BALLISTAE, new species.

Plate 1, fig. 5.

Shell small, solid, moderately stout, comprising six whorls separated by a slightly appressed suture; nucleus blunt and rounded;

subsequent whorls strongly marked by distinct, equal, equally spaced, elevated, retractive axial threads; base rounded, with a narrow chink in the umbilical region, under the reflection of the pillar lip; aperture as figured, with a reflected peritreme, the reflection of the posterior half of the outer lip narrow, the anterior part with a prominent nodule at the middle of the lip, in front which the lip is thickened and more strongly reflected; pillar arcuate, thickened; body with a layer of enamel, a faint subsutural thickening, and a narrow sinus at the junction of the outer lip; the latter rises slightly at the suture near the aperture. Height of shell 10.7, maximum diameter 4.5 mm.

Tampa silex beds, Ballast Point, Tampa Bay, Florida.

Type specimen from the Post collection, U. S. Nat. Mus. No. 165013.

BULIMULUS (HYPERAULAX) STEARNSII Dall.

Plate 2, fig. 4.

Bulimulus (? Anctus) stearnsii DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 7, pl. 1, fig. 12, Aug. 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida. One specimen, collected by Dall. U. S. Nat. Mus. No. 111964.

This is smoother than any of the other species, more slender and elongated.

BULIMULUS (HYPERAULAX) TORTILLA, new species.

Plate 1, fig. 2.

Shell small, subfusiform, blunt, with about five whorls, the nucleus in the type-specimen somewhat defective; suture distinct, slightly appressed; whorls slightly rounded, the apical two or three smooth, the later whorls sculptured with numerous close-set axial retractive threads, equal, equally spaced, and with equal furrows between them; base slightly attenuated, imperforate, with a chink behind the reflection of the pillar lip; aperture subovate; peritreme completed by a rather thick smooth parietal callus, with a feeble sinus or shallow channel at the subsutural angle; outer lip thin behind, thickened in the middle; anterior portion, together with the rest of the peritreme, thickened, simple, and slightly reflected; margin smooth. Height 8, maximum diameter 3.8 mm.

Tampa silex beds, Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165015.

BULIMULUS (HYPERAULAX) REMOLINA, new species.

Plate 1, fig. 18.

Shell small, slender, thin, moderately acute, with five whorls separated by a distinct, slightly appressed suture; nucleus small, smooth, rapidly enlarging; subsequent whorls moderately convex,

faintly axially striated by incremental lines, except the last, where the sculpture gradually assumes the form of fine, somewhat acute, retractive, equally spaced, elevated, threadlike lines of growth, with about equal interspaces covering the whorl; last whorl attenuated in front, with a relatively rather large umbilical perforation; aperture elongate-ovate, the peritreme slightly reflected, widest over the umbilicus, the outer lip slightly compressed behind the middle; pillar simple, smooth; body with a rather thick layer of enamel connecting the inner and outer lips of the shell, with a somewhat feeble subsutural nodule separated from the posterior end of the outer lip by a slight but perceptible sulcus. Height 9.2, maximum diameter 4 mm.

Tampa silex beds, Ballast Point, Tampa Bay, Florida.

Type from the Post collection, U. S. Nat. Mus. No. 165014.

Family CERIONIDAE.

Genus CERION Bolten.

Cerion BOLTEN, Mus. Boltenianum, p. 90, 1798. First species, *Turbo uva* Gmelin. Curaçao.

Strophia ALBERS, Heliceen, zweite ausg., Nov., 1860, p. 299. Type, *Pupa mumia* Bruguière. Cuba.

Section EOSTROPHIA Dall.

Eostrophia DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 12, 1890.

Shell without gular laminae or callosities. Type, *Strophia anodonta* Dall.

CERION (EOSTROPHIA) ANODONTA Dall.

Plate 1, fig. 15.

Strophia (*Eostrophia*) *anodonta* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 13, pl. 1, figs. 8*c*, 8*d*, Aug., 1890.

Tampa silex beds at Ballast Point; Shepard, Newman, Dall, and Burns; at Old Tampa bay, shore; Burns. U. S. Nat. Mus. No. 165016.

CERION ANODONTA var. FLORIDANUM Dall.

Plate 3, fig. 4.

Strophia (*anodonta* var. ?) *floridana* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 13, pl. 1, fig. 6, Aug., 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida, Dall. U. S. Nat. Mus. No. 111975.

This has the same number of whorls as the typical form, but is shorter and stouter, with a relatively larger aperture.

MICROCERION, new genus.

Shell small, solid, few whorled, with one parietal and one pillar tooth, a nodulous parietal callus uniting the lips, a thickened duplex peritreme, both edges sharp, the posterior sharply reflected backward, the inner or anterior projecting forward, externally beveled to meet the bottom of the sinus between the two lips.

Type.—Microcerion floridanus Dall, new species, Oligocene of the silex beds of Tampa, Florida.

This little shell stands about midway between *Cerion* proper and the small Pupidae. Nothing exactly corresponding to it is known from other formations or from the recent fauna.

MICROCERION FLORIDANUM, new species.

Plate 1, figs. 16, 17.

Shell small, solid, stout, smooth, with about five whorls separated by a distinct suture; nucleus smooth, rather blunt, hardly differentiated from the subsequent rather convex whorls which are somewhat irregularly wound, the last whorl, at the suture, rising near the aperture to the periphery of the penultimate whorl; base rounded, imperforate, but which a chink behind the upper part of the pillar lip; aperture rounded, the peritreme relatively thick, duplex, the outer part wider, reflected, the inner part narrower, projecting forward, the surface concentrically striated; parietal callus moderately thick with a small nodulous projection near the junction with either lip; deeper in the throat is a single parietal nodule or denticle; pillar with a single deep-seated similar denticle; throat smooth. Height 4.75, maximum diameter 2.4 mm.

Tampa silex beds, Ballast Point, Tampa Bay, Florida.

Two specimens in the Post collection, U. S. Nat. Mus. No. 165018.

Family PUPILLIDAE.

Genus PUPOIDES Pfeiffer.

Pupoides PFEIFFER, Malak. Blätt., vol. 1, p. 192, 1854; for *Bulimus nitidulus* Pfeiffer, and *B. fallax* Say.

Leucochila von MARTENS in Albers' Heliceen, 1860, p. 296.

Pupoides PILSBRY, Proc. Acad. Nat. Sci. Phila., for 1900, p. 585.

PUPOIDES PILSBRYI, new species.

Plate 1, fig. 6.

Shell small, rather pointed apically, with about five inflated whorls separated by a distinctly marked suture; surface smooth except for faint incremental lines; last whorl longer than the spire, terminating in a wide rounded-quadrate aperture with a widely reflected lip di-

minishing in width near the junction with the body-whorl across which a thin callus unites the pillar and outer lips; pillar and aperture without teeth or callosities, a marked chink behind the pillar lip but no umbilical perforation. Height 3.5, maximum diameter of shell 2 mm.

Tampa silex beds, Ballast Point, Tampa Bay, Florida, collected by E. J. Post, U. S. Nat. Mus. No. 165017.

This minute shell was submitted to Doctor Pilsbry, who concluded it should be referred to the genus *Pupoides*. It is notably smaller than the *P. marginatus* or *P. modicus*, perhaps most resembling the latter. The shell of the silex fauna is much thicker and heavier than in either of the recent American species.

Family UROCOPTIDAE.

Genus UROCOPTIS Beck.

Urocoptis Beck, Ind. Moll., p. 83, 1837.

Cylindrella Pfeiffer, Arch. f. Naturg., 1840, p. 41; not of Swainson, 1840.

UROCOPTIS FLORIDANA Dall.

Plate 1, fig. 4; plate 2, fig. 3.

Cylindrella floridana Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 13, pl. 1, fig. 6*a*, Aug., 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall and Post. U. S. Nat. Mus. No. 165019.

The original specimen being somewhat defective, a better one from the Post collection has been figured for the present paper. The species belongs to the section *Gongylostoma* of Albers.

Family PLANORBIDAE.

Genus PLANORBIS Müller.

Planorbis Müller (after Petiver) Verm. Terr., vol. 2, p. 152, 1774, no type selected.—Lamarck, Prodrome, p. 76, 1799 (monotype, *Helix cornuarietis* Linnaeus, not in Müller's original list); not of Perry, 1811.

Planorbis Montfort, Conch. Syst., vol. 2, p. 270, 1810 (monotype, *Helix corneus* Linnaeus).—Dall, Harriman Exp. Rep. Land and fresh water Moll. Alaska, p. 80, 1905.

PLANORBIS TAMPAENSIS, new species.

Plate 1, fig. 1.

Shell of moderate size, with about five rounded whorls, of which the last is only represented by a bit of the margin; the shell being regarded as dextral the upper side shows evenly rounded whorls with a deep suture between them, the spire subsiding in the center

of the coil so that the apex is hidden under a deep perforation; the surface is smooth; on the basal side (which in the specimen is badly obscured), the whorls seem to have formed a flattened concavity with all the whorls visible and separated by a closely appressed suture; it is not certain whether or not there was on the lower side a carina on which the suture was laid; periphery evenly and almost symmetrically rounded; aperture broken off in the specimen. Diameter of three whorls as figured 12.5 mm., that of the whole shell probably exceeded 16 mm. Height of the three remaining whorls 4.5 mm.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida.

Type from the Post collection, U. S. Nat. Mus. No. 165020.

Section TORQUIS Dall.

Torquis DALL, Harriman Exp. Rep. Land and fresh water Moll., p. 86, 1905.

Type.—Planorbis parvus Say.

PLANORBIS (TORQUIS) WILLCOXII Dall.

Plate 3, figs. 5, 6.

Planorbis willcoxii DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 4, pl. 1, figs. 6*c*, 6*d*, Aug., 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Dall. U. S. Nat. Mus. No. 111938.

The original type remains the only specimen of this species which has been brought to my attention.

PLANORBIS (TORQUIS) ELISUS, new species.

Plate 1, figs. 8, 9.

Shell small, depressed, almost symmetrically coiled, with at least four and a half whorls; periphery evenly rounded; surface smooth, except for inconspicuous incremental lines; suture rather deep; if regarded as dextral the upper surface displaying all the whorls, has the apex depressed in a broadly funicular space formed by the flattening of the coil; on the basal side the whorls evenly succeed one another without flattening; aperture defective. Height of shell 1.2, maximum diameter 4 mm.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida. One specimen from the Post collection, U. S. Nat. Mus. No. 165021.

FAMILY OLEACINIDAE.

Genus SPIRAXIS C. B. Adams.

SPIRAXIS? TAMPAE, new species.

Shell small, thin, smooth, of five rapidly elongating whorls; apex rounded blunt, smooth, suture distinct, not crenulate; later whorls

somewhat subcylindrical or laterally flattened; base rounded, slightly imperfect in the specimen; aperture narrow, the body smooth, the pillar twisted, with the edge perceptibly thickened. Height 11, maximum diameter 2, length of last whorl 4 mm.

Tampa silex beds. One specimen collected by E. J. Post and is U. S. Nat. Mus. No. 214738.

It resembles very much in form and size *Spiraxis annae* Pilsbry,[1] but I can find no traces of the sparse longitudinal grooves attributed to the recent Jamaican species.

Family ACTEONIDAE.

Genus ACTEON Montfort.

Acteon Montfort, Conch. Syst., vol. 2, 1810, p. 314. Type, *Voluta tornatilis* Gmelin (not *Actacon* Oken, 1815, or *Actcon* Fleming, 1828).—Dall, Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 235, 1908.

ACTEON TAMPAE, new species.

Plate 4, fig. 10.

Shell short, inflated, with a short, rather acute spire and about five whorls; nucleus rounded, smooth; suture distinct; general surface smooth except for the spiral sculpture, which consists of two close-set equidistant deep grooves in front of the suture which make the interspace and the sutural margin look like rounded threads; near the periphery and in front of it are two or three distant shallower striae; on the base and extending to the anterior end are seven or eight equidistant, moderately impressed striae; aperture moderately wide the margins thick and solid, the pillar with one strong plait; there is no umbilical perforation but a narrow depressed smooth space behind the pillar. Height 7, diameter 4.5 mm.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida. One specimen collected by E. J. Post, U. S. Nat. Mus. No. 166094.

This species is perhaps nearest to *A. shilohensis* Whitfield, from New Jersey, but differs in its sculpture and other minor details.

Family TORNATINIDAE.

Genus ACTEOCINA Gray.

Actcocina Gray, Proc. Zool. Soc. London, for 1847, p. 160, No. 294. Type, *Actcon wetherilli* Lea, Tertiary of New Jersey.

Tornatina A. Adams, Thesaurus Conch., vol. 2, p. 554, 1850.—Fischer, Man. de Conchyl., p. 555.—Pilsbry, Man. Conch., vol. 15, p. 181, 1893. Type, *Bulla voluta* Quoy and Gaimard. Guam.

Gray's name preceds that of Adams by at least three years.

Its typical species appears to be a typical *Tornatina*, and it therefore will supersede the latter name.

[1] Man. Conch., vol. 19, pl. 3, fig. 32.

ACTEOCINA WETHERILLI (Lea).

Acteon wetherilli I. Lea, Contr. Geol., p. 213, pl. 6, fig. 224, 1833.
Acteocina wetherelli Gray, Proc. Zool. Soc. London, p. 160, No. 294, 1847.
Tornatina wetherilli Conrad, Amer. Journ. Conch., vol. 1, p. 35, 1864.—Dall, Trans. Wagner Inst., vol. 3, p. 15, 1890.

Shell cylindrical, truncate above, smooth and rather solid; spire short and blunt; suture impressed; a single fold on the pillar; whorls four; aperture narrow, about four-fifths the whole length; outer lip simple, sharp. Length 5, width 2.5 mm.

Tertiary of Deal, New Jersey (Lea). Silex beds at Ballast Point, Tampa Bay, Florida; also the Tampa limestone above the silex beds, and from wells dug in the vicinity of Tampa, and at La Penotiere's sulphur spring. Also from the Oligocene of Santa Domingo, Trinidad, and Jamaica, West Indies. U. S. Nat. Mus. No. 97469.

ACTEOCINA SQUARROSA, new species.

Plate 6, fig. 8.

Shell of moderate size, subcylindrical, slightly wider anteriorly, of about four whorls, separated by a very deeply excavated channeled suture; the outer margin of the suture is formed by a sharp-edged thin carina, the inner margin is duplicated by a layer of enamel so that in the adult, in the whorls preceding the last, the carina seems double-edged; nucleus small, swollen, sunken so that the nuclear whorl is not visible above the squarely truncated posterior end of the shell; axial sculpture of faint vertical incremental lines, somewhat irregular in strength and receding arcuately to and near the carina; spiral sculpture on the anterior half of the whorl at first faint, but becoming accentuated anteriorly, and extending to the labial callus, composed of fine, nearly equally spaced grooves or striæ, apparently not punctate; aperture as long as the shell, narrow behind, where the commissure is deeply incised, wide in front; outer lip straight, sharp, simple; body without enamel; pillar short, almost horizontally twisted, bearing a single strong plait on a heavy callus, behind which is a rather deep narrow bounding furrow; anterior sinus wide and deep. Length of shell 11.5, depth of sutural channel 1, maximum diameter of shell 5.5 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165025.

Genus RETUSA Brown.

Retusa Brown, Ill. Conch. Gt. Brit., ed. 1, index and expl., pl. 38, figs. 1–6, 1827.
Utriculus Brown, Ill. Conch. Gt. Brit., ed. 2, p. 58, and expl. pl. 19, 1844; not *Utriculus* Schumacher, Essai, p. 203, 1817.

RETUSA VAGINATA Dall.

Utriculus vaginatus DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 16, Aug., 1890; pt. 2, p. 219, pl. 20, fig. 2, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall. U. S. Nat. Mus. No. 97473.

This species recalls *R. mayoi* Dall, of the recent fauna, in miniature, but has a deeper suture with the margin in front of the suture sharp edged as in *Olivella*.

Family SCAPHANDRIDAE.

Genus SCAPHANDER Montfort.

Scaphander MONTFORT, Conch. Syst., vol. 2, p. 334, 1810. Type, *Bulla lignaria* Linnaeus.

Assula SCHUMACHER, Essai, pp. 78, 258, 1817.

The gizzard plates of the animal were found separated from the rest of its anatomy and described under the names of Gioenia and Tricla in the eighteenth century.

SCAPHANDER PRIMUS Aldrich.

Scaphander primus ALDRICH, Journ. Cin. Soc. Nat. Hist., 1885, p. 148, pl. 2, figs. 7*a*, 7*b*.—DALL, Trans. Wagner Inst., vol. 3, p. 17, 1890.

Shell ovate, with crowded, inequidistant transverse striae; spire concealed; aperture large, expanding below, contracted above by the intrusion of the body whorl; outer lip sharp, arcuate, rising above the apex of the shell, pillar arcuate with a narrow callous margin and a thin layer of callus on the body. Length 15, diameter 10 mm.

Tertiary of Red Bluffs, Mississippi; Aldrich, Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 97476.

Though the specimens from the silex beds are smaller, they appear to be merely immature specimens of Aldrich's species.

Family BULLARIIDAE.

Genus BULLARIA Rafinesque.

Bulla LINNAEUS, Syst. Nat., ed. 10, p. 725, 1758; not *Bulla* Linnaeus, same reference, p. 427 (Orthoptera).

Bullaria RAFINESQUE, Anal. Nat., 1815, p. 142 (new name for *Bulla* Linnaeus).—DALL, Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 243, Oct., 1908. Type, *B. ampulla* Linnaeus.

Bullea BLAINVILLE, Malac., 1825, pp. 477, 626; not of Rafinesque, 1815.

Vesica SWAINSON, Malac., p. 360, 1840.

Since Linnaeus used his generic name on two occasions and for two entirely different animals, we are obliged to substitute for the later one the first valid name applied to the group, which is that of Rafinesque, as I pointed out in 1908.

BULLARIA PETROSA Conrad.

Bulla petrosa Conrad, Amer. Journ. Sci., ser. 2, vol. 2, p. 399, 1846, with figure. Not *Bullina petrosa* Conrad, Amer. Journ. Sci., ser. 2, vol. 5, p. 433, 1848, from Miocene of Oregon, nor *Bulla petrosa* Conrad, in Dana, Geol. U. S. Expl. Exp., p. 727, 1849 (=*Haminea petrosa*, Oregonian Miocene).—Dall, Trans. Wagner Inst., vol. 3, p. 18, 1890.

Rare in the Tampa silex beds, where it was first found by Conrad and later by Dall. U. S. Nat. Mus. No. 97488.

This belongs to the typical section of the genus with perforate apex and resembles *Bullaria solida*, but is of smaller size.

This species has also been collected from the Oligocene limestone of Jacksonboro, Georgia.

BULLARIA (HAMINEA ?) SULCOBASIS, new species.

Plate 6, fig. 6.

Shell small, subovate, anterior third spirally striated, posterior two-thirds smooth or faintly marked by incremental lines; whorls involved, thin, the apex depressed, showing only the external whorl; outer lip as long as the shell, thin, simple; anterior third with fine spiral striae, at first close, later coarser and with wider interspaces; around the minutely perforate umbilicus there is a narrow space free from striae; aperture behind extending beyond the apex, and rather narrow, in front wider; body with a thin wash of callus; pillar lip short, smooth with a slight free reflection over the umbilical region. Height 8.2, maximum diameter 5.4 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. One specimen from the Post collection, U. S. Nat. Mus. No. 165027.

This species may belong to the genus *Haminea*, but the specimen is hardly perfect enough to be positive as to its proper location.

Superorder STREPTONEURA.

Order CTENOBRANCHIATA.

Superfamily TOXOGLOSSA.

Family TEREBRIDAE.

Genus TEREBRA Bruguiere.

Terebra Bruguiere, Encycl. Meth., vol. 1, p. 15, 1789 (no species mentioned); Lamarck, Prodr., p. 71, 1799. Sole example, *Buccium subulatum* Linnaeus.

Epitonium (sect. 3) Bolten, Mus. Boltenianum, p. 93, 1799.

Terebra Dall, Nautilus, vol. 21, No. 11, p. 124, Mar., 1908, Bull Mus. Comp. Zool., vol. 43, No. 6, p. 246, 1908.

This group was associated with *Buccinum* by Linnæus, with *Turritella* and *Scalaria* by Bolten, and with *Cerithium* by Say. The name was used for *Turritella* in the Museum Calonnianum. A revision of the group by the writer appears as above cited.

Section **OXYMERIS** Dall.

Oxymeris Dall, Proc. U. S. Nat. Mus., vol. 26, No. 1342, p. 951, 1903; new name for *Acus* Gray, not of Edwards; section of *Terebra;* Nautilus, vol. 21, No. 11, March, 1908, p. 124; Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 246, 1908. (Not of August, 1900, as mistakenly entered in the synonymy of the last citation.)

TEREBRA (OXYMERIS) DISLOCATA Say.

Plate 5, fig. 2.

Cerithium dislocatum Say, Journ. Acad. Nat. Sci. Phila., vol. 2, p. 235, 1822.
Terebra petitii Kiener, Mon. Terebra, p. 37, pl. 13, fig. 32, 1838.
Terebra rudis Gray, Proc. Zool. Soc. London, 1834, p. 60.
Terebra dislocata Holmes, Post. Pl. fos. S. Car., p. 70, pl. 11, fig. 12, 1858.
Terebra carolinensis Conrad (part), Post. Pl. fos. S. Car., p. 70.
Terebra dislocatum Emmons, N. Car. Geol. Surv., p. 257, 1858.
Terebra (Acus) dislocata Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 24, Aug., 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; Dall. Also Miocene of Virginia and North Carolina; Pliocene of the Carolinas and of the Florida Caloosahatchee beds; Post Pliocene of the whole coast from Maryland southard; and living from Maryland southward to Florida, the Bahamas, and Venezuela. U. S. Nat. Mus. No. 113610.

This well-known form indulges in many variations. The Ballast Point specimens are somewhat intermediate between the typical form and *T. tantula* and *T. protexta.* Miocene specimens from South Carolina agree exactly with the large *T. dislocata* variety *rudis.* Similar mutations are common among the recent specimens.

TEREBRA (OXYMERIS) TANTULA Conrad.

Terebra tantula Conrad, Journ. Acad. Nat. Sci. Phila., n. ser., vol. 3, p. 114, pl. 11, fig. 15, 1848; Amer. Journ. Conch., vol. 1, p. 28, 1865.—Dall. Trans. Wagner Inst., vol. 3, pt. 1, p. 24, 1890.

Oligocene of Vicksburg, Mississippi, Conrad; of the Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall; and at De Funiak Springs, Florida; Burns. U. S. Nat. Mus. No. 165028.

Specimens of the typical *tantula* have been obtained from Ballast Point since my remarks in the Wagner Institute Transactions were published.

Family CONIDAE.

Genus CONUS Linnaeus.

Conus Linnaeus, Syst. Nat., ed. 10, p. 712, 1758; ed. 12, p. 1165, 1768.—Lamarck, Prodrome, p. 69, 1799 (monotype, *C. marmoreus Linnaeus*).

CONUS PLANICEPS Heilprin.

Plate 6, figs. 1, 2.

Conus planiceps HEILPRIN, Trans. Wagner Inst., vol. 1, p. 110, fig. 48, 1887.—DALL Trans. Wagner Inst., vol. 3, pt. 1, p. 25, pl. 11, figs. 5, 5*a*, Aug., 1890; pt. 2, p. 219, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; also from silicified rock at Martin Station about 12 miles North of Ocala, Florida; Willcox. The specimen figured is U. S. Nat. Mus. No. 165029.

The species has also been found at Bailey's Mill Creek sink, in Jefferson County, Florida, about 3 miles southwest of Lloyd's station on the railway. Here the fossils occur in the form of siliceous pseudomorphs, as at Ballast Point, in a sort of clay overlying a bed of limestone, with a number of other species common to the Tampa silex beds.

CONUS ILLIOLUS, new species.

Plate 6, figs. 3, 5.

Shell solid, slender, elongate, turrited, of about 9½ whorls; nucleus small, bulbous, of about 1 whorl, smooth and oblique; suture distinct; the shoulder of the whorl sharply keeled, the space between it and the suture slightly excavated, with two feeble spiral threads equidistant from each other, the suture, and the keel; excavated space transversely sculptured with numerous concavely flexuous, equal, close-set, slightly elevated incremental lines; suture meeting the whorl behind at nearly a right angle some distance below the keel; axial sculpture, beside that above mentioned, comprising a series of very small, short, subequal, and nearly equidistant folds on the whorl just below the keel, with subequal interspaces, which do not nodulate the keel and are stronger on the earlier whorls and nearly obsolete on the last whorl; these are crossed by two or three feeble spiral threads with narrower intervals, below which the spiral sculpture is obsolete and the surface practically smooth for two-thirds the length of the whorl; the anterior third has rather coarse spiral threading of which the first 10 are paired, the anterior 10 being coarser and equidistant, aperture narrow, outer lip (defective); pillar straight, the anterior edge a little prominent and twisted. Length 41.5, breadth at keel 17 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Type-specimen from the Post collection, U. S. Nat. Mus. No. 165030.

CONUS DESIGNATUS, new species.

Plate 6, fig. 4.

Shell of moderate size with low, broadly conical spire of about 8 whorls; nucleus prominent, subglobular, inflated, smooth; subsequent

whorls flattened on the spire, narrow, bordered at the shoulder by a slightly rounded keel, and separated by a distinct but not deep suture; the whorls on the spire are not spirally sculptured, but show faint traces of incremental, concavely arcuate lines; last whorl in front of the shoulder smooth, acutely conic, the only sculpture being in the anterior third, which has about a dozen fine spiral threads with wider interspaces becoming more crowded and feebly minutely nodulous anteriorly; on the smooth posterior part of the whorl in certain lights can be seen spiral lines distant and fine, but which appear rather to be in the substance of the shell and do not sculpture the surface; aperture narrow elongate, the canal short and wide; the outer lip sharp, simple and very slightly convexly arcuate. Length of shell 23.8, of aperture 21.5, maximum diameter 12 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165031.

Family TURRITIDAE.

Genus TURRIS Bolten.

Turris Bolten (after Rumphius, 1704) Mus. Bolt. 1798, p. 123. First species, *Murex babylonius* Linnaeus (after *Turris babylonica* of Rumphius).—Gray, Proc. Zool. Soc. Lond. for 1847, p. 134, type, *T. babylonius* (Linnaeus).—H. and A. Adams, Gen. Rec. Moll., vol. 1, 1853, p. 87.—Gabb, Journ. Acad. Nat. Sci. Phila., vol. 4, 1860, p 378.—Dall, Journ. Conch. (Leeds), vol. 11, April, 1906, p. 291; Bull. Mus. Comp. Zool., vol. 43, No. 6, 1908, p. 255, not *Turris* Montfort, 1910, or *Turris* Lesson, 1837.

Pleurotoma Lamarck, Prodrome, 1799, p. 73. Sole example, *Murex babylonius* Linnaeus.

TURRIS ALBIDA Perry.

Plate 5, fig. 13; plate 14, fig. 7.

Pleurotoma albida Perry, Conch. expl., pl. 32, fig. 4, 1811.—Dall, *Trans.* Wagner Inst., vol. 3, pt. 1, p. 28, pl. 4, fig. 8*a*, 1890.

Pleurotoma virgo Lamarck, An. s. Vert., vol. 7, p. 94, 1822.

Pleurotoma cochlearis Conrad, Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 1, p. 115, pl. 11, fig. 23, 1848.

Pleurotoma haitensis Sowerby, Quart. Journ. Geol. Soc. London, vol. 6, p. 50, 1849.

Pleurotoma barretti Guppy, Quart. Jour. Geol. Soc. London, vol. 22, p. 290, pl. 17, fig. 6, 1866.

Oligocene of Vicksburg, Mississippi; of Santo Domingo and Bowden, Jamaica; of the Tampa silex beds, Ballast Point, Tampa Bay, Florida; Pliocene of the Caloosahatchie River, Florida; living in the Gulf of Mexico and the Antilles in 26 to 125 fathoms. U. S. Nat. Mus. No. 112083.

Conrad's figure is very bad, but I have compared specimens with his types.

TURRIS VIBEX Dall.

Pleurotoma (*albida* var.?) *vibex* DALL, Bull. Mus. Comp. Zool., vol. 18, No. 19, p. 73, 1889.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 166095.

The examination of many specimens, both recent and fossil, since 1889, has confirmed the belief that this form is specifically distinct from *T. albida*. It is not only much smaller and proportionately much more slender than *albida* of the same length, but the recent form has blackish spiral bands in the periostracum between the spiral keels, while the young of *albida* is uniformly yellowish-white.

The most nearly related form is the Vicksburgian *Pleurotoma cochlearis* of Conrad, which I regard as conspecific with *T. albida*.

TURRIS (SURCULA) SERVATA Conrad.

Plate 5, fig. 16.

Pleurotoma servata CONRAD, Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 1, p. 115, pl. 11, fig. 18, 1848.—DALL., Trans. Wagner Inst., vol. 3, pt. 1, p. 28, 1890.

Oligocene of Vicksburg, Mississippi, and of the Tampa silex beds at Ballast Point, Florida; Dall and Post. U. S. Nat. Mus. No. 115267.

Genus DRILLIA Gray.

Drillia GRAY, Jardine's Ann. Nat. Hist., vol. 1, p. 28, 1838. Type, *D. umbilicata* Gray.

The typical *Drillia* is a rare African shell with a flaring umbilicus, quite different from the majority of the species commonly referred to it by the authors. However, in the chaotic state of the systematic arrangement of the family which exists at present, I can do no more than follow the general practice.

DRILLIA CONDOMINIA, new species.

Plate 12, fig. 25.

Shell of moderate size, rather thin, with an elongated, turrited spire of about eight whorls, separated by a closely appressed but distinct suture; nucleus defective, subsequent whorls strongly shouldered and sculptured; axial sculpture of (on the penultimate whorl ten) rounded ribs beginning at the shoulder, on the spire reaching the suture in front, and on the last whorl obsolete on the base, with subsequent interspaces which become wider on the last part of the last whorl; these ribs are slightly protractive; lines of growth not conspicuous; spiral sculpture of (on the spire 3 to 5) revolving

threads, the posterior two paired, the others more distant, on the last whorl about 15, becoming obsolete on the canal and slightly swollen where they override the ribs; on the base these threads are slightly undulated by their intersection with the lines of growth, and many of the interspaces have one (or even two) much finer intercalary threads; anal fasciole behind the shoulder but not quite at the suture, wide, smooth, or marked with concave growth-lines corresponding to the anal sulcus, somewhat excavated, and having a single thick obscurely defined thread between it and the suture; aperture rather wide; anal sulcus wide, shallow; outer lip thin, internally smooth, arcuately protractive, receding toward the canal, slightly crenulate by the spiral sculpture; pillar straight, smooth; canal nearly straight, ample. Length of shell exclusive of the nucleus 25, of aperture 14, maximum diameter 10 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Type-specimen from the Post collection, U. S. Nat. Mus. No. 165032.

DRILLIA LAPENOTIERI Dall.

Plate 8, fig. 4.

Pleurotoma lapenotieri DALL, Trans. Wagner Inst., vol. 5, p. 1199, pl. 43, fig. 14, 1900.

Tampa silex beds at Ballast Point, Tampa Bay, Florida, Dall. U. S. Nat. Mus. No. 130351.

This species recalls some of the large Oligocene forms of Santo Domingo. Only one specimen has so far been obtained.

DRILLIA SEVERINA, new species.

Plate 5, fig. 4.

Shell with a smooth rather swollen nucleus and about eight sculptured whorls; suture appressed, the margin in front of it in the early whorls elevated and sharp, later cordlike and swollen; anal fasciole in front of it nearly smooth except for incremental lines and a few very faint spirals; the fasciole is distinctly excavated; axial sculpture of about (on the last whorl) 10 slightly oblique rounded prominent ribs beginning at the shoulder of the whorl and becoming obsolete on the base; these are crossed by (between the sutures) four, and on the last whorl by about a dozen prominent spiral cords with finer threads between them and on the canal; the intervals between the cords are subequal as are those between the ribs; the anal sulcus is wide and rather shallow, the lip in front of it thin, sharp, and roundly produced; the pillar and body have a slight wash of callus; the canal is shorter than the aperture, rather deep and wide, slightly recurved.

Height of shell 23, of last whorl 15, maximum diameter of shell 9 mm.

Tampa silex beds, not rare. U. S. Nat. Mus. No. 166096.

This species is near *T. servata* Conrad, also found in the same horizon, but is more robust and has ten instead of only six axial ribs. It grows larger than the dimensions above given, but the description has been drawn from a more perfect if smaller specimen.

DRILLIA OSTREARUM Stearns.

Drillia ostrearum STEARNS, Proc. Boston Soc. Nat. Hist., vol. 15, p. 22, 1872.—DALL, Proc. U. S. Nat. Mus., vol. 6, p. 328, 1883.—TRYON, Man Conch., vol. 6, p. 197, pl. 34, fig. 79, 1884.—DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 30, 1890.

Oligocene of Alum Bluff, Chattahoochee River, and of the Tampa silex beds, Tampa Bay, Florida; Pliocene of the Caloosahatchie River, Florida: living from North Carolina south to Florida and Yucatan between low-water mark and 15 fathoms. U. S. Nat. Mus. No. 1122088.

A species of this type occurs in practically every horizon from the Eocene up.

DRILLIA SELLA, new species.

Plate 12, fig. 10.

Shell small, slender, acute, solid, with nine whorls separated by a closely appressed suture; nucleus smooth, plump, of about one whorl; subsequent whorls strongly and sharply sculptured; axial sculpture of (on the penultimate whorl nine) prominent rounded ribs, beginning in front of the anal fasciole, continuing over the whorl, on the spire to the suture, on the last whorl over the periphery, gradually becoming obsolete on the base; the interspaces are about equal in width to the ribs, and the incremental lines are not prominent; spiral sculpture behind the anal fasciole of a prominent keel close to the suture; the fasciole being a strong smooth-surfaced constriction, in front of which the ends of the ribs form a sort of shoulder to the whorl; there are also (on the spire three, on the last whorl nine) prominent spiral threads with wider interspaces which override the ribs and are continuous between them; the suture is laid on the fourth thread in front of the fasciole; anal sulcus shallow, rather wide; aperture narrow, outer lip prominent in the middle, sharp-edged, not varicose; inner lip raised, continuous over the body to sutural commissure, smooth; pillar smooth, canal wide and deep. Height 11.4, maximum diameter 3.7 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Type-specimen from the Post collection, U. S. Nat. Mus. No. 165035.

DRILLIA EUPORA, new species.

Plate 5, fig. 3.

Shell small, slender, elongate, of more than 6 flattish whorls (specimen decollate); suture distinct, separated from the fasciole in front by an elevated spiral ridge, carinated and beveled from the carina to the suture which is slightly undulated by the ribs; anal fasciole excavated and spirally faintly striated, especially on the anterior slope; axial sculpture of (on the last whorl) about 20 sharp low straight narrow ribs, with much wider interspaces, and extending from the shoulder to the canal; spiral sculpture between the sutures of 4 fine elevated threads, including 1 at the shoulder and a fifth on which the suture is laid, with wider flat interspaces; on the last whorl there are 14 or 15 equal and equally spaced similar threads; aperture narrow; anal sulcus wide, shallow; outer lip defective; canal long and straight, rather narrow; pillar and body with a rather thick smooth layer of callus. Height of five whorls 16, diameter at decollation 2, maximum diameter behind aperture 5.75 mm.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida, one specimen. U. S. Nat. Mus. No. 166099.

This species belongs to the group of *D. ostrearum* Stearns and resembles *D. abundans* Conrad, but is more slender and has sharper ribs.

DRILLIA BELOTHECA, new species.

Plate 4, fig. 7.

Shell small, slender, 8-whorled, the nucleus smooth and rounded; axial sculpture of 10 low narrow straight ribs with wider interspaces; spiral sculpture of a prominent cord at the suture, a nearly smooth more or less excavated anal fasciole, between the sutures two, and on the last whorl eight or nine subequal prominent threads crossing the ribs without interruption and giving the effect of a cancellated surface; anal sulcus shallow, outer lip (fractured) a heavy callus on body and pillar, canal short, straight. Height of shell 9, of last whorl 5.25; diameter 3 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. One specimen. U. S. Nat. Mus. No. 166097.

A very characteristic little species not closely related to any other of this horizon.

DRILLIA SPICA, new species.

Plate 12, fig. 8.

Shell small, slender, thin, acute, elongate, with about 8 whorls; nucleus of 2 smooth whorls rounded above; subsequent whorls sculptured, suture closely appressed but without a sutural cord; axial

sculpture of (on the penultimate whorl 12) narrow, rounded flexuous ribs, equal and with subequal interspaces, extending from the suture to the canal, concavely arcuate and compressed in front of the suture, thus indicating the anal fasciole, then arcuately protractive and in front receding to the canal; the ribs and interspaces smooth or faintly marked by incremental lines; spiral sculpture only of half a dozen oblique threads on the back of the siphonal fasciole; aperture moderately wide; anal sulcus wide and shallow, a narrow strip of callus between it and the suture; outer lip arcuately produced in the middle, sharp edged with a varical rib behind it between which and the last regular rib the whorl is smooth; inner lip and pillar with a moderately thick callus, smooth, and with a slightly raised outer edge; canal short, wide, slightly recurved. Length 13, maximum diameter 5 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165033.

DRILLIA TECLA, new species.

Plate 12, fig. 18.

Shell small, slender, thin, acute, elongate, with about seven whorls; nucleus of one whorl and a half, smooth, slightly bulbous; subsequent whorls sculptured, with a closely appressed suture, the sutural edge swollen into a prominent cord; axial sculpture of (on the penultimate whorl 10) narrow, rounded slightly flexuous ribs, with wider smooth interspaces, extending from the anal fasciole to the base of the whorl; surface smooth, probably polished in life; spiral sculpture comprising only a smooth constriction in front of the sutural cord, and on the base and canal about eight somewhat alternated threads mostly with wider interspaces diminishing anteriorly; aperture wide, anal sulcus as deep as wide; outer lip thin, with sharp edge and the usual varical rib behind it; body and pillar smooth, not callous; canal short, wide, and deep. Length 10, maximum diameter 4 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165036.

DRILLIA SMILIA, new species.

Plate 12, fig. 21.

Shell small, slender, solid, with 7 or more whorls, the apex of the specimen defective as well as the outer lip; suture distinct, appressed, preceded by a very strong cord which separates it from the anal fasciole; axial sculpture of (on the penutimate whorl 15) strong

rounded whorls which extend from the anal fasciole to the canal with wider interspaces which are axially striated by rather conspicuous incremental lines; spiral sculpture, comprising the sutural cord; a deep constriction, spirally striated, which forms the anal fasciole; and, in front of the fasciole about a dozen strong, subequal, distant, and nearly equally spaced rounded threads which are distributed over the whole whorl in front of the constriction; these threads are but slightly swollen where they override the ribs, between the sutures only two to four threads are visible; aperture sublunate; anal sulcus shallow; outer lip defective, probably produced with a swollen varix behind it; body and pillar callous; canal moderately wide, straight, short. Length of (decollate) shell 12.5, of last whorl 7, maximum diameter 4 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165037.

DRILLIA EUPATORIA, new species.

Plate 12, fig. 16.

Shell small, slender, acute, sharply sculptured, of about 7 whorls; suture distinct, not deep; anal fasciole marked by a constriction slightly in front of the suture, thus cutting off the posterior ends of the ribs and marginating the suture; axial sculpture of (on the penultimate whorl about 20) rather sharp narrow ribs, slightly retractively flexed where they cross the furrow of the anal fasciole, with wider interspaces, extending from suture to suture on the spire, and over the whorl to the canal on the last whorl; spiral sculpture of very fine equal parallel threads with about equal interspaces, on the spire and shoulder, and (about 7) more widely spaced on the base, and four or five more close set on the canal; these threads override the ribs but do not nodulate them; aperture sublunate; outer lip (in the specimen) thin, sharp, simple; pillar smooth, short; canal short and wide. Height of shell 7, of last whorl 5, maximum diameter 2.8 mm.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida. One specimen from the Post collection, U. S. Nat. Mus. No. 165040.

This species has much the sculpture of No. 165039, U. S. Nat. Mus., but is a much smaller and relatively more sharply sculptured shell. It is possible that the adult may have a varicose outer lip, and that the type-specimen is immature, in which case the species would be referable to the group to which *Drillia ostrearum* Stearns belongs. The first or nuclear whorl is smooth and somewhat inflated. The second shows the ribbing but not the spiral threads.

DRILLIA TAMA, new species.

Plate 12, fig. 23.

Shell small, turrited, of about 7 whorls; nucleus defective, subsequent whorls sharply sculptured; suture distinct; axial sculpture of (on the penultimate whorl 17) equal, narrow, not nodulous ribs, with much wider intervals, which between the suture and the anal fasciole are sharply retractive, in front of the fasciole slightly protractively arcuate, and on the last whorl extend unaltered to the canal; spiral sculpture of numerous close-set equal threads, prominent on the anal fasciole and on the canal where they are more widely separated; on the last whorl these threads slightly crenulate the summits of the ribs in overriding them. Aperture defective in the specimen, the anal sulcus near the suture with a depressed narrow fasciole behind it; pillar smooth, not callous; canal short, rather wide, hardly recurved. Height of shell 10, of last whorl 5, maximum diameter about 3.5 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

One specimen from the Post collection, U. S. Nat. Mus. No. 165029.

Section CYMATOSYRINX Dall.

Cymatosyrinx DALL, Bull. Mus. Comp. Zool., vol. 18, No. 29, p. 95, 1889. Type, *Pleurotoma lunata* Lea, Miocene of Virginia.

DRILLIA GLYPHOSTOMA, new species.

Plate 5, fig. 12.

Shell small, acute, with about 9 whorls, including the small rounded nucleus; surface polished, suture distinct, axial sculpture of about 14 narrow, flexuous rather sharp ribs with subequal interspaces, the ribs cross the anal fasciole and are abruptly arcuate there, reaching the suture which they slightly undulate, and in the other direction extending to the canal; the canal and base all sculptured with faint spiral threads which seem to be missing on the rest of the shell; aperture wide behind with a conspicuous rounded anal sulcus with an outwardly flaring edge; outer lip internally much thickened, incurved with a sharp edge, but no denticulation; body and pillar with a smooth layer of callus, the canal recurved, short, with a pronounced siphonal fasciole and a chink behind the pillar-callus. Height of shell 15, of last whorl 8.5, of aperture 6, diameter above the outer lip 4 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; two specimens. U. S. Nat. Mus. No. 166098.

The absence of denticulations on the pillar lip removes this species from the genus *Glyphostoma* Gabb, which it otherwise much resembles, and the character of the outer lip precludes a reference to *Clathurella*.

DRILLIA (CYMATOSYRINX?) SILFA, new species.

Plate 12, fig. 22.

Shell small, solid, the whorls rapidly increasing in diameter, the surface smooth except for axial sculpture; nucleus lost, subsequent (5) whorls strongly sculptured with twelve narrow, prominent, arcuately protractive ribs, continuous from the canal to the suture and so on to the apex in a continuous series; lines of growth not visible, canal short, smooth, slightly recurved; aperture rather wide, body and pillar slightly erased by the animal in process of growth. Height 7 mm. without the (lost) nucleus, maximum diameter 3.3 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

One specimen in the Post collection, U. S. Nat. Mus. No. 165034.

This specimen is obviously immature; the aperture if complete would probably have the characters of the section *Cymatosyrinx*, but it is distinct from any of the other species yet collected from this horizon.

DRILLIA (CYMATOSYRINX) NEWMANI Dall.

Plate 3, fig. 9; plate 7, fig. 3.

Drillia newmani Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 29, pl. 4, figs. 5, 5*a*, 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Newman. U. S. Nat. Mus. No. 112087.

Genus MANGILIA Risso (em.).

Mangelia (Leach Ms.) Risso, Hist. Nat. Eur. Mer., vol. 4, p. 219, 1826. First species, *M. costulata* Risso. *Murex nebula* Montagu.

Mangilia Philippi, Handb. der Conch., p. 138, 1853 (after Mangili, Italian naturalist.—Dall, Bull. Mus. Comp. Zool., vol. 43, No. 6, 1908, p. 259.

MANGILIA ILLIOTA, new species.

Plate 12, fig. 15.

Shell small, solid, acute, with about 8 whorls separated by a distinct but appressed suture; nucleus small, inflated, bulbous, smooth; subsequent whorls strongly sculptured; axial sculpture of (on the last whorl 13) narrow, rounded, nearly straight ribs, separated by wider interspaces and extending from the sutural cord to the vicinity of the canal with a constriction at the anal fasciole; the interspaces behind the periphery are smooth, the surface polished, and the incremental lines hardly visible; spiral sculpture of a rather strong low cord in front of the suture, a constriction indicating the anal fasciole in front of the cord, and in front of the periphery a dozen or more feeble subequal spiral threads growing stronger toward the canal and with about equal interspaces; on the back of the canal there are a

number of finer close-set threads; aperture sublunate, anal sulcus shallow, the outer lip thin, simple, not lirate internally; body and pillar smooth, not callous; canal short, wide, straight. Length 8, maximum diameter 3 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165038.

MANGILIA, sp. indet.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 165041.

A single specimen different from the preceding species seemed too badly preserved for identification.

Family CANCELLARIIDAE.

Genus CANCELLARIA Lamarck.

Cancellaria LAMARCK, Prodrome, 1799, p. 71. Sole example, *Voluta reticulata* Linnaeus.

Subgenus TRIGONOSTOMA Blainville.

Trigonostoma BLAINVILLE, Man. de Mal., vol. 2, 1827, p. 652. Type, *Murex scala* Gmelin, Syst. Nat., pt. 6, p. 3551, No. 95, 1792. (=*Delphinula trigonostoma* Lamarck, An. s. Vert., vol. 6, p. 231, note 1822).

Trigona PERRY, Conch., 1811, pl. 51, fig. 1; not of Jurine, 1807.

Trigonostoma, JOUSSEAUME, Le Naturaliste, Paris, vol. 9, 1887, pp. 157, 213; reprint 1888, p. 22.

CANCELLARIA SUBTHOMASIAE Dall.

Plate 3, fig. 7; plate 10, fig. 1.

Cancellaria subthomasiae DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 44, pl. 2, fig. 3, 1890.

Shell of moderate size, strongly sculptured, turrited, of about 7 whorls; nucleus minute, smooth, of about one whorl; subsequent whorls axially sculptured with (on the penultimate whorl 11, on the last whorl nine) strong, crenulated, elevated ribs, angular, or even subspinose at the shoulder behind which the whorl is subtabulate; these ribs are moderately retractive, feeble at the suture, most elevated at the shoulder, and continue over the whorl to the siphonal fasciole, somewhat recurved, and concave behind and axially striated in front; spiral sculpture of numerous fine threads, with a tendency to alternate in strength, subequidistant, the interspaces equal to the threads or wider; the threads override and somewhat crenulate the edges of the ribs; base with a strong siphonal fasciole and small umbilical perforation; aperture subtriangular, with continuous mar-

gin, notched in front obliquely by a distinct siphonal sulcus; outer lip subvaricose, with about a dozen internal lirae; pillar lip thinner, free from the body, sharp-edged, with three well-marked plaits, the posterior most prominent. Length of shell 20, of last whorl 14, of aperture 11, maximum diameter 12.2 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 165042.

The original specimen collected by me being quite defective, it was thought best to fully describe the species anew, from a beautifully preserved specimen in the Post collection. It belongs to the section *Bivetopsia* Jousseaume, 1888.

CANCELLARIA DEPRESSA, new species.

Plate 10, fig. 4.

Shell short, turbinate, solid, with about four well-rounded whorls; nucleus defective; suture deep, not channeled, the whorl in front of it narrowly tabulate; axial sculpture of (on the last whorl about 15) narrow, rounded, more or less unequal, riblets, which extend from the suture, slightly swollen at the angle of the shoulder, to the rounded margin of the umbilical funnel, with usually subsequent interspaces; the incremental lines are also rather coarse and prominent; all the axial sculpture is slightly retractive; spiral sculpture of (at the beginning of the last whorl about 10) subequal and mostly subequally spaced, flattish threads with wider interspaces, overriding the ribs, but not notably swollen at the intersections; near the periphery a few of these are alternately smaller and closer, there are also two or three finer threads between the shoulder and suture; umbilicus large and deep, funicular, with spirally threaded walls; aperture subtriangular, the margin continuous; body with a rather thick smooth layer of callus; outer lip with a small subsutural internal liration, and about 8 more lirae between the shoulder and canal; margin sharp oblique with a moderately swollen external varix; canal short, narrow, shallow; pillar-lip smooth with three plaits, enlarging posteriorly. Height of shell 17.5, of last whorl 14.5, maximum diameter 12 mm.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida. One specimen from the Post collection, U. S. Nat. Mus. No. 165043.

This also belongs to the section *Bivetopsia* Jousseaume.

CANCELLARIA (SVELTIA), sp. indet.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. One specimen, U. S. Nat. Mus. No. 165044.

The specimen is immature with the base defective. It has 5 whorls with a pronounced suture; about 12 rounded ribs crossed on

the last whorl by about 25 spiral threads with wider interspaces; the umbilicus is deep but narrow with its margin broadly rounded. The pillar has two prominent plaits, and the aperture was probably trigonal. The remaining portion of the shell is 9.5 mm. long with a maximum diameter of 5 mm. It belongs to the section called *Sveltia* by Jousseaume.

Family OLIVIDAE.

Genus OLIVA Martyn.

Oliva MARTYN, Univ. Conch., vol. 3, pl. 111, 1786. First species, *O. corticata* Martyn.

This genus is commonly attributed to Bruguière, but was proposed at least three years earlier by Martyn, as I showed in 1905.[1]

OLIVA POSTI, new species

Plate 12, fig. 24.

Shell small, solid, smooth, with 4 or more whorls; nucleus defective; suture moderately channeled; shell rather slender; last whorl with a wash of callus near the suture; aperture long and narrow, acute behind; outer lip slightly thickened, internally smooth; inner lip plicate, in front as figured: canal deeply excavated. Height, 21.5; height of last whorl, 18; maximum diameter, 8.5 mm.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus., No. 165045.

Genus OLIVELLA Swainson.

Olivella SWAINSON, Zool. Ill., vol. 2, pl. 58 and text, 1831. Type, *Oliva dama* Mawe; Dall, U. S. Geol. Survey, Prof. paper No. 59, p. 31, 1909.

OLIVELLA LATA Dall.

Plate 15, fig. 4.

Olivella lata DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 45, pl. 4, fig. 8*b*, 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida, Shepard, Dall, and Post. U. S. Nat. Mus., No. 165046.

This is perhaps nearest some of the recent forms like *O. strigata* Reeve, and *O. fuscocincta* Dall from the West Indies, none of which, however, are as broad and thin as *O. lata*.

[1] Proc. U. S. Nat. Mus., vol. 29, No. 1425, p. 428.

OLIVELLA EUTORTA, new species.

Plate 10, fig. 10.

Shell small, stout, solid, with 5½ whorls separated by a deeply channeled suture; first whorl rounded and subglobular; subsequent whorls smooth, moderately convex; aperture wide in front, behind ending in a deep narrow sinus at the end of the suture, between the body and the outer lip; anterior third of the body covered by a revolving band of enamel with a groove at the posterior edge, otherwise smooth; the outer lip sharp, smooth within; body with a thin wash of callus, pillar thick, callous, twisted, with its anterior edge forming a strong rounded fold with a depression behind it, the inner surface of the pillar finely spirally lirate; canal wide, shallow. Length, 12; length of aperture, 8.5; maximum diameter of shell, 6 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165047.

OLIVELLA COLLETA, new species.

Plate 12, fig. 9.

Shell very small, smooth, slender, with about 5½ whorls, separated by a deeply channeled suture; nucleus minute subglobular, of about one whorl; subsequent whorls subcylindrical, smooth; last whorl attenuated in front, with a faint fasciolar band of enamel close to the anterior edge; aperture narrow behind, wide in front; outer lip thin, sharp, simple; inner lip not callous; pillar with one or two faint very anterior folds; canal wide and deep. Length of shell 4.5, of aperture 2.5, maximum diameter 1.8 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

One specimen from the Post collection, U. S. Nat. Mus. No. 165048.

Genus ANCILLA Lamarck.

Ancilla LAMARCK, Prodrome, p. 90, No. 6, 1799. Type, *Voluta ampla* Gmelin; Syst. an. s. Vert. 1801, p. 73; sole example cited, *A. cinnamomea* Lamarck; Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 225, 1892.

Ancillaria LAMARCK, Ann. du Mus., Paris, vol. 16, p. 305, 1811. Not *Ancilia* Meuschen, 1787.

The name of this genus was changed by Lamarck because it was thought too close to *Ancylus* (Geoffroy) Müller, 1774. Meuschen's name is misspelled *Ancilla* in the Index Animalium, but in any case, as his system was frankly not Linnean, we are fortunately not obliged to consider his names, which are all in the plural number and not systematically binomial.

ANCILLA SHEPARDI Dall.

Plate 7, fig. 1.

Ancillaria shepardi DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 46, pl. 4, fig. 4, 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Shepard, Dall, Burns, and others, U. S. Nat. Mus. No. 165049.

Family MARGINELLIDAE.

Genus MARGINELLA Lamarck.

Marginella LAMARCK, Prodrome, p. 75, 1799. Type, *Voluta glabella* Linnaeus.

Pterygia (sp.) BOLTEN, Mus. Boltenianum, 1798, p. 51.

Pterygia LINK, Beschr. Rostock Samuel, 1806, p. 93. First species, *Voluta glabella* Linnaeus.

Voluta (sp.) LINNAEUS, GMELIN, PERRY, etc.

The *Pterygia* of Bolten, though heterogeneous according to modern ideas, when the shells included in it are compared, seems to be on the whole a very natural grouping if form alone be considered, though we now know that the species have very different affinities. He named no type and therefore we have to consider what is left after various genera have been deducted from it. We may at once exclude the members of the prior genera *Voluta* (Linnaeus) Scopoli, 1777, and *Strombus* Linnaeus, of which last an immature specimen is included in Bolten's list.

Genera subsequently eliminated in 1799 by Lamarck are: *Columbella* (*mercatoria*) and *Marginella* (*glabella* Linnaeus), both represented by monotypes. The next reviser was Link, in 1806. He attempted to reconcile the names of Bolten and Lamarck by dividing the Marginellas in the wide sense into two natural groups, applying Bolten's name to one and Lamarck's to the other. Unfortunately instead of giving Lamarck's name to the group containing the monotype of Lamarck, he applied it to the group containing *Pterygia persicula* Linnaeus, and used Bolten's name for the group containing Bolten's first species, which is the same as Lamarck's monotype. This, if accepted, would leave us no escape from regarding *Marginella* Lamarck as a synonym of *Pterygia* Bolten, while *Marginella* Link, not Lamarck, would equal the later *Persicula* Schumacher, 1817.

We may take the view, however, since Lamarck has segregated *Marginella* (*glabella*) and *Columbella* (*mercatoria*) as representing new groups from the heterogeneous *Pterygia* of Bolten, in which still remained valid material for more than one genus, that *Pterygia* must therefore be applied to one of the still remaining valid generic groups and proceed by elimination to determine which one, as no

one has fixed a type-species for *Pterygia*. Montfort, in 1810, gave a masculine termination to Lamarck's name and called the genus *Marginellus*. Perry, in 1811, referred his only species of *Marginella* to the genus *Voluta*.

The next reviser of the classification was Schumacher, in 1817. He accepted *Marginella* Lamarck, with Lamarck's type. He further eliminates in succession the following new genera, *Persicula* (*Voluta persicula* Linnaeus), *Imbricaria* (*Voluta conus* Gmelin), and *Cylindra* (*Voluta crenulata* Gmelin). The last is a homonym of *Cylinder* Müller, 1766, and Montfort, 1810, and therefore not to be accepted. It is a member of the same genus as Bolten's *Pterygia nucella* according to the consensus of authors. I therefore name the latter (=*Voluta dactylus* Linnaeus) as type of *Pterygia*, of which *Cylindromitra* Fischer, 1884, will be a synonym. In this way we may avoid the confusion which the rejection of *Marginella* at the present day would create, since there are few species of *Cylindromitra* and they have so far been the subject of very little publication.

The species from the silex beds so far obtained all have the spire exposed. Doubtless if the complete fauna was available we should also find species of *Persicula* and *Volvarina*, as in most of our tertiary faunas.

MARGINELLA MOLLITOR, new species.

Plate 12, fig. 1.

Shell small, smooth, solid, with about 4 whorls, which are obscured by a continuous coat of enamel covering the spire; last whorl rather convex, the periphery at the shoulder terminating at the aperture in a prominent wide, smooth varix, distinctly and sharply separated by a difference in level from the surface behind it, and which also marginates the canal; aperture narrow; outer lip receding at the suture and canal, thick, having between the shoulder and canal about 11 internal denticulations, or short lirae, which do not enter the aperture beyond the varix; body smooth, with a slight wash of callus; pillar slightly concavely arcuate with four nearly equal and equally spaced plaits, of which the anterior is at the edge of the wide shallow and short canal. Length of shell 11.5, of apertures 7.5, maximum diameter 6 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type specimen from the Post collection, U. S. Nat. Mus. No. 165058.

MARGINELLA INFECTA, new species.

Plate 12, fig. 3.

Shell small, smooth, solid, of about 4 whorls, the spire being covered with a coat of enamel which obscured the suture and nucleus;

last whorl comprising most of the shell, moderately convex, aperture narrow, wider in front; outer lip thickened, especially toward the middle, its posterior end somewhat protracted on the whorl behind the suture: posterior sinus of the aperture rounded, body with a thin wash of callus; pillar short, carrying four prominent subequal plaits, the anterior of which is coincident with the twisted edge of the pillar; canal very short and wide. Height 7.7, maximum diameter 4.7 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type specimen from the Post collection, U. S. Nat. Mus. 165061.

MARGINELLA BELLULA Dall.

Plate 16, fig. 9.

Marginella bella var. *bellula* Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 53, pl. 4, fig. 8*c*, 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida: Newman, Burns, and Dall. U. S. Nat. Mus. No. 165053.

MARGINELLA INEPTA Dall.

Plate 15, fig. 2.

Marginella bella var. *inepta* Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 53, pl. 4, fig. 8*d*, 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; Newman and Dall. U. S. Nat. Mus. No. 112101.

MARGINELLA FAUNULA Dall.

Plate 16, fig. 14.

Marginella faunula Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 53, pl. 4, fig. 9*b*, 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; rare; Dall. U. S. Nat. Mus. No. 112103.

The habit of this species is somewhat like *M. fauna* Sowerby, but the form is more like *M. bellula*.

MARGINELLA ELEGANTULA Dall.

Plate 16, fig. 11.

Marginella elegantula Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 54, pl. 4, fig. 7, 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; rare; Dall. U. S. Nat. Mus. No. 1112104.

The characters of this species point to it as a probable precursor of such forms as *M. margarita* and *M. haematita* Kiener, but the Pliocene link in the series has not yet been detected.

MARGINELLA BALLISTA Dall.

Plate 16, fig. 12.

Marginella ballista DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 47, pl. 4, fig. 6, 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; Dall. U. S. Nat. Mus. No. 112906.

This has a peculiarly rounded form and thickened outer lip destitute of internal denticulation.

MARGINELLA TAMPAE Dall.

Plate 11, fig. 6.

Marginella (*ballista* var.?) *tampae* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 47, Aug., 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; Dall. U. S. Nat. Mus. No. 112097.

It was at first thought this might be a variety of *M. ballista*, but the examination of a larger number of specimens leads to the conclusion that it is distinct. The nearest species to it thus far noted is *M. incrassata* Nelson from the Peruvian Tertiary, which has a lower spire, one less plait, and a thinner outer lip.

MARGINELLA LIMATULA Conrad.

Plate 11, fig. 7.

Marginella limatula CONRAD, Journ. Acad. Nat. Sci. Phila., vol .7, p. 140, 1834; Fossils Medial Tert. U. S., p. 86, pl. 49, fig. 9 (err. for fig. 11 *fide* Conrad *in litt.*) 1845.—DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 49, 1890.

Porcellana limatula TUOMEY and HOLMES, Pleioc. foss. S. Car., p. 130, pl. 27, figs. 10, 11, 1857.

Marginella roscida REDFIELD, Proc. Acad. Nat. Sci. Phila., vol. 12, p. 174, 1860.

Prunum limatula CONRAD, Amer. Journ. Conch., vol. 4, p. 67, pl. 6, fig. 5, 1868.

Oligocene of the White Beach sandstone (and the Tampa silex beds?) Burns and Dall; Miocene of Virginia, the Carolinas and Florida: Pliocene of South Carolina and Florida, on the Caloosahatchee and Shell Creek; living abundantly off the Carolina coast in 25 to 100 fathoms, on a bottom of sand and gravel. U. S. Nat. Mus. No. 11462.

This is a species rather northern in its present range and has not so far been found living in Floridian waters. Some of the Pliocene specimens show traces of white flecks, somewhat like those of the *M. nivosa* Hinds, a marking which is much less common in the recent

shell. The specimen figured is from the Miocene of South Carolina, the White Beach specimen being too poor to figure.

MARGINELLA GREGARIA, new species.

This species, in my original studies from imperfect material supposed to be a variety of *M. limatula*, seems now, from material received too late for figuring, to be quite distinct. I therefore describe it comparatively until an opportunity may arise when I can supply a figure.

The shell is of a shape not unlike *M. limatula*, but longer and more ovoid. Its relative diameter at the shoulder of the last whorl is much less and the outer lip at the shoulder is therefore less prominent. The thickening of the outer lip is less pronounced, and in all the specimens received it is perfectly smooth, while in *M. limatula* fully adult specimens have it finely denticulate on the inner edge. The plaits are also much more delicate than in *M. limatula*. Comparative measurements are as follows:

M. gregaria: Length 17.5, maximum diameter 9.3, length of aperture 15 mm.

M. limatula: Length 14.7, maximum diameter 9, length of aperture 13 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall and Post. U. S. Nat. Mus. No. 165081.

M. gregaria somewhat resembles *M. onchidella* Dall, of the Pliocene, but is smaller and less arcuate laterally, with the spire more apparent. The specimen of *M. limatula* measured above is that figured on plate 11, figure 7, of this paper.

MARGINELLA BELLA Conrad.

Plate 16, fig. 10.

Prunum bella (sic) CONRAD, Amer. Journ. Conch., vol. 4, p. 67, pl. 6, fig. 4, 1868; Proc. Acad. Nat. Sci., Phila., for 1862, p. 564 (name only).

Marginella bella DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 53, pl. 4, figs. 9^a, 1890.

Oligocene of the Tampa silex beds and of the overlying Orbitolite bed at Ballast Point, Tampa Bay, Florida; Burns and Dall; Miocene of Virginia; Pliocene of the Caloosahatchie River, Florida; living off the coast of North Carolina on sandy bottom in 14 to 50 fathoms. U. S. Nat. Mus. No. 165052.

This species was the type of Conrad's undefined group *Porcellanella*, which he afterwards abandoned. Among Conrad's original specimens two species were represented, one of which he had already named *M. succinea*, the other will retain the present name. Figure 9^a of the Wagner Transactions represents the normal form. The recent

shell is yellowish or pinkish white with obscure, fine, opaque, axially directed streaks, and varies a good deal in size.

MARGINELLA IMPAGINA, new species.

Plate 12, fig. 4.

Shell minute, smooth, with indication of what may possibly be two spiral color bands on the last whorl, with a gently tapered spire of about 4 whorls, the suture obscured by a coat of enamel which covers the entire spire; shell fusiform; aperture sublunate; outer lip ascending a little from the suture behind, arcuately projecting in the middle, thin, simple with (in the specimen) no varix; canal wide, shallow; pillar with four equal and equally spaced oblique plaits, the anterior plait situated on the edge of the pillar; body with little or no callus. Length 5, maximum diameter 2.7 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165060.

This specimen may be slightly immature.

MARGINELLA POSTI, new species.

Plate 12, fig. 6.

Shell small, smooth, of about 4 whorls, which are more or less obscured by a coating of enamel covering the entire spire, solid, slender; on the last whorl are a few faint axial sulci or incremental markings; terminating the whorl in the adult is a heavy wide varix, the posterior edge of which is sharply elevated above the general surface; aperture narrow behind, wide in front; outer lip varicose, simple, thicker in the middle, receding to the canal, without internal lirae; body smooth not callous; pillar shorter than the aperture with four subequal, equidistant plaits, the anterior set on the twisted edge of the pillar; canal short, wide, with a continuation of the varix marginating it on the back. Length 6.4, maximum diameter, 3.5 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165057.

MARGINELLA INTENSA, new species.

Plate 10, fig. 8.

Shell small, short, solid, smooth, with a short spire, obscured by a coat of enamel covering it entirely, and about 3 whorls; aperture narrow; outer lip produced behind over nearly half the penultimate whorl, heavily smoothly varicose, the varix distinctly limited behind, marginating the lip and canal, internally smooth, thicker in the middle; body with a slight wash of enamel; pillar with four low,

stout, equal and equally spaced plaits, the anterior on the edge of the pillar at the narrow and shallow canal. Length 8, maximum diameter 5 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165055.

MARGINELLA MYRINA, new species.

Plate 12, fig. 2.

Shell small, stout, short, smooth, of about 3 whorls, the spire, nucleus, and suture obscured by a rather thick coat of enamel; outer lip varicose and externally marginate, receding toward the suture and broader toward the middle; aperture rather wide, posterior sinus rounded; outer lip not internally lirate; body with a thin wash of callus; pillar with four distinct plaits, the anterior coincident with the edge of the pillar and with the adjacent plait somewhat larger than the posterior pair, all about equidistant; canal shallow, short, wide. Height 6, maximum diameter 4 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165056.

MARGINELLA NEWMANI Dall.

Plate 16, fig. 13.

Marginella newmani DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 54, pl. 4, fig. 8, 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; rare; Mr. L. G. Newman, U. S. Nat. Mus. No. 112105.

This species groups with the last.

Family VOLUTIDAE.

Subfamily CARICELLINAE Dall.

Caricellinae DALL, Smiths. Misc. Coll., vol. 48, pt. 3, No. 1663, p. 344, Feb., 1907.

The features of this subfamily were fully set forth in my paper above referred to. One or two changes may be noted here as advisable. The *Voluta stearnsii* Dall of Alaska which, from worn specimens, was supposed to be referable to *Adelomelon* proves to have a shelly protoconch, not unlike that of *Fulgoraria*, and may be regarded as the type of a new section *Arctomelon* of that genus. A shell described by Locard in the Report on the mollusks of the Talisman expedition in 1897, under the name of *Latiromitra*, and supposed by him to be related to *Latirus*, is sufficiently like my

Miomelon of 1907 to make a comparison advisable. At any rate Locard's shell has nothing to do with *Latirus*.

Proscaphella Ihering, June, 1907, is a synonym of *Miomelon* Dall, February, 1907. A genus named by me *Calliotectum* in 1889, and supposed to belong in the Pleurotomidae, proves to belong to the Volutidae. Some magnificent species, closely related, were obtained by the U. S. Bureau of Fisheries steamer *Albatross* in deep water in the Philippines.

Subfamily VOLUTINAE.

Genus LYRIA Gray.

Lyria GRAY, Proc. Zool. Soc. London, for 1847, p. 141; type, *Voluta nucleus* Lamarck. Not *Liria* (from *Liri* of Adanson) Gray, Philos. Mag. and Journ., 1824.

The different derivations of *Liria* and *Lyria* fortunately prevent the necessity of regarding them as homonyms: in which case we should have been obliged to substitute *Otocheilus* Conrad, 1865, for *Lyria* Gray.

LYRIA PULCHELLA Sowerby.

Plate 10, fig. 11.

Voluta pulchella SOWERBY, Quart. Journ. Geol. Soc. London, vol. 6, p. 46, pl. 9, fig. 4, 1850.

Lyria pulchella DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 84, pl. 4, fig. 3, 1890.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, Florida (Dall), and of Santo Domingo (Sowerby and Gabb). Figured specimen U. S. Nat. Mus. No. 165064.

LYRIA HEILPRINI, new name.

Plate 10, fig. 13.

Voluta (Lyria) zebra HEILPRIN, Trans. Wagner Inst., vol. 1, p. 110, pl. 15, fig. 46, 1887; not *Voluta zebra* Leach, Zool. Misc., vol. 1, pl. 12, fig. 1, 1814.

Lyria zebra DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 84, 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Willcox, Burns, and others. U. S. Nat. Mus. No. 165063.

In my paper in the Transactions I refrained from giving a new name to this species, of which the specific name is preoccupied as above indicated, thinking the late Professor Heilprin might rename it himself, but as he did not do so I now substitute another.

The young of this species is very close to *L. harpula* Lamarck, but the adults develop marked distinctions.

LYRIA MUSICINA Heilprin.

Plate 9, figs. 1, 4.

Voluta musicina HEILPRIN, Trans. Wagner Inst., vol. 1, p. 109, pl. 15, fig. 45, 1887.

Lyria musicina DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 85, 1890.

Oligocene of Richard's quarry, Ocala, Florida, in the so-called Nummulitic bed; of the Chipola River marl, near Bailey's Ferry (now the County bridge); of the lower bed at Alum Bluff, Chattahoochee River; and of the Tampa silex beds at Ballast Point, Tampa Bay, Florida; Shepard, Willcox, Burns, and others. U. S. Nat. Mus. No. 111842.

LYRIA SILICATA, new species.

Plate 10, fig. 3.

Shell small, light, slender, with 5 or more gently convex whorls, the apex decollate in the type-specimen; suture distinct, not channeled; third whorl (counting backward from the aperture) with about 16 narrow, rather sharp, riblets, with much wider interspaces extending from suture to suture; these riblets on the later whorls become less regularly spaced and obsolete, on the last whorl absent; except for these riblets the surface appears to be smooth; last whorl much the largest, terminating at the outer lip in a thickened, rounded, and expanded varix; aperture narrowly lunate with no sinus or channel at the posterior commissure; inside of the outer lip smooth, without lirae; body with a thin layer of callus; pillar short, thick, with two strong anterior plaits behind which are indications of six or more minor unequal lirae; canal short, wide, deep, the pillar extending a little in advance of the outer lip, twisted, and with a faint siphonal fasciole. Length of (decollate) shell 27.2, of last whorl 22.5, of aperture 16, maximum diameter 14 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. One specimen from the Post collection, U. S. Nat. Mus. No. 165065.

Family MITRIDAE.

Genus MITRA Martyn.

Mitra MARTYN, Univ. Conch., vol. 1, 1784, table 1, fig. 19. (First species, *M. tessellata* Martyn).—BOLTEN, Mus. Boltenianum, 1798, p. 135.—LAMARCK, Prodrome, 1799, p. 70; monotype, *M. episcopalis* Linnaeus.

The first appearance of the genus *Mitra* in binomial nomenclature was in Martyn's Universal Conchologist, in the explanatory table of plates 19 to 23, inclusive. The name derives from Rumphius, who used it for shells of the same group in 1705, in the Amboinische Rariteitkammer. Five species were included, all belonging to the

genus Mitra in the Lamarckian sense. These were 1, *M. tessellata* Martyn; 2, *M. fasciata* Martyn (=*M. castra* Lamarck); 3, *M. sphærulata* Martyn; 4, *M. nexilis* Martyn (belonging to the group of *filaris* Linnaeus); and 5, *M. versicolor* Martyn (probably afterwards described as *M. nebulosa* Swainson).

It is obvious that the type of the genus and of the typical section must be one of these species, and not the *M. episcopalis* which was Lamarck's monotype 15 years later. Numbers 1 and 3 belong the subgenus *Scabricola* Swainson; No. 2 to the section *Swainsonia* H. and A. Adams; No. 4 to the subgenus *Cancilla* Swainson; while No. 5 is referred by Tryon to the typical section as sometimes understood and to which it is nearest. However, the possession of marked punctate spiral grooving induced Swainson to make a section for it which he called *Nebularia*. This name must give way to *Mitra* in the strict sense, while for the smooth red-spotted Mitras, hitherto wrongly regarded as typical, the new sectional name *Papalaria* may be used.

The silex bed fossils of this genus belong to the subordinate groups *Cancilla* Swainson and *Fusimitra* Conrad, for the most part.

MITRA SILICATA Dall.

Plate 14, fig. 2.

Mitra (*mississippiensis* Conrad, var?) *silicata* Dall, Trans. Wagner, Inst., vol 3, pt. 1, p. 93, pl. 4, fig. 11, 1890.

Tampa silex beds between Ballast Point and the town, collected by Mr. Shepard. U. S. Nat Mus. No. 165066.

This species was included in Conrad's genus *Fusimitra* (type *M. cellulifera* Conrad) since abandoned.

MITRA SYRA, new species.

Plate 12, fig. 17.

Shell small, slender, acute, with about 9 whorls separated by a distinct but not deep suture; nucleus smooth subglobular, the succeeding 3 whorls smooth, or very faintly axially striated, the sculptured whorls succeeding abruptly; axial sculpture of (on the penultimate whorl 17) narrow, slightly protractive, rounded ribs extending completely over the whorls to the base on the last whorl, with an inconspicuous contriction near the suture, but otherwise smooth and even, separated by much wider interspaces; spiral sculpture of (between the sutures about 7) flattened close-set cords, which do not override the ribs, and continue to the canal on the last whorl, where they are succeeded by four or five larger and more distant rounded spirals; aperture narrow, sublunate; outer lip simple, hardly thick-

ened, not internally lirate; inner lip smooth; pillar with four plaits, the largest posterior, the others regularly diminishing forward, the most anterior not quite reaching the edge of the pillar; canal rather wide and deep, slightly recurved. Length of shell 15.5, of last whorl 9, of aperture 6, maximum diameter 4.5 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus., No. 165067.

MITRA MYRA, new species.

Plate 12, fig. 7.

Shell small, acute, with 6½ whorls, of which the first 2 are smooth, subsequent whorls being sculptured with narrow rounded riblets (on the penultimate whorl 12) slightly protractive and with wider interspaces, which extend from suture to suture, making slight undulations in the sutural line where the ends of the riblets reach it; on the last whorl the riblets are carried over the periphery and become obsolete on the base; there is no spiral sculpture except on the canal, where there are 4 threads, the anterior pair close set, small, the third large with a marked sulcus on each side, and the fourth faint at the base of the whorl; the remainder of the surface is smooth; aperture narrow, less than half the length of the shell; outer lip (defective in the specimen); pillar strong, with three strong, oblique plaits decreasing in prominence forward; canal short, wide, very slightly recurved. Length of shell 8, of last whorl 5.8, maximum diameter 3.5 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

One specimen in the Post collection, U. S. Nat. Mus., No. 165068.

Genus STRIGATELLA Swainson.

Strigatella Swainson, Mal., p. 319, 1840. Type, *Mitra zebra* Lamarck.

STRIGATELLA AMERICANA, new species.

Plate 9, fig. 2.

Shell ovoid, heavy, with a short acute spire of 7 whorls, exclusive of the (lost) protoconch; upper whorls closely spirally threaded, the threads disappearing in front of the shoulder on the last whorl; suture closely appressed; axial sculpture of fine rounded riblets, with equal interspaces traversing the whole width of the last whorl, but faint and irregular on the spire; outer lip much thickened with a prominent nodule internally near the middle; body with a thin wash of callus; pillar with four stout nearly horizontal plaits, with wider interspaces; canal short, narrow, sharply recurved; siphonal

fasciole well marked. Height 28, maximum diameter 15, aperture 20 mm.

Oligocene of the Chipola River marls near the county bridge (station 2212), U. S. Nat. Mus. No. 114343; also in the Tampa silex beds?

Fragments were found at Ballast Point, which were supposed to belong to this species, but were subsequently mislaid. It is probably the first American fossil species of the genus.

Genus CONOMITRA Conrad.

Conomitra CONRAD, Amer. Journ. Conch., vol. 1, p. 25, Feb., 1865; first species, *Mitra fusoides* Lea, Contr. Geol., p. 169, pl. 6, fig. 176, 1833. Eocene.

This genus was named, but not diagnosed, three species mentioned, but no type selected, *C. fusoides* was selected by Tryon, Str. and Syst. Conch., vol. 2, p. 170, 1883.

CONOMITRA STAMINEA Conrad.

Plate 10, fig. 2.

Mitra staminea CONRAD, Journ. Acad. Nat. Sci., Phila, ser. 2, vol. 1, p. 120, pl. 12, fig. 4, Aug. 1848.

Mitra vicksburgensis CONRAD, Journ. Acad. Nat. Sci., Phila., ser. 2, vol. 1, p. 120.

Conomitra angulata HEILPRIN, Trans. Wagner Inst., vol. 1, p. 110, pl. 15, fig. 47, 1887.

Conomitra staminea DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 94, pl. 4, fig. 2, 1890.

Oligocene of Vicksburg, Mississippi; of the Tampa silex beds at Ballast Point, and at Six Mile Run, near Orient station, northeast from Tampa, and in the overlying Orbitolite bed; also in the Chipola marl of the Chipola River, northwest Florida; Burns, Dall and others. U. S. Nat. Mus. No. 165069.

An extremely similar recent species *C. blakeana* Dall, has been dredged in deep water in the Antilles.

Family TURBINELLIDAE.

Genus XANCUS Bolten.

Xancus BOLTEN, Mus. Boltenianum, p. 134, 1798. Type, *Voluta pyrum* Gmelin.

Turbinella LAMARCK, Prodrome, p. 73, 1799. Type *Voluta pyrum* Linnaeus.

Bolten's name is derived from the East Indian appellation of Chank, or Siank shell, given to the typical species.

XANCUS POLYGONATUS Heilprin.

Turbinella polygonata Heilprin, Trans. Wagner Inst., vol. 1, p. 108, pl. 15, fig. 43, 1887.—Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 97, 1890.

Oligocene of the Tampa silex beds and of the lower bed at Alum Bluff, Chattahoochee River, Florida, Heilprin, Dall, and others. U. S. Nat. Mus. No. 165071.

This species was described from a very imperfect young specimen from Tampa and the description somewhat enlarged from fragments from Alum Bluff. A well-preserved specimen is still a desideratum.

Genus VASUM Bolten.

Vasum Bolten, Mus. Boltenianum, p. 56, 1798. First species, *Voluta capitellum* Gmelin.—Link, Beschr. Rostock Samml., vol. 3, p. 119, 1807.

Cynodonta Schumacher, Essai, p. 73, 1817.

Cynodona Schumacher, Essai, p. 141, 1817. Sole example, *Voluta ceramica* Linnaeus.

This genus is represented by some very remarkable species in the Tertiary of the Coastal Plain of the United States.

VASUM SUBCAPITELLUM Heilprin.

Plate 7, fig. 2.

Vasum subcapitellum Heilprin, Trans. Wagner Inst., vol. 1, p. 109, pl. 15, fig. 4, 1887.—Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 99, pl. 4, fig. 12, 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida. Willcox, Burns, Dall, Post and others. U. S. Nat. Mus. No. 165072.

This species should be compared with the *Turbinellus aedificatus* Guppy, which I have not had an opportunity of studying.

VASUM ENGONATUM Dall.

Plate 11, figs. 2, 3.

Vasum haitense Sowerby var. *engonatum* Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 100, 1890.

Oligocene of the lower bed at Alum Bluff, Chattahoochee River, and of the Chipola marl, Chipola River, at the county bridge, formerly Bailey's Ferry, west Florida; of White Beach, Little Sarasota Bay; and Ballast Point, Tampa Bay, south Florida; Burns, Dall, Willcox, and Post. U. S. Nat. Mus. No. 165070.

An examination of the Haitian species leads to the conclusion that it is distinct from the present one.

Family FASCIOLARIIDAE.

Genus FASCIOLARIA Lamarck.

Colus (sp.) Bolten, Mus. Boltenianum, p. 117, 1798. First species, *Murex tulipa* Gmelin.

Fasciolaria Lamarck, Prodrome, p. 73, 1799. Sole example, *Murex tulipa* Linnaeus.

FASCIOLARIA PETROSA, new species.

Plate 6, fig. 7.

Shell of moderate size and about 7 whorls exclusive of the (lost) nucleus; whorls with a somewhat turrited appearance, due to the flattish slope to a prominent shoulder emphasized by the strong ribs; suture closely appressed; spiral sculpture of rounded threads with equal or wider interspaces, the threads alternating in size, the larger ones becoming more prominent and slightly nodulous on the base and canal; axial sculpture of 7 to 9 strong rounded ribs, with wider interspaces and obsolete above the shoulder and on the base; aperture subovate; the outer lip sharp and crenulate, the throat with about 24 entering lirae; a shallow subsutural channel with a rather thick callus on the body and pillar; the edge of the pillar is prominent with three well-defined plaits behind it diminishing in size backward, with a faint indication of a fourth; siphonal fasciole strong, with a deep chink between it and the callus of the pillar; canal narrow. Height of type-specimen 100, last whorl 70 (the canal and apex slightly defective), maximum diameter 47 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida, one specimen; E. J. Post, U. S. Nat. Mus. No. 165073.

This is a well marked species of the general aspect of the group to which *F. gigantea* Kiener belongs.

Genus LATIRUS Montfort.

Latirus Montfort, Conch. Syst., vol. 2, p. 531, 1810. Sole example, *Murex polygonus* Gmelin.

Lathyrus Latreille, Fam. Nat., p. 187, 1825.

Turbinella (sp.) Lamarck et auct. aliis.

LATIRUS FLORIDANUS Heilprin.

Plate 8, Fig. 6.

Latirus floridanus Heilprin, Trans, Wagner Inst., vol. 1,, p. 108, pl. 15, fig. 47, 1887.—Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 106, pl. 8, fig. 2, 1890.

Oligocene of the "nummulitic bed" near Martin Station, eastward from Tampa, and of the Tampa silex beds at Ballast Point,

Tampa Bay, Florida; Heilprin and Dall. U. S. Nat. Mus. No. 165077.

The following species originally described as a variety seems from additional material to be distinct.

LATIRUS MULTILINEATUS Dall.

Latirus floridanus var. *multilineatus* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 107, 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall and Post. U. S. Nat. Mus. No. 112121.

LATIRUS RUGATUS Dall.

Plate 8, fig. 2.

Latirus rugatus DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 107, pl. 8, fig. 7 (only), 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Burns and Dall. U. S. Nat. Mus. No. 112123.

By an error in numbering figure 6 of plate 8 in the original publication was referred to this species, but it really belongs to another shell.

LATIRUS CALLIMORPHUS Dall.

Plate 7, fig. 8.

Latirus callimorphus DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 107, pl. 8, fig. 1, 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall. U. S. Nat. Mus. No. 112122.

A single specimen was collected by the writer. It differs by its shorter canal and the number of its axial ribs from *L. multilineatus*.

Genus FUSINUS Rafinesque.

Fusinus RAFINESQUE, Anal. de la Nature, p. 145, 1815. New name for *Fusus* Lamarck, not Helbling.

Fusus BRUGUIÈRE, Encycl. Méth., p. 15, 1789; nude name. Lamarck, Prodrome, p. 73, 199. Sole example, *Murex colus* Linnaeus. Not *Fusus* Helbling, 1779.

Fusinus DALL, U. S. Geol. Survey Prof. Paper 59, p. 36, 1909.

I have shown in the above-cited paper and in the Journal of Conchology (Leeds) for April, 1890, p. 289, that the familiar name *Fusus* having been first binomially used for a group of species entirely distinct from that of Lamarck can not be used for the latter, and therefore it is necessary to take the first available substitute as the name of the latter.

The Museum Calonnianum having been eliminated by the International Commission for Zoological Nomenclature, the name *Colus* which occurs in it need not be considered.

FUSINUS BALLISTA Dall.

Plate 7, fig. 6.

Fusus ballista DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 127, pl. 8, fig. 4, 1890. (*Fusus nexilis* by typographical error in explanation of plate 8, p. 186.)

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall and Burns. U. S. Nat. Mus. No. 112052.

FUSINUS QUINQUESPINUS Dall.

Plate 5, fig. 6.

Fusus? quinquespinus DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 128, 1890; pt. 2, p. 234, pl. 20, fig. 8, 1892.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; rare; and also in the overlying lime rock, in the form of molds, associated with *Cerithium;* Dall. U. S. Nat. Mus. No. 112053.

Complete specimens of this species have not yet been obtained, and there is yet some question as to its correct generic place.

FUSINUS NEXILIS Dall.

Plate 8, fig. 8.

Fusus (Chrysodomus?) nexilis DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 128; pl. 8, fig. 6, 1890; (fig. 4 by typographical error in explanation of plate 8, p. 196).

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; rare; Dall. U. S. Nat. Mus. No. 112054.

The figure does not show as clearly as desirable the strength of the sculpture on the upper part of the spire, the curvature of the canal or its constriction at the base of the whorl.

Family BUCCINIDAE.

Genus BUSYCON Bolten.

Busycon BOLTEN, Mus. Boltenianum, p. 149, 1798. First species, *Fulgur carica* Montfort.

Fulgur MONTFORT, Conch., vol. 11, 1810, p. 503, and figure. Type, *F. carica* var. *eliccans* Montfort.

Sycopsis CONRAD, Amer. Journ. Conch., vol. 3, p. 184, 1867.

Sycopsis (Browne) GILL, Amer. Journ. Conch., vol. 3, p. 147, 1867; not of Gray.

In my memoir in the Wagner Institute Transactions I adopted the name *Fulgur* in preference to the earlier name of Bolten, because the latter was published without a diagnosis, but as it has been since

definitely established that a diagnosis is not essential for the validity of a generic name provided other conditions are fulfilled. I have accepted the ruling of the International Committee, and adopt *Busycon*.

BUSYCON (SPINIGER var.?) TAMPAENSE Dall.

Plate 10, fig. 5.

Fulgur spiniger var. *tampaense* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 111, 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; Shepard, Heilprin, Willcox, Dall, and Burns. U. S. Nat. Mus. No. 165075.

This is the common species of the silex beds though usually collected in an immature state, the adults appearing only as fragments. It is without doubt derived from the Vicksburgian *B. spiniger* of Conrad.

BUSYCON SPINIGER var. NODULATUM Conrad.

Plate 9, fig. 5.

Fulgur nodulatum CONRAD, Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 1, p. 207, 1849; vol. 2, p. 41, pl. 1, figs 6, 7; Proc. Acad. Nat. Sci. Phila., vol. 6, p. 317, 1854.

Fulgur nodulatus GILL, Amer. Journ. Conch., vol. 3, p. 147, 1867.

Busycon (Sycopsis) nodulatum CONRAD, Amer. Journ. Conch., vol. 3, p. 184, 1867.

Fulgur spiniger var. *nodulatum* DALL, Trans Wagner Inst., vol. 3, pt. 1, p. 110, 1890.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, Florida; and of the marl of the Chipola River, West Florida. Burns and Dall. U. S. Nat. Mus. No. 165076.

BUSYCON SPINIGER var. PERIZONATUM Dall.

Fulgur spiniger var. *perizonatum* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 111, 1890.

Fulgur coronatum HEILPRIN, Trans. Wagner Inst., vol. 1, p. 108, 1887, not of Conrad, Bull. Nat. Inst., p. 187, 1849.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; rare. Heilprin, Burns. U. S. N. Mus. No. 112126.

BUSYCON STELLATUM Dall.

Plate 10, figs. 7, 9.

Fulgur stellatum, DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 114, pl. 4, fig. 9, 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; rare; Dall. U. S. Nat. Mus. No. 165074.

Additional material of this beautiful species has been obtained since the original publication, fully confirming the diagnosis of its characters.

Genus MELONGENA Schumacher.

Galeodes Bolten, Mus. Bolt., p. 53. 1798. Type, *Murex melongena* (Linnaeus), Gmelin. Not *Galeodes* Olivier, 1791. *Arachnida.*

Melongena Schumacher, Essai, p. 212, 1817. Type, *Murex melongena* Linnaeus.

Pyrula (sp.) Lamarck, *et auct. aliis.*

MELONGENA SCULPTURATA Dall.

Plate 11, fig. 1.

Melongena sculpturata Dall, Trans. Wagner Inst., vol. 3, pt. 1, 118, pl. 8, fig. 3 (var.), 1890.

Oligocene of the Tampa silex beds at Ballast Point, of the overlying "Cerithium rock" of Heilprin at the same locality and in other adjacent localities, and in the marl of the Chipola River, near the county bridge, formerly Bailey's Ferry. Dall, Burns, and others. U. S. Nat. Mus. No. 114543.

The typical form is most common in the "Cerithium rock," the following variety more so in the silex beds underlying the former.

MELONGENA SCULPTURATA var. TURRICULA Dall.

Plate 8, fig. 7.

Melongena sculpturata var. *turricula* Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 119, pl. 8, fig. 3, 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Burns and Dall. U. S. Nat. Mus. No. 112045.

The specimen noted in the Transactions as from the Miocene of South Carolina, is of somewhat dubious extraction and may be the immature stage of another species.

Genus SOLENOSTEIRA Dall.

Solenosteira Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 122, 1890. Type, *Pyrula anomala* Reeve, Conch. Icon. *Pyrula*, pl. 8, fig. 12, 1847.

SOLENOSTEIRA INORNATA Dall.

Solenosteira inornata Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 123, 1890; pt. 2, p. 234, pl. 20, fig. 17, 1892.

Oligocene limestone at Ballast Point, Tampa Bay, Florida, from the "Cerithium rock" of Heilprin, immediately over the silex horizon, and from the bed of the Hillsboro River above Tampa. U. S. Nat. Mus. No. 112050.

The figure above cited was made from gutta percha casts taken from the molds of the species in the lime rock.

Family COLUBRARIIDAE.

Genus CANTHARUS Bolten.

Cantharus Bolten, Mus. Boltenianum, p. 132, 1798, First species, *Buccinum tranquebaricum* Gmelin.
Tritonidea Swainson, 1840.

CANTHARUS PAUPER Dall.

Plate 7, fig. 5; plate 10, fig. 12.

Tritonidea pauper Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 129, pl. 4, fig. 8c, 1890.

Tampa silex beds, Dall and Post. U. S. Nat. Mus. No. 165079.

This pretty little species belongs to the group of *C. orbignyi* Payraudeau which occurs both in the Mediterranean and Floridian recent fauna, indicating a considerable antiquity for the race.

Genus PHOS Montfort.

Phos Montfort, Conchyl, Syst., vol. 2, p. 494, 1819. Sole example, *Murex senticosus* (Linnaeus) Gmelin.
Muricidea Swainson (sp.) Mal., p. 294, 1840.

PHOS, sp. indet.

An indeterminable species of *Phos* was collected from the Tampa silex beds at Ballast Point by the late Frank Burns. Since then, Mr. E. J. Post, of Tampa, has obtained imperfect specimens of a different species. Unfortunately neither of them is in a sufficiently perfect state to make it advisable to describe it.

Family ALECTRIONIDAE.

Genus ALECTRION Montfort.

Alectrion Montfort, Conch. Syst., vol. 2, 1810, p. 565. Monotype, *Buccinum papillosum* Linnaeus.
Nassa Lamarck, Prodrome, 1799, p. 71. Monotype, *Buccinum mutabile* Linnaeus. Not *Nassa* Bolten, 1798.
Tritonella A. Adams, 1853; not of Swainson, 1840.
Alectrion Dall, Bull. Mus. Comp. Zool., vol. 43, No. 6, 1908, p. 306.

ALECTRION URSULA, new species.

Plate 12, fig. 13.

Shell small, fusiform, strongly sculptured, with about 5 whorls, the apex of the spire defective in the specimen; suture appressed, distinct; nucleus lost; subsequent whorls axially sculptured with (on the last whorl 10) rounded ribs, with wider interspaces, extending from suture to suture and, on the last whorl to the canal.

incremental lines inconspicuous; spiral sculpture of (on the spire 3, on the last whorl 9) strong spiral, equal and equidistant spiral threads, with wider interspaces, and slightly swollen where they override the ribs; between these, in the interspaces, are two or more extremely fine intercalary threads, or striae; aperture sublunate; outer lip (in the specimen) thin, simple; body not callous; pillar short, keeled at the edge of the short canal; siphonal fasciole inconspicuous with no marked constriction behind it. Length 7.5, maximum diameter 4 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165081.

This specimen may not be quite mature. It appears from its sculpture to be a member of the group to which *Nassa acuta* Conrad belongs.

ALECTRION ETHELINDA, new species.

Plate 13, fig. 17.

Shell small, subturrited, thin, of about 5½ whorls separated by a deep but not channeled suture; whorls prominently rounded, the shoulder marked and situated not far in front of the suture; nucleus of about one whorl, smooth and subglobular; subsequent whorls sculptured; axial sculpture of (on the last whorl 10) narrow rounded ribs, extending from the suture to the siphonal fasciole, with subequal much wider interspaces; spiral sculpture of very numerous fine equal threads, with equal or somewhat narrower interspaces, covering evenly the whole surface of the whorls, overriding but not nodulating the ribs; aperture semilunate, the outer lip sharp edged, faintly varicose, internally smooth in the type-specimen which may not be quite mature, and would possibly have developed lirae later; inner lip short, straight; canal short, deep, with a strong spirally striate siphonal fasciole, keeled behind, with a deep constriction behind the keel; body, in the type-specimen, without callus, which might have been supplied in the fully adult shell. Height of shell 11.2, of last whorl 7.5, maximum diameter 6.2 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

One specimen from the Post collection, U. S. Nat. Mus. No. 165080.

ALECTRION GARDNERAE, new species.

Shell short, stout, inflated, acute, with five rapidly increasing whorls; nucleus smooth, minute; subsequent whorls with (on the last whorl 8) stout ribs most prominent on the periphery and fainter toward the suture and the base; these are overrun by numerous strong subcarinated threads with on the later whorls a much finer inter-

calary thread frequently intervening; final varix strong, the body without callus, the outer lip with small denticles internally, siphonal fasciole feeble, canal (defective), aperture large, obovate. Height 16, of last whorl 11, maximum diameter 11.3 mm.

Tampa silex beds, collected by E. J. Post, but received too late for figuring. U. S. Nat. Mus. No. 214737.

This species belongs to the group of *A. versicolor* C. B. Adams, of the Pacific coast recent fauna. It is named in honor of Miss Julia Gardner, of the Johns Hopkins University, whose work in paleontology of our Tertiary has been praiseworthy.

Family COLUMBELLIDAE.

Genus COLUMBELLA Lamarck.

Columbella LAMARCK, Prodrome, 1799, p. 70. Monotype, *Voluta mercatoria* Linnaeus.

Columbella LAMARCK, An. s. Vert., vol. 7, p. 292, 1822.

The genus *Pyrene* Bolten, proposed in 1798, for *Buccinum punctatum* Bruguière (*semipunctatum* Lamarck) is sufficiently distinct from the true Columbellas to be regarded, as by the brothers Adams, as a distinct genus, although it has sometimes been held to preoccupy the name of the Lamarckian genus.

Subgenus ANACHIS H. and A. Adams.

Anachis H. and ADAMS, Gen. Rec. Moll., vol. 1, p. 184, 1853; no type selected.—DALL, Proc. Boston Soc. Nat. Hist., vol. 13, 1870, p. 242. Sole species, *A. avara* Say.

ANACHIS EUTHERIA, new species.

Plate 12, fig. 11.

Shell small, slender, attenuated, with a minute blunt tip of 2 smooth, inflated whorls, and about $6\frac{1}{2}$ subsequent reticulately sculptured whorls; suture well defined, but not appressed or channeled; sculpture of, on the penultimate whorl, about 16 rather sharp, uniform, axially directed lamellae, slightly concavely flexuous on the later whorls, and passing from the suture over the whole whorl to the canal without enlargement or nodulation; these are crossed between the sutures by 4 or 5, and on the last whorl by 13 narrow, equal revolving threads, flat-topped, and about equal to the lamellae on the spire; dividing the surface into rather deep rectangular reticulations; on the last whorl the lamellae assume the form of narrow ribs; there are a few spiral smaller threads on the short canal; aperture narrow, pointed behind, with a short, wide canal in front; pillar smooth, not callous, the anterior portion slightly twisted; outer lip

(not fully mature ?) thin, sharp, slightly arcuate behind. Length of shell 9 mm.; of last whorl 5 mm.; maximum diameter 3 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

One specimen from the Post collection, U. S. Nat. Mus. No. 165084.

Subgenus ASTYRIS H. and A. Adams.

Astyris H. and A. ADAMS, Gen. Rec. Moll., vol. 1, p. 187, 1853; no type selected.—DALL, Proc. Boston, Soc. Nat. Hist., vol. 13, 1870, p. 242; *A. rosacea* (Gould as *Buccinum*).

The group *Alia* H. and A. Adams sometimes united with this has bright colored shells and seems sufficiently distinct to preserve both names.

ASTYRIS TURGIDULA Dall.

Plate 15, fig. 6.

Astyris turgidula DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1196, pl. 40, fig. 12^b, 1900.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; Dall and Post. U. S. Nat. Mus. No. 130350, and 214439 (adult).

The specimen figured lacks the thickened outer lip. A later example retains it.

ASTYRIS ELUTHERA, new species.

Plate 12, fig. 12.

Shell small, slender, subacute, smooth, with about 7 whorls; apical whorl small, inflated, rounded; suture distinct but not deep; subsequent whorls moderately convex, gradually and uniformly increasing in size, smooth, and without sculpture, except the last, which has a small swollen varix behind the posterior part of the outer lip, and on the canal half a dozen fine, sharp spiral grooves with somewhat wider flattened interspaces; outer lip (defective) slightly thickened, the posterior part remaining shows one internal liration and doubtless anteriorly there were others; body with a slight callus with the edge free anteriorly; pillar short, obliquely truncate in front, straight. Length of shell 8, of last whorl 5.7, maximum diameter 3 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

One specimen from the Post collection, U. S. Nat. Mus. No. 165082.

ASTYRIS DICARIA, new species.

Plate 4, fig. 2.

Shell very small, smooth, short, with somewhat more than 4 whorls; suture very distinct, the whorls between moderately convex; last whorl much the largest, base attenuately rounded; aperture nar-

rowly lunate, the outer lip slightly protractively arcuate, simple; inner lip smooth; canal short, wide, slightly recurved; aperture obstructed by matrix, so that the existence of lirae on either lip is doubtful. Height of shell 4.3, of last whorl 3, maximum diameter 2 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165083.

ASTYRIS ACANTHODES, new species.

Plate 4, fig. 4.

Shell small, acute, of about 6 whorls regularly increasing; suture distinct; surface smooth except for 4 or 5 minute spiral grooves on the canal; whorls not inflated; outer lip thickened with 6 or 7 low denticles internally; body and pillar with a smooth, thin layer of callus, canal very short and deeply notched. Height of shell 6, of aperture 2, maximum diameter 2.5 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; one specimen. U. S. Nat. Mus. No. 166100.

This little shell is almost identical with one which we have without a name in the collection of the United States National Museum from the Natural Well, Duplin County, North Carolina, of Miocene age.

Family MURICIDAE.

Genus MUREX (Linnaeus) Bolten.

Murex LINNAEUS, Syst., Nat., ed. 10, p. 746, 1758. First species, *M. haustellum* Linnaeus.—BOLTEN, Mus. Boltenianum, p. 144, 1798. First species, *M. haustellum* Linnaeus.

All Bolten's species of *Murex* belong to the group as commonly restricted.

Subgenus **MUREX** sensu strictu.

Type.—Murex haustellum Linnaeus.

MUREX MISSISSIPPIENSIS Conrad.

Plate 5, fig. 10.

Murex mississippiensis CONRAD, Journ. Acad. Nat. Sci. Phila., series 2, vol. 1, p. 116, pl. 11, fig. 30, 1848.—DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 139, 1890.

Murex tritonopsis HEILPRIN, Trans. Wagner Inst., vol. 1, p. 107, pl. 15, fig. 39, 1887.

Oligocene of Vicksburg, Mississippi, Conrad; of the Tampa silex beds, Heilprin and Dall; and of the Chipola marls near the county bridge over the Chipola river, formerly Bailey's Ferry, Florida, Dall. U. S. Nat. Mus. No. 166102 and 168085.

MUREX (CHRYSOSTOMA var.?) CHIPOLANUS Dall.

Murex chrysostoma GRAY, var. *chipolana* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 139.

Oligocene of the Chipola marl, at the county bridge over the Chipola River, Calhoun county, and, possibly, of the Tampa silex beds at Ballast Point, Tampa, Florida. U. S. Nat. Mus. No. 165086.

The specimens differ from the typical recent *M. chrysostoma* in being smaller, with a somewhat shorter canal, from which the antecedent canal tends to divaricate, while in the typical *chrysostoma* it is usually continuous. The anterior margin of the varices in the fossil also tends to be more spinose, having the projecting points more produced than in the recent shell, though similar in number and situation.

MUREX SEXANGULA, new species.

Plate 13, fig. 11.

Shell small, stout, rather short, with about 6 whorls of which the nuclear one and a half are smooth and rounded, the subsequent whorls subtabulate, with 6 well-developed varices; suture deep, distinct; whorls rather abruptly shouldered, but not keeled; varices continuous and somewhat retractive, the line ascending the spire making about a quarter turn; spiral sculpture of about five rounded ridges, one behind the shoulder, subequally spaced, the two near the periphery closest, which are most prominent on the back of the varices and obsolete in the spaces between the varices; besides these there are numerous spiral grooves with wider, flattened interspaces which cover the whole surface and end in minor crenulations on the recurved edges of the varices; axial sculpture only of incremental lines and the varices, which are thick, recurved, longitudinally striate in front, finely crenulate at the recurved edge, with about five projections corresponding to the ends of the spiral ridges, of which the most prominent is at the shoulder; aperture rounded, the outer lip with six or eight feeble lirations internally; inner lip smooth, continuous, partly free from the body whorl, canal rather wide, open, with a strong siphonal fasciole; a very narrow umbilical chink present. Length of shell (canal slightly defective) 22, of aperture 6.5, maximum diameter 14 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

One specimen from the Post collection, U. S. Nat. Mus. No. 165086.

MUREX TROPHONIFORMIS Heilprin.

Plate 9, fig. 7.

Murex trophoniformis HEILPRIN, Trans. Wagner Inst., vol. 1, p. 107, pl. 15, fig. 40, 1887.—DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 140, 1890.

Tampa silex beds, Heilprin and Post; Chipola marl, at the county bridge, formerly Bailey's Ferry, Chipola river, Florida, Dall. U. S. Nat. Mus. Nos. 115771 and 214440.

Genus CHICOREUS Montfort.

Chicoreus MONTFORT, Conch. Syst., vol. 1, 1810, p. 611. Type, *Murex ramosus* Linnaeus.

CHICOREUS LARVAECOSTA Heilprin.

Murex larvaecosta HEILPRIN, Trans. Wagner Inst., vol. 1, p. 106, pl. 15, fig. 37, 1887.—DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 140, 1890.

Tampa silex beds at Ballast Point Tampa Bay, Florida; rare; Heilprin and Post. U. S. Nat. Mus. No. 165087.

CHICOREUS CRISPANGULA Heilprin.

Plate 5, fig. 14.

Murex crispangula HEILPRIN, Trans. Wagner Inst., vol. 1, p. 107, pl. 15, fig. 38, 1887.

Murex (Chicoreus) crispangula DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 140, 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; two specimens, Heilprin and Post. U. S. Nat. Mus. No. 214442.

This is related to *M. larvaecosta*, having the same number of varices, but is less prominent and angular at the shoulder.

CHICOREUS BURNSII Whitfield.

Murex shilohensis var. *burnsii* (Whitfield Ms.) DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 141, 1890.—WHITFIELD, Miocene Gastr. N. J., p. 98, pl. 17, fig. 2, 1894.

Oligocene of the Tertiary marls at Shiloh, New Jersey, Whitfield; Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 112065.

Genus PURPURA Martyn.

Purpura MARTYN, Univ. Conch., vol. 2, table, pl. 66, fig. 1, 1784. Sole example, *Purpura foliata* Martyn.

Cerostoma CONRAD, 1837, not of Latreille, 1802.

Pterorhytis CONRAD, Proc. Acad. Nat. Sci. Philadelphia for 1862, p. 560. Type, *Murex umbrifer* Conrad, Tert. Fos., 1832, p. 17, pl. 3, fig. 1.—DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 143, 1890.

Not *Purpura* LAMARCK, Prodrome, p. 71, 1799 (*P. persica* Linnaeus).

Purpura DALL, Proc. Biol. Soc. Wash., vol. 18, p. 189, 1905; Proc. U. S. N. Mus., vol. 29, p. 427, 1905; U. S. Geol. Survey, Prof. Paper 59, p. 45, 1909.

I have fully demonstrated in the publications above referred to the necessity of returning to the usage of the ancients who applied the name *Purpura* especially to certain purpuriferous muricoid shells, a practice Lamarck was the first to violate.

The typical *Purpura* has a small projecting spur or tooth, projecting from the anterior part of the outer lip, and most of the species are shore or shallow-water denizens. But there is a very closely allied group which lives in deeper water and is without the tooth, and has as a rule more delicate shells. For these out of a host of synonyms I selected in 1889, the name *Pteropurpura* Jousseaume.

Subgenus **PTEROPURPURA** Jousseaume.

Pteropurpura Jousseaume, Rev. de Zool. for 1879 (1880). Type, *Murex macropterus* Deshayes.—Fischer, Man. de conchyl., p. 641, 1884.—Dall, Trans. Wagner Inst., vol. 3, pt. 2, 1892, p. 242; pt. 5, 1900, p. 1199.

PURPURA (PTEROPURPURA) POSTI Dall.

Plate 7, fig. 9.

Pteropurpura posti Dall, Proc. U. S. Nat. Mus., vol. 18, p. 44, 1895; Trans. Wagner Inst., vol. 3, pt. 5, p. 1199, pl. 43, fig. 7, 1900.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; two specimens, E. J. Post. U. S. Nat. Mus., No. 130349.

The young specimens have an intercalary axial rib between the varices which might be taken for a varix in a hasty examination.

Genus **MURICIDEA** (Swainson) Mörch.

Muricidea (part) Swainson, Mal., pp. 67, 296, 1840.—Mörch, Yoldi Cat., p. 95, 1852. First species, *Murex hexagona* Lamarck.

Swainson's original group was heterogeneous, *Muricopsis* Bucquoy, Dautzenberg, and Dollfus, 1882, is synonymous.

MURICIDEA HEILPRINI Cossmann.

Plate 7, fig. 4.

Murex spinulosa Heilprin, Trans. Wagner Inst., vol. 1, p. 108, pl. 15, fig. 41, 1887; not of Deshayes.

Muricidea spinulosa Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 149, pl. 8, fig. 9, 1890.

Muricidea heilprini Cossmann, Essais Pal., vol. 5, p. 34, Dec., 1903.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Heilprin, Post. U. S. Nat. Mus. No. 165089.

MURICIDEA, sp. indet.

Muricidea (sp. ind.) Dall, Trans. Wagner Inst., vol. 3, p. 149, 1890. (Cf. *M. cristata* Brocchi).

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Burns.

This is evidently a *Muricidea* but too imperfect to determine specifically.

Genus TRITONALIA Fleming.

Tritonalia Fleming, Hist. Brit. Anim., p. 167, 1828, in corrigenda. Type, *Murex erinaceus* Linnaeus.

Ocenebra (Leach Ms.) Gray, Ann. Mag. Nat. Hist., vol. 20, 1847, p. 269; Proc. Zool. Soc. London, 1847, p. 133, No. 10.

Ocinebra H. and A. Adams, Gen. Rec. Moll., vol. 1, 1853, p. 74.—Fischer, Man. de Conchyl., 1883, p. 642. Same type.

TRITONALIA SCABROSA, new species.

Plate 5, fig. 15.

Shell small, elevated, scabrous, of about 5 whorls beside the (decollate) nucleus; suture appressed, indistinct, flexuous; spire rather acute; axial sculpture of 7 rather stout rounded ribs extending from suture to canal, and of numerous more or less minutely scaly incremental lines covering the surface; spiral sculpture on the spire of 2 prominent duplex threads, slightly swollen where they cross the ribs and more or less minutely imbricate; on the body of the last whorl 5, and on the canal 3 similar spirals tending to become more or less spinose or bluntly pointed on the ribs at the shoulder; between these are numerous finer imbricate threads with wider interspaces; the whorl slopes to the shoulder from the suture; aperture with the outer lip thickened and crenulated by the spiral sculpture, internally with 5 short rather distant denticles; body and pillar with a thin wash of callus, the spiral sculpture on the canal under the enamel is perceptible; canal open, short, recurved. Height 22, height of aperture and canal 12.5, maximum diameter 12 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus., No. 166101.

This might almost equally well be referred to *Muricidea*, but it has the surface of *Tritonalia*.

Genus TYPHIS Montfort.

Typhis Montfort, Conch. Syst., vol. 1, p. 615, 1810. Type, *Murex tubifer* Roissy.—Dall, Bull. Mus. Comp. Zool., vol. 18, 1889, p. 214.

TYPHIS SIPHONIFERA, new species.

Plate 13, fig. 9.

Shell small, short, stout-conic, of four whorls, of which the first is smooth and rounded, the others, rapidly enlarging, smooth, angulated by four varices, about midway between which, on a subangular shoulder of the whorl, intervene stout tubes slightly backwardly and apically directed, entire and with subcircular orifices, one tube being situated in each interspace; suture distinct, deep, the whorl in front of it to the shoulder subtabulate, the shoulder rounded

carinate, the whorl in front rapidly, flattishly attenuated; varices thin, recurved, between the shoulder and the canal with eight or nine crenulations, between which and the margin of the aperture the front of the varix is somewhat convex and smooth; aperture rounded-ovate, with an entire thin, projecting free margin; canal closed, short, stout, wide, slightly curved to the right and backward; siphonal fasciole with three projecting imbrications; the umbilical region deeply grooved, but not perforate. Length of shell 10.5, of last whorl 8, of the aperture 2.7, maximum diameter 6.5 mm.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida.

One specimen in the Post collection, U. S. Nat. Mus. No. 165090.

Genus CORALLIOPHILA Adams.

Coralliophila H. and A. ADAMS, Gen. Rec. Moll, vol. 1, p. 135, Sept. 1853. No type mentioned; *Pyrula neritoidea* Lamarck, selected by Tryon.

CORALLIOPHILA MAGNA Dall.

Plate 7, fig. 7; plate 10, fig. 6.

Coralliophila magna DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 155, pl. 11, figs. 11, 12, 1890.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; rather common, and reaching an unusual size for the genus. U. S. Nat. Mus. No. 165091.

Genus RAPANA Schumacher.

Rapana SCHUMACHER, Essai, p. 214, 1817. Type, *Pyrula bezoar* Lamarck.

RAPANA TAMPAËNSIS Dall.

Plate 13, fig. 8.

Rapana tampaënsis DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 153, 1890; pt. 2, p. 244, pl. 20, fig. 14 (var.?), 1892.

Ecphora quadricostata var. MARTIN, Pal. Maryland, Miocene, 1904, p. 211, Not of Say, Journ. Acad. Nat. Sci., Phila., vol. 4, p. 127, Nov. 1824 (as *Fusus*).

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall and Post. U. S. Nat. Mus. No. 165096.

The reception of several perfectly preserved specimens enables me to give a satisfactory figure of this pretty little species. The form figured on plate 20 of the Wagner Memoir as a possible variety, from Church Hill, Maryland,[1] is probably a different species, which might be called *Rapana ecclesiastica*. The reference to *Ecphora* is mitigated by the imperfect condition of my original specimens.

[1] Martin, Paleontology Maryland, 1904, pl. 52, fig. 9.

There is more or less variation in the amplitude of the umbilicus. *Ecphora quadricostata* is unknown from the Oligocene.

RAPANA BICONICA, new species.

Plate 13, fig. 10.

Shell heavy, solid, biconic, of 5 or 6 whorls (the nucleus defective in the specimen); spire less than half as long as the aperture, short conic with flattish slopes; suture distinct, on the early whorls a little undulated as if by obsolete ribs; axial sculpture chiefly of rather prominent incremental lines, which give a rough feel to the surface; spiral sculpture of a well-marked carina at the periphery and between the sutures about 10 revolving threads, of which the anterior half are rather smaller than the others; in front of the periphery of the last whorl are 4 more flattened cords separated by narrow grooves and mostly with a smaller groove dividing the flattened surface of the cord; in front of these are 10 or 12 wider straplike revolving ridges, of which the surface is divided usually by two smaller grooves and which extend to the canal; aperture subquadrate; outer lip thin, sharp, crenulate by the spiral sculpture; body with the sculpture erased; pillar smooth, slightly twisted; siphonal fasciole strong with a deep chink between it and the anteriorly reflected pillar; canal wide, rather long, and a little recurved. Height of shell 51, of aperture 32, maximum diameter of shell 25 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. E. J. Post, U. S. Nat. Mus., No. 165092.

Family EULIMIDAE.

Genus MELANELLA Bowdich.

Melanella Bowdich, Elem. Conch., vol. 1, p. 27, 1822, type, *M. dufresnii* Bowdich, Elem. Conch., vol. 1, pl. 6, fig. 17.—Dall, Rep. *Blake* Gastr. Bull. Mus. Comp. Zool., vol. 18, p. 326, June, 1889.—Fischer, Journ. de Conchyl., vol. 25, 1887, p. 197. Not *Melanella* Bory St. Vincent, 1824, Swainson, 1840, or Morch 1852.

Eulima Risso, Hist. Nat. Eur. Mér., vol. 4, 1826, p. 123; first species, *E. elegantissima* Risso (=*Turbo politus* Gmelin, fide Jeffreys); only figured species *E. subulata* Brocchi, 1814, which is a fossil extremely close to *Turbo subulata* Donovan, 1804.

Balcis (Leach MS. 1819) Gray, Ann. Mag. Nat. Hist., vol. 20, 1847, p. 271. First species, *Helix polita* Montagu (as *B. montagui* Leach); Proc. Zool. Soc. London, 1847, p. 160, example named by Gray, "*Helix subulata.*"

Leiostraca H. and A. Adams, Gen. Rec. Moll., vol. 1, 1853, p. 237. Type, *L. metcalfei* A. Adams. Gen. Rec. Moll., vol. 3, pl. 25, fig. 3*a*. Not *Leiostracus* Albers, 1850, nor *Liostracus* Martens, 1860.

Vitreolina MONTEROSATO, Nom. Conch. Medit., 1884, p. 100. Type, *E. distorta* Jeffreys, not Deshayes. (Section of *Eulima*.)

Acicularia MONTEROSATO, Nom. Conch. Medit., 1884, p. 102. Type, *Eulima beryllina* Monterosato. (Section of *Eulima*.) Not *Acicularia* Adams, 1875.

Subularia MONTEROSATO, Nom. Conch. Medit., 1884, p. 103. New name for *Liostraca* H. and A. Adams.

Halicilla MONTEROSATO, Bol. Malac. Ital., 1880, p. 74. Type, *Eulima stenostoma* Jeffreys. Not *Halicilla* Ulrich, 1891.

Melanella and *Eulima* DALL, Bull. Mus. Comp. Zool., vol. 18, 1889, p. 326.

Melanella proposed by Bowdich four years earlier than *Eulima* should, as pointed out by Fischer in 1887, be accepted as the generic name of this genus as originally conceived. However, in dividing the genus into groups, it is still possible to retain the familiar name of *Eulima*, as indicated by me. The researches of my colleague, Dr. Paul Bartsch, have shown that the groups in this genus are difficult to separate sharply by the shell; the absence of characters except of the most simple kind is, one may say, characteristic of the shells of the genus.

The anatomical relations are hardly more satisfactory. Since these animals are found even at great depths, as well as between tides, and comprise both free-living species and those which are commensal or even truly parasitic, they are subject especially to the direct action of the environment, including degenerations due to disuse of organs.

Rosen has found *Eulima polita*, a large free species, to be possessed of a radula "mit zahlreichen Zahnen." This species also has eyes situated behind the tentacles, and a well developed operculum. *Eulima distorta*, however, a parasitic species, is without a radula, living on the juices of its host. The former is opaque and (for the genus) heavy; the latter, as its situs requires, is smaller, pellucid, and thin. It is well known that deep-sea shells lose weight and color, and frequently their optical organs; *Eulima stenostoma* Jeffreys lives in 75 to 410 fathoms, and has the aspect of shallow-water species, which bear color markings. It is, however, colorless and blind. The peculiar tortuosity of the spire characteristic of typical *Melanella* is found in all degrees of emphasis, some specimens of the same species being absolutely straight axially and others more or less tortuous, contrary to the opinion I had formed from insufficient material in 1889. It is, therefore, evident that this character can not be used to divide groups. The acuteness of the apex varies in different species, and the position of the varices, with relation to each other, in the same species is not constant; nor, Doctor Bartsch assures me, does the presence of internal projections due to the

varices (a character used by Monterosato) preserve constancy. It is, therefore, evidently a difficult task to divide the genus naturally.

Risso named no type, but the only species figured by him belongs to the group afterwards called *Leiostraca* by H. and A. Adams. *Melanella* Bowdich is monotypical; the species named by him *M. dufresnii* is supposed to be that later called *Eulima major* Sowerby. *Eulima polita* Risso's first species is a *Melanella*, and a type must therefore be selected from among the others, and his figured species *E. subulata* Brocchi (and probably also of Donovan, 1804) is the most appropriate.

A tentative arrangement follows:

Genus MELANELLA Bowdich, 1822.

Type of the genus—Melanella dufresnii Bowdich.

Shell white or colorless, usually solid, free living, with an ovoid operculum with a small, partly spiral nucleus, the aperture holostomate when adult, the whorls nearly or quite flat-sided, the suture, appressed, the pillar and peristome simple and slightly thickened. Animal with slender tentacles, the eyes sessile behind or slightly outside the tentacular bases, with no epipodial lobes; a radula present; the anterior margin of the foot double and squarely truncate; the sexes separated. The parasitic and commensal species often with certain organs degenerate, absent, or specially modified to suit their mode of life.

Subgenus MELANELLA sensu strictu.

Characters as above stated, *Balcis* Gray, *Vitreolina* Monterosato, and *Acicularia* Monterosato (1884, not *Acicularia* Adams, 1875) are synonymous.

Subgenus EULIMA Risso, 1826.

Type.—Turbo subulata Brocchi.

Shell usually with colored bands or streaks, thin pellucid, straight, the whorls axially wider than in *Melanella*, acute, slender, the pillar straight, the outer lip sharp, simple, the aperture elongate oval. Animal and operculum much as in *Melanella*.

Leiostraca H. and A. Adams, 1853, in part; *Subularia* Monterosato, 1884, in part; and *Eulima* (sp.) of Authors, are synonymous.

Section HALIELLA Monterosato, 1880.

Type.—Eulima stenostoma Jeffreys.

Shell resembling *Eulima* s. s. (in the typical species colorless) but with the columella distinctly twisted. The animal in the typical species is blind.

Section SUBULARIA Monterosato, 1884.

Type.—Leiostraca metcalfei A. Adams.

Shell short spired, with color markings, pellucid, markedly compressed, with the varices continuous on each side, as in *Bursa*, the spire hardly acute and the last whorl larger in proportion than in typical *Eulima*.

This is the type of Adams's genus and so far the only species known of it. *Hoplopteron* Fischer may present an extreme development of this compression and lateral expansion. *Iopsis* Gabb, from an examination of the type, proves to be an immature smooth *Rissoina*, although it has been referred to the Eulimidæ.

There is a number of named groups which have been associated with this family, but of which I have been unable to study authentic specimens and therefore can not attempt to express an opinion about them. Doctor Bartsch has observed that there is a certain number of species of Melanella which, when immature, have a marked keel at the periphery of the last whorl, and even show some traces of angulation on the last whorl of the adult. This verges by almost imperceptible gradations into the evenly rounded species, and, while as a group it is perceptible, can hardly rank higher than a section, if, indeed, worthy of a name at all. *Subeulima* Souverbie may have been proposed for the most conspicuous development of this feature, if it is not the tip of a Vermetid.

MELANELLA CONOIDEA Kurtz and Stimpson.

Plate 3, fig. 13.

Eulima conoidea KURTZ and STIMPSON, Proc. Boston Soc. Nat. Hist., vol. 4, p. 115, 1851.—KURTZ, Cat. South Carolina Mar. Sh., p. 8. 1860.—DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 159, pl. 5, fig. 11, 1899.

Odostomia alba CALKINS, Davenport Acad. Sci., 1878, p. 239, pl. 8, fig. 3 (from type).

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, Florida. Pliocene of South Carolina and southern Florida; Pleistocene of the Carolinas; living from North Carolina to the Florida Keys, in shallow water. U. S. Nat. Mus. No. 112191.

EULIMA BOWDICHI, new species.

Plate 12, fig. 14.

Shell small, smooth, conic, with $5\frac{1}{2}$ remaining and probably 7 or more original whorls; suture not strongly marked; the only sculpture consists of a few axial impressed lines indicating resting stages which are probably more or less variable in number and position;

whorls slightly convex; aperture sublunate; outer lip protractively arcuate, passing insensibly into the columellar lip, which is thickened, prominent, and with a slight depression behind it. Length of 5½ decollate whorls 7.5, of last whorl 4, maximum diameter 3 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. One specimen from the Post collection, U. S. Nat. Mus. No. 165093.

Family PYRAMIDELLIDAE.

Genus PYRAMIDELLA Lamarck.

Pyramidella LAMARCK, Prodrome, p. 76, 1799. Monotype, *Trochus dolabratus* Linnaeus.

Obeliscus ANONYMOUS, Mus. Calonnianum, p. 24, 1797. First species, *Voluta dolabrata* Solander, manuscript.

Obeliscus is proposed in an anonymous work which is rejected as an authority for nomenclature by the International Commission on Nomenclature, there is no diagnosis or figure, and the two species mentioned are manuscript names. We need not therefore concern ourselves with the name *Obeliscus* in any event.

Subgenus LONGCHAEUS Mörch.

Longchæus MÖRCH, Malak. Blatt, vol. 20, 1875, p. 158. Type, *Pyramidella punctata* Schubert and Wagner.—DALL and BARTSCH, Mon. W. Amer. Pyr., Bull. U. S. Nat. Mus., No. 68, p. 21, 1909.

PYRAMIDELLA (LONGCHAEUS) CRENULATA Holmes.

Plate 13, fig. 4.

Obeliscus crenulatus HOLMES, Post. Plioc. fos. S. Car., p. 88, pl. 13, figs. 14, 14ª, 1860.

Jacksonian Eocene to Recent. Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 165164.

This species appears without perceptible change in different horizons from that of the Jackson up to the Pleistocene and is found living in moderate depths of water from the West Indies northward to South Carolina.

Genus TURBONILLA Risso.

Turbonilla RISSO, Hist. Nat. Eur. Mer., vol. 4, 1826, p. 224. Type, *Turbonilla plicata* Risso, 1826 (not Brocchi, 1814). *T. typica* Dall and Bartsch, Bull. U. S. Nat. Mus. No. 68, pp. 28, 29, 1909.

Subgenus PTYCHEULIMELLA Sacco.

Ptycheulimella SACCO, Moll. Piem. e. della Liguria, pt. 11, 1892, p. 59. Type, *Tornatella pyramidata* Deshayes.

TURBONILLA (PTYCHEULIMELLA) ETHELLINA, new species.

Plate 12, fig. 20.

Shell minute, slender, smooth, with 6 or more whorls (apex decollate) regularly increasing; whorls of the spire flattened with the suture wound a little in front of the periphery, giving a beveled aspect to the anterior edge of the whorl; base rounded, imperforate; aperture rounded-quadrate; pillar thin, straight (plicate?); outer lip rather straight, thin, entire; anterior margin rounded. Height of last five whorls 3.5 mm., maximum diameter of last whorl 1 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. One specimen in the Post collection, U. S. Nat. Mus. No. 165094.

Under the microscope faint indications of axial ribs appear. The aperture is filled with matrix, obscuring the plait if any exists.

Genus ODOSTOMIA Fleming.

ODOSTOMIA (MENESTHO) IMPRESSA Say.

Odostomia (Menestho) impressa (Say) Bartsch, Proc. Boston Soc. Nat. History, vol. 34, p. 103, pl. 13, fig. 51, 1909.

Tampa silex beds, one specimen; E. J. Post. U. S. Nat. Mus., No. 214739.

Though not quite mature this specimen seems to differ in no respect from the recent shell.

Family CYPRAEDAE.

Genus CYPRAEA Linnaeus.

Cypraea Linnaeus, Syst. Nat., ed. 10, p. 718, 1758.

CYPRAEA TUMULUS Heilprin.

Plate 3, figs. 1, 12.

Cypraea tumulus Heilprin, Trans. Wagner Inst., vol. 1, p. 111, pl. 16, figs. 49, 49[a], 1887.

Cypraea pinguis Conrad, in Wailes' Geol. Miss., p. 289, pl. 17, figs. 3[a], 3[b], 1854; Proc. Acad. Nat. Sci. Phila., vol. 7, p. 262, 1855; not of Bonelli, 1827.

Cypraea ventripotens Cossmann, Essais Pal., vol. 5, p. 161, 1903.

Jacksonian Eocene of Creole Bluff, Grant Parish, Louisiana (L. C. Johnson); Jackson, Mississippi (Wailes); Oligocene of White Beach, Little Sarasota Bay, and of the Tampa silex beds at Ballast Point, Tampa Bay, Florida. Its presence in the Miocene of North Carolina is very doubtful.

M. Cossmann proposed a new name for Conrad's species which was preoccupied by Bonelli, but Heilprin's name has sixteen years' priority. No name should be substituted for a preoccupied name without a previous examination of the history of the species to see if there is not already an available synonym.

CYPRAEA HEILPRINII Dall.

Plate 3, figs. 2, 14.

Cypraea heilprinii DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 166, pl. 11, figs. 2, 2a, 1890.

Oligocene (Nummulitic) of Ocala, Florida, and at Ballast Point in the silex beds and overlying "orbitolite bed," Tampa Bay, Florida. U. S. Nat. Mus. No. 112073.

CYPRAEA BALLISTA, new species.

Plate 6, figs. 9, 10, 11.

Shell small, pyriform, with a slight dimple over the spire, the sides of the base somewhat expanded by callus; aperture rather wide flexuous, with (on the right side 25 and on the opposite side about 20) sharp-edged lirae or denticulations, which do not extend over the base, but on the left side pass deeply into the aperture; these are separated by interspaces of greater width which on the right side are somewhat excavated, on the left side rather less so; posterior sinus curved upward, anterior sinus direct. Length 27, maximum width 19, height 16 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 165098.

This form is more attenuated behind and has a flatter base, wider aperture behind, less adjacent teeth, and the anterior sinus less recurved and smaller than in *C. heilprinii*. *C. tumulus* has the teeth closer together, the base not expanded, and the aperture less flexuous. It is also consistently smaller than *C. ballista*.

Family CASSIDIDAE.

Genus MORUM Bolten.

Morum BOLTEN, Mus. Bolt., p. 53, 1798. Sole example, *Strombus oniscus* Gmelin.—DALL, Prof. Paper No. 59, U. S. Geol. Survey, p. 67, 1909.

Section HERCULEA Hanley.

Herculea HANLEY, in H. and A. Adams, Gen. Rec. Moll., vol. 2, p. 621, Nov., 1858.—DALL, Prof. paper No. 59, U. S. Geol. Survey, p. 68, 1909.

MORUM DOMINGENSE Sowerby.

Plate 12, fig. 28.

Oniscia domingensis SOWERBY, Quart. Journ. Geol. Soc., London, vol. 6, pt. 1, 1849, p. 47, pl. 10, fig. 3 (Santo Domingo).—HEILPRIN, Trans. Wagner Inst., vol. 1, p. 120, 1886.

Morum domingense GABB, Trans. Amer. Philos. Soc., vol. 15, p. 223, 1873.

Lambidium domingense DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1567, 1903.

Morum (*Herculea*) *domingense* DALL, Prof. paper, No. 59, U. S. Geol. Survey, p. 69, 1909.

Oligocene of St. Domingo and Panama. Tampa silex beds at Ballast Point, Tampa Bay, Florida, U. S. Nat. Mus. No. 165095.

This species has the cancellate structure of *Oniscidia* and a deep recurved sulcus at the posterior end of the aperture. Its recent analogue appears to be *M. dennisoni* Reeve, of the lesser Antilles.

Family STROMBIDAE.

Genus ORTHAULAX Gabb.

Orthaulax GABB, Proc. Acad. Nat. Sci. Phila., vol. 24, p. 272, pl. 9, figs. 3, 4, 1872; Geol. St. Domingo, p. 274, 1873.—GUPPY, Quart. Journ. Geol. Soc. London, Nov. 1876, p. 520, pl. 28, fig. 8.—TRYON, Manual, vol. 2, p. 192, 1883.—DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 169, 1890.

Hippochrenes (part) ZITTEL, Tr. de. Paleont., vol. 2, p. 258, 1887.

Wagneria HEILPRIN, Trans. Wagner Inst., vol. 1, p. 105, pl. 15, figs. 36, 36*a*, 1887.

This genus is the most characteristic and typical of those belonging to the Middle Oligocene of our southern coastal plain and the Antilles, including Middle America. It does not appear in the Vicksburgian fauna or the Nummulitic Ocala beds of Florida; it seems to have become extinct before the development of the Oak Grove, Florida, fauna. So far it has been recognized in the Middle Oligocene of Santo Domingo, Cuba, Antigua, the Canal Zone of Panama, the Tampa silex beds, the Oligocene of Bainbridge, Georgia, and the lower bed at Alum Bluff, with its stratigraphically equivalent marl of the Chipola River, Florida. It is not known from the Bowden beds of Jamaica, which are doubtless younger than the Haitian Oligocene explored by Gabb, if indeed the latter be not divisible into several distinct horizons.

But the range in time appears so narrow and the genus so sharply characterized that, according to our present knowledge, the discovery of a species of *Orthaulax* in a Tertiary fauna may be taken as positive proof of its Middle Oligocene age.

The type of the genus is *O. inornatus* of Gabb, of which only immature specimens have been figured as above noted; a figure of the upper part of a mature individual is given herewith. No fully complete specimen has yet been collected of this species, but the form of either of the two other Florida species is well known, and they may be discriminated without the slightest difficulty.

ORTHAULAX INORNATUS Gabb.

Plate 11, fig. 4.

Orthaulax inornatus GABB, Proc. Acad. Nat. Sci. Phila., vol. 24, p. 272, pl. 9, figs. 3, 4, 1872.—GUPPY, Quart. Journ. Geol. Soc. London, Nov. 1876, p. 520, pl. 28, fig. 8.

Oligocene of Santo Domingo, Gabb (under the old appellation of "Miocene"); of the limestone at White Beach, Florida; and of

the Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 165099.

This is the typical species of the genus, distinguished by its long-ovate, elevated form, of which immature specimens have been figured by Gabb and Guppy.

ORTHAULAX PUGNAX Heilprin.

Plate 15, figs. 5, 10.

Wagneria pugnax HEILPRIN, Trans. Wagner Inst., vol. 1, p. 106, pl. 15, figs. 36, 36*a*, 1887.

Orthaulax pugnax DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 170, pl. 8, figs. 5, 8, 1890.

Middle Oligocene of the Tampa silex beds, at Ballast Point, Tampa Bay, Florida, Heilprin and Dall; also at Bainbridge, Georgia, the islands of Antigua and Cuba, and in the Canal Zone, Panama, MacDonald. U. S. Nat. Mus. No. 165100.

This is the commoner species of the silex beds, though usually badly broken, and can be discriminated from the other two Floridian species by its short, stout, and remarkably heavy shell. So far as yet known, it also has the widest geographical range.

ORTHAULAX GABBI Dall.

Orthaulax gabbi DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 170, pl. 12, figs. 5, 5*a*, 5*b*, 1890.

Oligocene marl of the lower bed at Alum Bluff and the adjacent marl of the Chipola River, Florida. Burns and Dall.

I have included a reference to this species, though it is not known yet from the silex beds, for the sake of completeness and because it may at any time turn up in other Middle Oligocene beds. It is more strombiform than either of the other species and has been well figured. The species occur in large numbers at Alum Bluff, but the expanded outer lip is almost invariably defective.

Genus STROMBUS (Linnaeus) Lamarck.

Strombus LINNAEUS, Syst. Nat., ed. 10, p. 742, 1758.

Strombus LAMARCK, Prodrome, p. 72, 1799. Sole example, *S. pugilis* Linnaeus.

STROMBUS CHIPOLANUS Dall.

Plate 9, figs. 8, 10.

Strombus chipolanus DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 176, pl. 4, fig. 1, 1890; pt. 2, p. 263, pl. 13, figs. 1, 3, 1892.

Oligocene marls of the Chipola River, West Florida, and Tampa silex beds, Ballast Point, Tampa Bay, Florida. Dall and Burns. U. S. Nat. Mus. No. 112227.

This is a common species at Chipola, but so far only fragmentary at Ballast Point. The *S. albirupianus* Dall, from the White lime-

stone of Jacksonboro, Georgia, which was sent to me as Claibornian by the late Professor Whitfield has since been proved by Dr. T. Wayland Vaughan, of the United States Geological Survey, to be Oligocene in age.

STROMBUS LIOCYCLUS, new species.

Plate 13, figs. 6, 7.

Shell small for the genus, slender, with a rather narrowly attenuated spire, and 7 (or more) whorls; apex decollate in the specimen, having originally about two or three more turns than are preserved; whorls moderately convex and slightly shouldered; whole surface originally sculptured with minute, close-set, straight, axial threads; on the fourth whorl, counting backward from the aperture there are about 16 rounded riblets, which become obsolete toward the sutures and pass insensibly into the somewhate narrower interspaces; on the apical whorls, as in most species of this group of the genus, these riblets are narrower, closer and less prominent; and on the last half of the last whorl obsolete, there being about 7 on this whorl, mostly on the first half of it, the series in the type-specimen on this whorl being confined to the shoulder of the whorl; the upper whorls also show traces of faint, equal, revolving threads, three behind and six in front of the shoulder on the penultimate whorl; on the base of the last whorl there are also traces of half a dozen shallow rather distant spiral grooves, though the canal proper seems smooth; aperture narrow, produced and patulous behind; the outer lip straight, thickened, parallel with the inner lip, internally without lirae; ocular sulcus shallow, wide; canal short, wide, slightly recurved; inner lip smooth, somewhat callous. Length of shell 36.5, of last whorl 27.5, of aperture 24.5, maximum diameter 17.5 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. One specimen from the Post collection, U. S. Nat. Mus. No. 165101.

Superfamily CERITHIACEA.

Family CERITHIIDAE.

Genus BITTIUM Leach.

Bittium (Leach MS.) Gray, Proc. Zool. Soc., London, 1847, p. 154, No. 234. Sole example, *Murex reticulatus* Montagu.

BITTIUM PRISCUM Dall.

Plate 8, fig. 3.

Bittium (*Styliferina?*) *priscum* Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 189, 1890; pt. 2, p. 275, pl. 11, fig. 6, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Shepard, Dall, and Post. U. S. Nat. Mus. No. 165103.

BITTIUM (PRISCUM var.?) SORA, new variety.

A shell which may be a variety of *B. priscum* and is only represented by a single specimen has been received too late for figuring. It has 11 whorls and an acute apex; the whorls in front of the suture are excavated and plain; at the periphery there is one strong spiral thread separated by an interval from two closely adjacent threads in front of it, and in the later whorls a still stronger thread just behind the suture and on the last whorl marginating the base; the base is flattish, with four or five fine spiral threads, and the canal obsolete. The axial sculpture is of numerous obscure riblets which slightly undulate the spirals. Height 8.75; of last whorl 3.5; maximum diameter 3.0 mm.

Tampa silex beds, collected by E. J. Post, U. S. Nat. Mus., No. 214740.

BITTIUM ADELA, new species.

Plate 13, fig. 16.

Shell small, thin, with 8 rather rapidly increasing whorls; spire conic, apex acute; suture distinct, not channeled; axial sculpture of (on the penultimate whorl eleven) short nodular ribs, conspicuous on the periphery, obsolete toward the sutures; behind the periphery the whorl slopes flatly toward the preceding suture, the anterior slope is much shorter and terminates at a carina in front of which the next suture is laid; on this slope there is spiral sculpture of four or more fine close-set revolving threads; the posterior slope is similarly sculptured, and on the periphery there are indications of a slightly stronger but similar single thread; the sculpture is essentially the same over the whole spire; base of the shell limited by the post sutural carina before mentioned; flattish, sculptured with about nine revolving little elevated threads, with slightly wider interspaces; canal short, distinct; outer lip thin, defective, not internally lirate; aperture subquadrate. Length 8.5, maximum diameter 4.5 mm.

Tampa silex beds, Ballast Point, Tampa Bay, Florida. One specimen, possibly immature, from the Post collection, U. S. Nat. Mus. No. 165104.

Genus CERITHIUM Bruguière.

Cerithium (part) BRUGUIÈRE, Encycl. Méth., pt. 2, 1792, p. 467.—LAMARCK, Prodrome, 1799, p. 73. Type, *Murex aluco* Linnaeus.

Pseudovertagus VIGNAL, Bull. Mus. Nat. Hist. Paris, p. 358, 1904.

CERITHIUM GEORGIANUM Lyell and Sowerby.

Cerithium georgianum LYELL and SOWERBY, Quart. Journ. Geol. Soc. London, vol. 1, p. 439, fig. —, 1845.—DALL., Trans. Wagner Inst., vol. 3, pt. 2, p. 278, 1892.

Tampa silex beds Ballast Point, Tampa Bay, Florida; also in the rock dredged from the ship channel off the point, and from the Oli-

gocene limestone of Jacksonboro, Screven County, Georgia; Vaughan. U. S. Nat. Mus. No. 165105.

This species does not belong to the typical group of the genus, but in the present confused state of the nomenclature of Cerites I use the generic name in its widest sense.

CERITHIUM PRAECURSOR Heilprin.

Plate 5, fig. 5; plate 12, fig. 26.

Cerithium praecursor HEILPRIN, Trans. Wagner Inst., vol. 1, p. 114, pl. 16, fig. 58, 1887.—DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 285, 1892.

Shell small, thin, slender, with about 9 sculptured whorls, the nucleus defective; suture distinct; axial sculpture of (on the penultimate whorl 11) small rounded riblets, with wider interspaces, not continuous over the spire and slightly retractive, they practically become obsolete at the periphery; besides these the axial sculpture comprises only rather marked incremental lines and the usual varices at the beginning of the second half of the last whorl, and at the aperture; spiral sculpture of (on the spire 3 and on the last whorl 6) primary spiral threads with wider, nearly equal interspaces, the threads equal and slightly swollen where they cross the axial riblets; between these, in the interspaces, are two or three much finer equal threads (hardly apparent in the figure) equally spaced, and on the back of the canal 5 or 6 close-set coarser threads; aperture sublunate with a narrow sulcus between a subsutural nodule, and the outer lip behind; inner lip continuous, with a smooth free edge; outer lip smooth internally with a slight varical thickening behind; canal wide, very short, slightly recurved, with no sulcus at the base of the whorl behind it. Length 12 mm., maximum diameter 4.5 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Various collectors. U. S. Nat. Mus. Nos. 112523 and 165106.

This seems to have been an ancestor of such forms as *C. muscarum* Say. It has also been found in the shape of molds in the limestone of Wakulla County, northwest Florida, near Wakulla.

CERITHIUM, sp. indet.

Cerithium sp. indet, DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 285, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, and also in the Wakulla limestone, Florida. U. S. Nat. Mus. No. 113371.

The specimens were too imperfect for description but not identical with the preceding.

CERITHIUM PLECTRUM, new species.

Plate 9, fig. 3.

Shell small, solid, comprising about 5 whorls without the (decollate) nucleus which seems to have been smooth; spiral sculpture:

on the two succeeding whorls 1, on the next whorl 3, on the fourth whorl 4, and on the last whorl 8 spiral ridges, crossing about 16 axial ribs and slightly nodulous at the intersections, the interstitial reticulations looking like squarish pits; the whorls are slightly turreted by the sculpture and the suture very distinct; the aperture ovate, the outer lip thickened and outwardly denticulated by the ends of the spirals; a thick layer of callus on the body; the anterior sulcus distinct, the whorls under the sculpture well rounded; length of shell 5.2, of last whorl 3, maximum diameter 2.3 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. One specimen. U. S. Nat. Mus. No. 166105.

This species is nearest to *C. milium* Dall, of the Pleistocene and recent fauna at Colon, Panama.

Genus POTAMIDES Brongniart.

Potamides BRONGNIART, Ann. du Muséum, Paris, vol. 15, 1810, p. 368. Sole example, *P. lamarckii* Brongniart. Oligocene.

POTAMIDES HILLSBOROËNSIS Heilprin.

Plate 8, fig. 5.

Cerithium hillsboroënsis HEILPRIN, Trans. Wagner Inst., vol. 1, p. 124, pl. 8, fig. 67, 1887.

Potamides hillsboroënsis DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 286, pl. 15, fig. 12, 1892.

Tampa silex beds, Dall; also in the overlying Orbitolite bed or Tampa limestone at Ballast Point and on the Hillsboro river near Tampa Bay, and on the Chattahoochee River near the railway bridge at Chattahoochee, northwest Florida, and in the Wakulla county limestone; Burns and Willcox. U. S. Nat. Mus. No. 164700.

POTAMIDES (LAMPANELLA) TRANSECTA Dall.

Plate 14, fig. 3.

Potamides (Lampanella) transecta DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 189, pl. 11, fig. 7, 1890; pt. 2, p. 287, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, Florida, where it is not uncommon, Willcox, Burns, and Dall. U. S. Nat. Mus. No. 112525.

Subgenus PYRAZISINUS Heilprin.

Pyrazisinus HEILPRIN, Trans. Wagner Inst., vol. 1, p. 115, 1887.—DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 287, 1892.

Sole example and type *P. campanulatus* Heilprin.

POTAMIDES (PYRAZISINUS) CAMPANULATUS Heilprin.

Plate 13, figs. 15, 18.

Potamides (*Pyrazisinus*) *campanulatus* HEILPRIN, Trans. Wagner Inst., vol. 1, p. 115, pl. 16, fig. 59, 1887.—DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 288, pl. 11, figs. 10, 10*a*; pl. 15, figs. 2, 6, 10, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, very common, Wilcox, Shepard, Dall, and Burns; also in residual clay at Baileys Mill Creek sink, three-quarters of a mile northeast of Lloyds, Jefferson County, Florida; L. C. Johnson. U. S. Nat. Mus. No. 165108.

The species varies in size a good deal, at the adult stage, and also in the strength of the spiral sculpture, which is usually most pronounced in front of the suture. The varix is often very prominent but the transverse ribs are never as strong and square as in *P. scalatus* or *P. cornutus*.

POTAMIDES (PYRAZISINUS) CORNUTUS Heilprin.

Plate 8, fig. 1.

Cerithium cornutum HEILPRIN, Trans. Wagner Inst., vol. 1, p. 124, pl. 8, fig. 68, 1887.

Potamides (*Pyrazisinus*) *cornutus* DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 288, pl. 15, fig. 3, 1892.

Tampa silex beds at Ballast Point, Florida, very rare; also, as molds, in the overlying Orbitolite limestone near Tampa City, and in the limestone of the Pithlachascotee River, Willcox and Heilprin, and in Wakulla County, Florida, Burns.

This species was originally described from a pathologic specimen which had been injured and formed an irregular double mouth, the projecting lip of which suggested the specific name. This will be evident on an inspection of the figure. A somewhat analogous species *P. scalatus* Heilprin (as *Cerithidea*) occurs in the Florida Pliocene, and another in the Oligocene of Santo Domingo. The type is in the collection of the Philadelphia Academy of Natural Sciences.

POTAMIDES (PYRAZISINUS) ACUTUS Dall.

Potamides (*Pyrazisinus*) *acutus* DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 289, pl. 22, fig. 19, 1892.

Tampa limestone overlying the silex beds at Ballast Point, Tampa Bay, and along the Hillsboro River emptying into the Bay, Dall. Found in the form of molds from which a gutta percha cast was made.

I have included this reference because the relation of the limestone and the silex beds is so close that it may eventually prove to be found in both, like many other species. The species is shorter and more acute than either of the others, with a remarkably produced lip.

Family CERITHIOPSIDAE.

Genus CERITHIOPSIS Forbes and Hanley.

Cerithiopsis Forbes and Hanley, Brit. Moll., vol. 3, p. 364, 1853. Type, *Murex tubercularis* Montagu.

CERITHIOPSIS SILICATA, new species.

Plate 12, fig. 19.

Shell small with an acute apex, later becoming subcylindrical; nucleus lost, the next 2 or 3 whorls with 2 elevated spiral threads and no axial sculpture, followed by whorls with 3, gradually increasing to four straplike spirals over riding numerous axial stouter rounded ribs with equal interspaces extending nearly from suture to suture, and forming nearly square deep equal pits by their intersections; suture close, but the elevated spirals on each side of it give it a deeply channelled aspect; there are three spirals on the rather convex base diminishing in size forward, but only incremental axial sculpture; aperture defective, but without lirae; remaining whorls in all, 10. Height, 6.5; maximum diameter, 2 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall. U. S. Nat. Mus. No. 165.111.

Family TRICHOTROPIDAE.

Genus TRICHOTROPIS Broderip and Sowerby.

Trichotropis Broderip and Sowerby, Zool. Journ., vol. 4, 1826, p. 373. Type, *Turbo bicarinatus* Sowerby.

Subgenus CERITHIODERMA Conrad.

Cerithioderma Conrad, Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 4, p. 295, March, 1860.—Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 293, 1892.

TRICHOTROPIS (CERITHIODERMA) PRIMA Conrad.

Cerithioderma prima Conrad, Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 4, p. 295, pl. 47, fig. 30, 1860.—Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 293, 1892.

Mesostoma rugosa Heilprin, Proc. Acad. Nat. Sci. Phila., 1879, p. 215, pl. 13, fig. 13.—Meyer, Ber. Senckenb. Ges., 1887, p. 18.

Middle and upper Eocene of Claiborne, Mississippi, and Lisbon, Alabama. Oligocene of the Tampa silex beds? U. S. Nat. Mus. No. 113394.

The specimen from Ballast Point is in such poor condition that the identification of the species is doubtful.

Family MODULIDAE.

Genus MODULUS Gray.

Modulus Gray, Synopsis Brit. Mus., 1842, pp. 60, 90, (name only); Proc. Zool. Soc. London, for 1847, p. 150.—Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 293, 1892. Monotype, *Trochus modulus* Linnaeus.

Turbinopsis Conrad, Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 4, p. 289, March, 1860. Type, *T. hilgardi* Conrad, Cretaceous of Mississippi.

Pseudotrochus Heilprin, Trans. Wagner Inst., vol. 1, p. 114, 1887; not of Klein.

This genus has existed in America since the era of the Cretaceous, and it is somewhat remarkable that it has so few recent species as descendants.

MODULUS TURBINATUS Heilprin.

Plate 15, fig. 7.

Pseudotrochus turbinatus Heilprin, Trans. Wagner Inst., vol. 1, p. 114, pl. 16, fig. 57, 1887.

Modulus turbinatus Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 294, pl. 18, fig. 12, 1892.

Tampa silex beds at Ballast Point, Florida; Heilprin and Dall. U. S. Nat. Mus. No. 165110.

This is, perhaps, the finest and largest species of the genus.

Family LITTORINIDAE.

Genus LACUNA Turton.

Lacuna Turton, Zool. Journ., vol. 3, p. 190, Oct. 1827. Type, *Helix lacuna* Montagu.

Lutea Brown, Ill. Brit. Conch., Dec. 1827, expl. pl. 46, figs. 50–53; *Helix lutea* and *H. lacuna* Montagu.

Epheria Leach, Moll. Gt. Brit. 1852, p. 192, pl. 9, fig. 3; *Turbo vincta* Montagu?

Temina Leach, Moll. Gt. Brit. 1852, p. 182; fig'd sp. *Lacuna puteolus* Forbes and Hanley.

Medoria Leach, Moll. Gt. Brit. 1852, p. 196, *Turbo crassior* Walker, first species.

For *Lacuna* Turton named no type, but *Helix lacuna* Montagu would by the rules be taken as the homonym, and was so taken by Herrmannsen in 1847, though Gray, in the same year, suggested Turton's first species, *L. pallidula.*

LACUNA PRECURSOR, new species.

Plate 12, fig. 5.

Shell small, smooth, turbinate-conic, with about 4 well rounded whorls separated by a deep suture; apical whorl very small and flattened above, the others almost inflated, regularly increasing, with

no visible sculpture; base rounded to the angular margin of a narrow flatly excavated groove behind the inner lip; aperture ovate, retractively oblique, entire, the margin crossing the body with a band of callus; outer lip thin, entire; inner lip a little thickened behind, passing evenly into the outer lip in front. Height 5.75, maximum diameter 3.5 mm.

Tampa silex beds, Ballast Point, Tampa Bay, Florida.

One specimen in the Post collection, U. S. Nat. Mus. No. 165124.

Family CAECIDAE.

Genus CAECUM Fleming.

Caecum Fleming, Edinb. Encycl., vol. 7, p. 67, 1817. Fig'd species, *C. glabrum*, Edinb. Encycl., vol. 7, pl. 204, fig. 7.

Caecalium Fleming, Philos. Zool., 1822, *fide* Macgillivray, Moll. Aberdeen, pp. 25, 39, 1843.

Brochus Brown, Ill. Conch. Gt. Brit., ed. 1, 1827, expl. pl. 10.

CAECUM SOLITARIUM O. Meyer.

Caecum solitarium O. Meyer, Alabama Geol. Rep., p. 68, pl. 3, fig. 9, 1886.—Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 297, 1892.

Oligocene of Vicksburg, Mississippi (Meyer), and of Ballast Point, Tampa Bay, Florida, in the silex beds. U. S. Nat. Mus. No. 113396.

Family VERMETIDAE.

Genus SERPULORBIS Sasso.

Serpulorbis Sasso, Giorn. Ligustica, 1827, p. 482.—Bronn, Ital. Tertiärgeb., p. 65, 1831.

SERPULORBIS GRANIFERA Say.

Serpula granifera Say, Journ. Acad. Nat. Sci. Phila., ser. 1, vol. 4, p. 154, pl. 8, fig. 4, 1824.

Serpulorbis granifera Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 303, 1892.

Oligocene of Tampa silex beds at Ballast Point, Tampa Bay, Florida, and at White Beach, near Osprey, Florida, Dall; also at Martins Station, Hernando County, Florida, Willcox. Miocene of Maryland, Finch; and of City Point, Virginia, Haldeman. U. S. Nat. Mus. No. 165113.

SERPULORBIS BALLISTAE Dall.

Plate 14, fig. 4.

Serpulorbis (*granifera* var.?) *ballistae* Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 304, pl. 22, fig. 21, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, Florida, Willcox and Dall. U. S. Nat. Mus. No. 165114.

SERPULORBIS DECUSSATA Gmelin.

Serpula decussata GMELIN, Syst. Nat., vol. 13, p. 3745, 1792.
Vermetus decussatus (Morch) TRYON, Manual, vol. 8, p. 181, pl. 53, figs. 71, 72, 1886.
Serpulorbis decussata DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 304, 1892.

Oligocene of the Tampa silex beds, at Ballast Point, Dall, and of Santo Domingo, Gabb. Pliocene of the Caloosahatchie and Shell Creek, Florida, Dall and Willcox. Pleistocene of Simmons Bluff, South Carolina, Burns. Living from North Carolina to the Antilles in 22 fathoms or less, United States Fish Commission.

Genus PETALOCONCHUS Lea.

Petaloconchus LEA, Trans. Amer. Philos. Soc., ser. 2, vol. 9, p. 233, 1845. Type, *P. sculpturatus* Lea, Trans. Amer. Philos. Soc., ser. 2, vol. 9, pl. 34, fig. 3.

PETALOCONCHUS VARIANS Orbigny.

Vermetus varians ORBIGNY, Voy. Am. Mer. Moll., p. 456, pl. 54, figs. 7–10, 1843.
Vermetus (*Petaloconchus*) *varians* DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 305, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Pliocene of the Waccamaw beds of North Carolina and of the Caloosahatchie and Shell Creek, Florida, Willcox. Pleistocene of the Florida Keys, and living from southwest Florida, south to Rio Janeiro; Orbigny. U. S. Nat. Mus. No. 165716.

Another species of *Petaloconchus* appears to exist in the silex beds, but the specimens so far obtained are insufficient for its identification.

Genus VERMICULARIA Lamarck.

Vermicularia LAMARCK, Prodrome, p. 78, 1799. Monotype, *Serpula lumbricalis* Linnaeus.
Vermetus DAUDIN, Recueil de Mémoires, 1800, p. 34, same type.

VERMICULARIA (ANGUINELLA) VIRGINICA Conrad.

Serpula virginica CONRAD, Foss. Medial Tert., page 3 of cover to part of the editions of parts 1 and 2, April 16, 1839.
Vermetus virginica (Conrad) ORBIGNY, Prodr. Pal., vol. 3, p. 48.
Anguinella virginica CONRAD, Medial Tert., p. 77, pl. 44, fig. 41, 1845; Proc. Acad. Nat. Sci. Phila., for 1863, p. 568.—DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 306, 1892.
Vermetus anguina TUOMEY and HOLMES Pleioc. Foss. S. Car., p. 123, pl. 26, fig. 12, 1857; not of Lea.

Oligocene of Shiloh, New Jersey, and of White Beach, near Osprey, Florida, Dall. Miocene of Virginia, Conrad, and of the Pedee River, South Carolina, Tuomey and Holmes.

Genus SILIQUARIA Lamarck.

Siliquaria LAMARCK, Prodrome, 1799, p. 73. Type, *Serpula anguina* Linnaeus.

SILIQUARIA VITIS Conrad.

Siliquaria vitis CONRAD, Foss. Tert. Form., ed. 1, pt. 3, p. 36, Aug., 1833; ed. 3, p. 47, pl. 17, fig. 3, 1845.—DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 307, 1892.

Tenagoda vitis CONRAD, Amer. Journ. Conch., vol. 1, p. 33, 1865.

Eocene of the Claiborne sands. Oligocene of the Tampa silex beds, Ballast Point, Florida, Dall. U. S. Nat. Mus. No. 165112.

Family TURRITELLIDAE.

Genus TURRITELLA Lamarck.

Turritella LAMARCK, Prodrome, p. 74, 1799. Sole example, *T. terebra* Linnaeus.

Terebra (ANONYMOUS) Mus. Calonnianum, 1797, not of Bruguière

Aculea PERRY, Conch., 1811.

Turritellus MONTFORT, 1810

Epitonium No. 2, BOLTEN, Mus. Boltenianum, p. 92, 1798.

TURRITELLA TAMPAE Heilprin.

Plate 14, fig. 1.

Turritella tampae HEILPRIN, Trans. Wagner Inst., vol. 1, p. 113, pl. 8, fig. 53, 1887.—DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 309, pl. 17, fig. 8, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, Florida, Willcox Shepard, and Dall. U. S. Nat. Mus. No. 165119.

The almost microscopic spiral threads with which the entire surface is covered are not attempted to be shown on the figure given.

TURRITELLA TAMPAE var. TRIPARTITA Dall.

Plate 5, fig. 1.

Turritella tampae var. *tripartita* DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 309, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, Florida, Dall. U. S. Nat. Mus. No. 112588.

This variety has the equatorial constriction marginate on both sides by a primary cord, with one marginating the suture behind; the other primaries obsolete, the fine spiral striation remaining. The surface of the whorl is thus divided into three equal striated bands, separated by two prominent threads.

Two specimens of this variety were found among the numerous *Turritellae* collected from the Ballast Point beds.

TURRITELLA (TAMPAE var.?) MEDIOCONSTRICA, new species.

Plate 13, fig. 3.

Shell slender, acute, with age showing a tendency to loose coiling of the whorls, which are then constricted in the middle; number of the whorls in the figured specimen 16, the nucleus lost, the subsequent whorls rounding to the suture, with two low spiral keels, each about one-fourth of the axial width of the whorl, from the most adjacent suture; between these the whorl is excavated and shows at first one (the number gradually increasing to five on the last whorl) small rounded closely adjacent spiral threads, separated only by a narrower groove; aperture with a wide rounded excavation of the outer lip, the deepest part of which is slightly above the middle of the whorl; the basal portion of the lip is also moderately excavated, and between the two the portion at the anterior keel of the whorl projects most prominently, though distally rounded off. Length of shell 59, axial length of last whorl 11, maximum diameter 15 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida, E. J. Post. U. S. Nat. Mus. No. 165122.

TURRITELLA TAMPAE var. PAGODAEFORMIS Heilprin.

Plate 14, fig. 8.

Turritella pagodaeformis Heilprin, Trans. Wagner Inst., vol. 1, p. 112, pl. 8, fig. 52, 1887.

Turritella tampae var. *pagodaeformis* Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 310, pl. 17, fig. 9, 1892.

Tampa silex beds, Heilprin, Willcox, Dall, and Burns. U. S. Nat. Mus. No. 112595.

The specific distinctness of this form from *T. tampae* is rendered doubtful by better specimens than were available to Professor Heilprin.

TURRITELLA MEGALOBASIS Dall.

Plate 14, fig. 6.

Turritella megalobasis Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 310, pl. 17, fig. 11, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall. U. S. Nat. Mus. No. 165120.

This seems to be a rare species, and no more material has come to hand.

TURRITELLA CHIPOLANA Dall.

Turritella chipolana Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 312, pl. 22, fig. 24, 1892.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, and of the Chipola marls, on the Chipola River, northwest Florida. U. S. Nat. Mus. No. 165121.

TURRITELLA SYSTOLIATA, new species.

Plate 9, fig. 6.

Shell large, solid, with rather rapidly increasing whorls, medially constricted whorls, and with the basal carina conspicuously overhanging the succeeding whorl; spiral sculpture on the upper part of the spire of two small beaded threads in the middle of the whorl, with two more conspicuous flattish transversely nodulous cords on each side of them, a wide, nearly smooth space on each outer side, and on the basal carina a still more prominent rippled cord; on the later part of the shell a more or less numerous series of small interstitial threads is found, and the anterior major cord behind the carina becomes more conspicuous than the others; over the whole surface small, wavy spiral grooves appear under a magnifier; the axial sculpture consists only of incremental lines, which indicate a deep, wide sulcus in the outer lip about the middle of the whorl; base apparently flattened; specimen decollate, diameter at the decollation 7 mm., length of nine whorls 74, maximum diameter of last whorl 24, of the constricted part of the same 19 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 166103.

This remarkably fine species appears to be rare. In its rapidly increasing whorls it recalls *T. megalobasis* Dall, but is quite differently sculptured.

TURRITELLA LITHARIA, new species.

Plate 13, fig. 2.

Shell small, slender, the type-specimen with 9 whorls, the apex being decollate; sculpture of the early whorls composed of lines of growth crossed by two spiral ridges equidistant from the suture and each other; the anterior margin of the whorls at the suture is angulate, gradually becomes prominent and finally functions as a third spiral ridge; all these ridges are closely, minutely beaded with the interspaces nearly smooth; on the last whorl there is a small beaded thread close behind the posterior spiral; base flattish or even somewhat excavated and nearly smooth; aperture defective, the sulcus of the outer lip rounded, deepest near the posterior spiral ridge. Length 19, maximum diameter 45 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida, one specimen. U. S. Nat. Mus. No. 165118.

This is doubtless a young shell, but it differs from the young of any of the species yet known from this horizon.

TURRITELLA ATACTA, new species.

Plate 13, fig. 5; plate 14, fig. 5.

Turritella gatunensis DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 310, pl. 17, fig. 10, 1892, not of Conrad.

This species resembles rather closely Conrad's description of *T. uvasana* (but not his figure, which is a mere caricature) and the Costa Rica species recently named *tristis* by Brown and Pilsbry, which was figured by Gabb in 1878, under the name of *gatunensis*. A careful review of the available material leads to the belief that it is distinct from either. Any one who will compare either of Gabb's figures with the original diagnosis of *T. uvasana* will certainly find them irreconcilable. The figure on plate 13 represents what may be a variety.

The shell is slender (13 whorls to 26 mm.) with a rather indistinct suture. The top of the whorls flattish or slightly excavated with 3 or 4 medium spiral threads with a much finer thread in the interspaces: the rest of the whorl with 3 prominent major threads, equidistant and with 2 or 3 smaller threads in the intervals; the base slightly convex with 1 major and numerous minor spiral threads; aperture subquadrate, the outer lip somewhat flexuous; length of type-specimen (13 whorls) 26 mm., breadth 6 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 165123.

The shell figured as *T. uvasana* by Gabb in the Paleontology of California has rather prominently rounded whorls with 5 or more subequal, equally distributed spiral threads, and there is a Californian species with these characters, but the diagnosis of *T. uvasana* calls for quite different characters. *T. gatunensis* Conrad has been shown by Pilsbry to be quite distinct. The *tristis* of Pilsbry and Brown should be carefully compared with *uvasana* Gabb not Conrad.

T. atacta belongs in the group with *T. acropora* Dall of the Pliocene.

Family VIVIPARIDAE.

Genus LIOPLAX Troschel.

Lioplax TROSCHEL, Gebiss d. Schnecken, vol. 1, p. 100, 1857. Type, *Paludina subcarinata* Say.

LIOPLAX FLORIDANA Dall.

Plate 16, fig. 8.

Lioplax floridana DALL, Trans. Wagner Inst., vol. 3, pt. 1, pl. 1, fig. 3, 1890.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 111937.

This species is represented only by one poor specimen, of which, however, the genus is sufficiently recognizable. It was thought best to put its occurrence on record and not await better material, which it is to be hoped may eventually not be lacking.

Family ASSIMINIIDAE.

Genus ASSIMINEA Leach.

Assiminea (Leach Ms.) Fleming, Hist. British Anim., p. 275, 1828. Type, *A. grayana* Jeffreys.

? Assemania Knight, Journ. Conch. (Leeds), vol. 9, p. 296, 1900.

ASSIMINEA ALDRA, new species.

Plate 5, fig. 9.

Shell minute, of about 5 moderately rounded whorls with a distinct suture; spire tapering evenly to a somewhat blunt apex; surface smooth; last whorl more than half the length of the shell; aperture rounded ovate, peristome moderately thickened not reflected, a well marked layer of callus on the body; umbilical region imperforate. Height 2, maximum diameter 1 mm.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida. One specimen, E. J. Post, U. S. Nat. Mus. No. 166106.

This is perhaps the oldest member of the genus which is reported from the Pliocene or Pleistocene only, as far as I can ascertain.

Family RISSOIDAE.

Genus RISSOINA Orbigny.

Rissoina Orbigny, Voy. Amer. Mer., 1840, p. 395. Type, *R. inca* Orbigny.

RISSOINA SUPRALAEVIGATA, new species.

Plate 13, fig. 1.

Shell small, smooth, subacute, with about 7 flattish whorls separated by a feebly defined suture; nuclear whorl defective, the remainder gradually increasing; last whorl rounded on the base, with a thick pillar lip; outer lip protractively arcute, markedly receding toward the suture, slightly thickened; body with no perceptible callus in the specimen. Length 5.5 mm., maximum diameter 2 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165125.

Genus AMNICOLA Gould and Haldeman.

Amnicola Gould and Haldeman, Inv. Mass., 1841, p. 228. Type, *A. porata* Say, as *Paludina*.

Leachia Risso, Hist. Nat. Eur. Mer., 1826, p. 102. First species, *L. viridescens* Risso. Hist. Nat. Eur. Mer., 1826, fig. 35. Not *Leachia* Leseuer, 1821.

Microna Ziegler, *fide* Stimpson, Hydrobiinæ, p. 4, 1865.

AMNICOLA ADESTA, new species.

Plate 1, fig. 7.

Shell minute, smooth with 5 whorls; nucleus minute not differentiated from the succeeding whorls, rather blunt; whorls plumply rounded with a deep suture between them; at the end of the penultimate whorl is a constriction marking the place of a former resting stage; aperture sublunate, peritreme complete, simple, slightly thickened, pillar lip slightly separated from the body whorls with a chink behind it, extending across the body to the posterior sutural commissure of the aperture; base rounded. Height 3.2, maximum diameter 1.7 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

One specimen from the Post collection, U. S. Nat. Mus. No. 165023.

AMNICOLA, sp. indet.

A defective specimen of an *Amnicola*, different from *A. adesta*, but too imperfect to describe, was collected by Mr. Post. It is short and stout and notable for its inflated whorls and very deep constriction at the suture. U. S. Nat. Mus. No. 214742.

Genus CRUCIBULUM Schumacher.

Crucibulum Schumacher, Essai, p. 182, 1817. Type, *Calyptræa chinensis* Lamarck.

Section DISPOTAEA Say.

Dispotaea Say, Journ. Acad. Nat. Sci. Phila., vol. 4, p. 131, 1824. Type, *Calyptraea costata* Say.

CRUCIBULUM CONSTRICTUM Conrad.

Dispotaea constricta Conrad, Bull. Nat. Inst., vol. 2, p. 194, pl. 1, fig. 2, 1842; Fos. Med. Tert., p. 80, pl. 45, fig. 4, 1845.

Crucibulum costata Tuomey and Holmes, Pleioc. fos. S. Car., p. 107, pl. 25, fig. 4, 1857; not of Say.

Crucibulum constrictum Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 350, 1892.

Oligocene of Jericho, New Jersey, and of the Tampa silex beds at Ballast Point, Tampa Bay, Florida, Burns and Dall; Miocene of the Choptank River, and St. Mary's County, Maryland; of the James

River, Virginia; of North and South Carolina, and of the upper bed at Alum Bluff, Chattahoochee River, Florida. U. S. Nat. Mus. No. 112597.

This species does not appear to have survived into the Pliocene.

Genus CALYPTRAEA Lamarck.

Calyptraea LAMARCK, Prodrome, p. 78, 1799 (not of Lamarck, Syst. des Anim. s. Vert, 1801, p. 70). Type, *C. chinensis* Linnaeus.

Trochita SCHUMACHER, Essai, p. 184, 1817.

Infundibulum SOWERBY, Min. Conch., vol. 1, pl. 97, 1812; not of Montfort, 1810.

Galerus (ANONYMOUS) Mus. Calonnianum, p. 1797 (not available under the rules).

Leptonotis Conrad, 1866, which was regarded as a very young *Calyptraea* by the writer in the Tertiary of Florida, 1892, is now, according to Prof. G. D. Harris, to be referred to the very young stage of *Capulus complectus* Aldrich.

CALYPTRAEA TROCHIFORMIS Lamarck.

Calyptraea trochiformis LAMARCK, Ann. du Museum, Paris, vol. 5, pt. 1, p. 385, pl. 15, fig. 3, 1804.—DESHAYES, Coq. fos. bas. de Paris, vol. 2, p. 30, pl. 4, figs. 1–4, 11–13, 1824.

Infundibulum echinulatum SOWERBY, (*I. spinulosum, I. tuberculatum* Sowerby), Min. Conch., vol. 1, pl. 97, figs. 1, 2, 7, 1812.

Infundibulum trochiformis LEA, Contr. Geol., p. 96, pl. 3, fig. 76, 1833.

Infundibulum urticosum CONRAD, Fos. Tert. form., ed. 1, No. 3, p. 32, 1833.

Trochita alta CONRAD, in Wailes' Geol. Miss., p. 289, pl. 15, figs. 3*a*, 3*b*, 1854; Proc. Acad. Nat. Sci. Phila., for 1855, p. 259.

Infundibulum perarmatum CONRAD, Proc. Acad. Nat. Sci. Phila., pl. 1, p. 31, 1841; Fos. Med. Tert., p. 80, pl. 45, fig. 6.

Trochita tetrica CONRAD, Checkl. Eoc. Fos. Smiths. Inst., p. 28, No. 817, 1866; Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 1, p. 113, lines 8 and 9, and ref. to plates p. 133, pl. 11, fig. 3, Aug. 1848.

Calyptraea trochiformis DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 352, 1892.

Velutina (*Otina*) *expansa* Whitfield, 1865, and *Leptonotis* (new genus) *expansa* Conrad, 1866, which were tentatively placed as synonyms of *Calyptræa trochiformis* by the writer in the Wagner Transactions above cited, are referred to the young of *Capulus complectus* Aldrich by Prof. G. D. Harris. They were founded on a young shell one millimeter in diameter.

The species is fossil in the Eocene of the Paris Basin, of Britain, and of America; in the Oligocene of Vicksburg, Miss., and of the Tampa silex beds at Ballast Point, Tampa Bay, Florida, and of the lower bed at Shiloh, New Jersey; in the Miocene of the Choptank River in Maryland, and of Wilmington, North Carolina. U. S. Nat. Mus. No. 112598.

Like most sessile gastropods, the sculpture of the surface varies from smooth to spinose or shagreened, and the shell from nearly flat to elevated according to situs. Similar variations may be observed in the recent *Crucibulum spinosum*, and are without specific value.

Family HIPPONICIDAE.

Genus HIPPONIX Defrance.

Amalthea Schumacher, Essai, 1817, p. 181; not *Amalthea* Montfort, 1810.
Hipponix Defrance, Bull. Soc. Philom. Paris, Jan. 1819, ser. 3, pp. 3–9. Type, *H. cornucopiae* Defrance.
Pilcopsis (part) Lamarck, An. s. Vert., vol. 6, 1822, pt. 2, p. 19.
Hipponyx Blainville, Dict. Sci. Nat., vol. 32, 1824, p. 297.
Malluvium Melvill. Proc. Mal. Soc. London, vol. 7, 1906, p. 82. Type, *Capulus lissus* E. A. Smith.
Hipponix Dall, Bull. Mus. Comp. Zool., vol. 43, No. 6, 1908, p. 330.

HIPPONIX PYGMAEUS Lea.

Plate 13, figs. 12–14.

Shell small, solid, convex, with a deeply incurved posterior apex forming a little more than one whorl; nucleus smooth, the remainder of the shell radially sculptured with numerous flattened threads, which project slightly at the margin and the various resting stages and are separated by slightly wider interspaces, most of which contain a single, much finer intercalary thread; the radial sculpture is crossed by numerous subimbricating incremental lines or resting stages, which in the earlier portion of the shell are rather regularly spaced and produce a reticulated effect; base rounded ovate with a thick margin, more or less crenulated by the radial sculpture. Length of shell 9.2, of aperture 7, height 5, maximum breadth 7. mm.

Eocene of Claiborne, Alabama, Lea; Oligocene of Tampa silex beds, Ballast Point, Tampa Bay, Florida.

Figured specimen from the Post collection, U. S. Nat. Mus. No. 165127.

HIPPONIX WILLCOXII Dall.

Plate 16, fig. 7.

Amalthea willcoxi Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 359, pl. 17, fig. 6, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall. U. S. Nat. Mus. No. 165126.

An imperfect cast of a species resembling this was found in the Oligocene white limestone at Jacksonboro, Georgia, of which specimens were sent me by the late Professor Whitfield under the erroneous impression that they were of Claibornian Eocene age.

Family XENOPHORIDAE.

Genus XENOPHORA Fischer de Waldheim.

Xenophora Fischer de Waldheim, Tab. Syn. Zoogn., p. 113, 1808.

XENOPHORA CONCHYLIOPHORA Born.

Plate 15, figs. 1, 3.

Trochus conchyliophorus Born, Mus. Caes. Vind., index, p. 333, 1778.
Xenophora lacvigata Fischer de Waldheim, Tab. Syn. Zoogn., p. 113, 1808.
? *Trochus leprosus* Morton, Syn. Org. Rem., p. 46, pl. 15, fig. 6, 1834.
Phorus reclusus Conrad, Proc. Acad. Nat. Sci., vol. 7, p. 262, 1855; Wailes' Geol. Miss., p. 289, pl. 17, figs. 6*a*, 6*b*, 1854.
Onustus reclusus Conrad, Amer. Journ. Conch., vol. 1, p. 33, 1865.
Xenophora agglutinans De Gregorio, Mon. Eoc. Ala., p. 144, 1890, not of Lamarck.
Xenophora reclusa De Gregorio, Mon. Eoc. Ala., p. 144.
Xenophora humilis Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 182, figs. 10, 10*a*, 1890, not of Conrad.
Xenophora conchyliophora Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 360, 1892.

In the "Ripley" Cretaceous of Alabama, at Prairie Bluff, Morton and Conrad; the Eocene of Woods Bluff, Alabama, and of Jackson, Mississippi, Aldrich, Wailes, and Conrad; Oligocene of the Tampa silex beds, of the superincumbent limestone at Bartow, and of the Chipola River marl in Florida; the Miocene of Cape Fear River, North Carolina, at Mrs. Purdy's marl bed, C. W. Johnson; Pliocene of the Caloosahatchie River and Shell Creek, Florida; and living in moderate depths of water off the eastern coast of the United States from Cape Hatteras to the Gulf of Mexico, and through the Antilles.

The groups *Xenophora* s. s. and *Tugurium* which are sufficiently distinct in the existing fauna, as we recede in Tertiary time become merged so far as to be indistinguishable.

Family NATICIDAE.

Genus NATICA Scopoli.

Natica (*Adanson*) Scopoli, Intr. Hist. Nat., p. 392, 1777.—Bruguière, Encycl. Meth., vol. 1, p. XVI, 1789.—Lamarck, Prodrome, p. 77, 1799.—Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 366, 1892.
Cochlis Bolten, Mus. Bolten, p. 146, 1798.
Nacca Risso, Hist. Nat. Eur. Merid., vol. 4, 1826, p. 148. *Nerita fulminea* (Linnaeus) Gmelin.

Subgenus CRYPTONATICA Dall.

Cryptonatica Dall, Trans. Wagner Inst., vol. 3, pt. 2, pp. 362, 366, 1892. Type, *N. clausa* Broderip and Sowerby.

This group has the shelly operculum smooth and without grooves, and the umbilicus completely filled with a smooth callus.

NATICA (CRYPTONATICA) FLORIDANA Dall.

Plate 16, fig. 3.

Natica (Cryptonatica) floridana Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 366, pl. 17, fig. 5, 1892.

Oligocene of the Tampa silex beds, at Ballast Point, Tampa Bay; and of the Chipola marl, on the Chipola River, Calhoun County, Florida; Dall and Burns. U. S. Nat. Mus. No. 165129.

There are differences of rotundity at the shoulder in different specimens, similar to differences due to sex in recent species.

Genus POLINICES Montfort.

Polinices Montfort, Conch., vol. 2, p. 223, 1810. Type, *Nerita mamilla* Linnaeus.—Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 367, 1892.

Subgenus EUSPIRA Agassiz.

Euspira Agassiz, German ed. Sowerby's Min. Conch., pp. 14, 320, 1842. First species, *N. glaucinoides* Sowerby.

Lunatia Gray, Proc. Zool. Soc. London, 1847, p. 149. Type, *Natica ampullaria* Lamarck.

Naticina Fischer, Man. Conchyl., p. 766, 1885; not of Guilding, Trans. Linn. Soc., vol. 5, p. 31, 1834.

Natica Risso, Hist. Nat. Eur. Merid., vol. 4, 1826, p. 147. Type, *N. pulchella* Risso; not *Natica* Scopoli s. s.

Lunatia Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 369, 1892.

Euspira Dall, Bull. Mus. Comp. Zool., vol. 43, p. 334, 1908; U. S. Geol. Survey, Prof. paper 59, p. 87, 1909.

Notwithstanding a misstatement in the diagnosis (which is contradicted by the figures) *Euspira* will take the place of the more familiar *Lunatia* of Gray, having five years' priority, as I showed in 1908. The type is *E. glaucinoides* Sowerby=*N. labellata* Lamarck, 1804.

POLINICES (EUSPIRA) HEMICRYPTUS Gabb.

Plate 9, fig. 9.

Natica hemicrypta Gabb, Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 4, p. 375, pl. 67, fig. 5, 1860.—Conrad, Amer. Journ. Conch., vol. 4, p. 66, pl. 6, fig. 1 (not fig. 7), 1868.—Whitfield, Gastr. N. J. Miocene marls, p. 118, pl. 22, figs. 1–5, 1895.

Lunatia eminuloides Gabb, Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 8, p. 339, pl. 44, fig. 4, 1875.

? Natica caroliniana Tuomey and Holmes, Pleioc. fos. S. Car., p. 116, pl. 25, fig. 18, 1857.

Polynices (Lunatia) hemicryptus Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 371, 1892.

Oligocene of Shiloh and Jericho, New Jersey, Gabb and Burns; of the Tampa silex bed, at Ballast Point; of the Chipola marls, near

the county bridge, Calhoun County, Florida; and of Sapote, Costa Rica (Gabb). U. S. Nat. Mus. No. 165130.

Genus AMPULLINA (Lamarck) Bowdich.

Ampullina (Lamarck) BOWDICH, Elem. Conch., vol. 1, p. 31, 1822. Type, pl. 9, fig. 2 (*Ampullaria depressa* Lamarck, not Sowerby; not *Ampullina* Blainville, 1825).—DALL, U. S. Geol. Survey, Prof. paper No. 59, p. 89, 1909.

The name of this genus appears in its French form (*Ampulline*) in the works of Defrance and other writers, as proposed by Lamarck, some years before it appeared in Latin as above indicated. The type as figured by Bowdich is one of the heavier species with a distinct umbilicus, probably *A. depressa* Lamarck, and not the form in which the umbilicus is closed over by a mass of callus, as imagined by several respectable authors.

The group contains both umbilicated and imperforate species and has been considerably divided. *Lupia* Conrad is an elevated form of the imperforate type and differs from *Amauropsis* Mörch only in having no channel at the suture. The *Natica phasianelloides* of Orbigny is a typical *Lupia*. The full synonymy is given in Professional paper No. 59, above cited. While not using the Latinized form of the name Defrance, in the Dictionnaire des Sciences Naturelles,[1] states that Lamarck had arranged, first in *Ampullaria* and afterwards in a genus which he called "Ampulline," the marine fossils belonging to this group, Defrance gives a list of 14 species. Bowdich, in his work published somewhat later, cites in connection with *Ampullina* part of the remarks of Defrance.

AMPULLINA STREPTOSTOMA Heilprin.

Plate 12, fig. 27.

Natica streptostoma HEILPRIN, Trans. Wagner Inst., vol. 1, p. 112, pl. 16, fig. 51, 1887.

Ampullina streptostoma DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 374, 1892.

Oligocene of Tampa silex beds at Ballast Point and La Penotiere's hammock, Florida, and the white limestone of Jacksonboro, Georgia; Heilprin, Dall, and Whitfield. U. S. Nat. Mus. No. 165131.

This species is related to *A. sigaretina* Lamarck, of the Paris basin Eocene, but has a wider basal callus and more open umbilicus. From *A. fischeri* Dall, of the Chipola beds, it differs by not having the umbilicus closed. The young, however, of these species are practically identical.

[1] Vol. 20, 1821, p. 446.

AMPULLINA AMPHORA Heilprin.

Plate 11, fig. 5.

Natica amphora Heilprin, Trans. Wagner Inst., vol. 1, pp. 112, 120, pl. 16, fig. 50, 1887.

Ampullina (Ampullinopsis) amphora Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 375, 1892.

Oligocene of the Tampa silex beds at Ballast Point (Stearns, Heilprin) and of the overlying limestone, and of the Chipola marl of Calhoun County, Florida. U. S. Nat. Mus. No. 165133.

This bears to the *A. mississippiensis* Conrad, much such a relation as the *A. maxima* of France does to the typical *A. crassatina* of the Parisian Eocene. The basal fasciole is narrower and defined by a more distinct line than in *A. mississippiensis*, which otherwise it much resembles.

AMPULLINA SOLIDULA Dall.

Plate 3, fig. 10.

Ampullina solidula Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 376, pl. 22, fig. 31, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall, U. S. Nat. Mus. No. 112933.

Only a single specimen has been obtained, which is a very solid shell, much more so than *A. streptostoma* of the same size, and with a different umbilicus.

Genus AMAUROPSIS Mörch.

Amauropsis Mörch, Moll. Gronl. Nat. Bidr. Beck's Gronl., 1857, p. 81, subgenus of *Mamma*. Sole example, *Nerita islandica* Gmelin; see Conchyl. Cabinet, vol. 1, p. 215, fig. 1181.

This group has a thin elevated shell, with a channeled suture and a horny operculum, a conspicuous periostracum (dehiscent in the typical species) and in the recent fauna is confined to the boreal seas. *Amaura* Möller, often associated with it, belongs to the Pyramidellidae.

AMAUROPSIS FLORIDANA Dall.

Plate 5, fig. 11.

Amaura guppyi (Gabb) Heilprin, Trans. Wagner Inst., vol. 1, p. 112, 1887.

Polinices (Amauropsis) (guppyi Gabb var. ?) *floridana* Dall, Trans Wagner Inst., vol. 3, pt. 2, p. 378, 1892.

Tampa silex beds at Ballast Point Tampa Bay, Florida, Dall and Willcox. U. S. Nat. Mus. No. 112955.

The differences noted in the Wagner memoir seem sufficient to distinguish the Floridian from Gabb's Antillean species.

Genus SINUM Bolten.

Sinum BOLTEN, Mus. Boltenianum, 1798, p. 14. Type, *Helix haliotoidea* (Linnaeus) Gmelin, Syst. Nat., vol. 6, p. 3663, 1792, *ex parte*.—DALL, U. S. Geol. Surv. Prof. paper No. 59, p. 91, 1909.
Sigaretus LAMARCK, Prodrome, 1799, p. 77. Same type.
Cryptostoma BLAINVILLE, 1817.
Catinus H. and A. ADAMS, 1853; not of Oken, 1815.

SINUM CHIPOLANUM Dall.

Plate 12, fig. 29; plate 16, fig. 1.

Sigaretus chipolanus DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 379, pl. 17, fig. 7, 1892.

Oligocene of the Tampa silex beds at Ballast Point, also of the Chipola marl, Calhoun County, Florida; Dall. U. S. Nat. Mus. No. 165135.

This species is most nearly related to the *S. declive* Conrad, of the Claibornian Eocene, from which it is separable by its closed umbilicus and the absence of the emargination of the pillar, which is a characteristic of *S. declive*. The Chipola specimens are larger and finer than any yet obtained at Ballast Point.

SINUM IMPERFORATUM, new species.

Plate 5, fig. 8.

Shell small, elevated, solid, of about 5 whorls, of which the nuclear $2\frac{1}{2}$ appear smooth; subsequent whorls sharply densely grooved, the grooves having a tendency to pair, and the interspaces flattened; both grooves and interspaces are minutely zigzagged by the intersection with them of the incremental lines; spire moderately elevated, suture distinct; aperture oblique, the outer lip joining the body above the periphery of the preceding whorls; inner or pillar lip thickened, with a slight depression behind it, but no umbilical chink. Height of shell 13.2, of aperture 11.7, maximum diameter 11 mm.

Tampa silex beds from the vicinity of the Hillsboro river, Florida, collected by E. J. Post. U. S. Nat. Mus. No. 166107.

This species has some resemblance to *S. fragile* Conrad, but is much more solid and the characters of the sculpture and of the umbilical region differ.

Family TURBINIDAE.

Genus TURBO (Linnaeus) Lamarck.

Turbo LINNAEUS, Syst. Nat., ed. 10, p. 761, 1758.—LAMARCK, Prodrome, p. 74, 1799. Type, *T. marmoratus* Linnaeus.

The original group was very heterogeneous, but by common consent the name has been restricted to shells of the type of *T. marmoratus* Linnaeus, which was Lamarck's monotype in 1799.

Section SENECTUS Swainson.

Senectus SWAINSON, Mal., pp. 214, 348, 1840. Type, *Turbo chrysostomus* Linnaeus.

This group was indicated by Da Costa in the anonymous Museum Calonnianum, which has been excluded from nomenclature by the International Committee's decision.

TURBO (SENECTUS) CRENORUGATUS Heilprin.

Turbo crenorugatus HEILPRIN, Trans. Wagner Inst., vol. 1, p. 113, pl. 16, fig. 54, 1887.—DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 382, 1892.

Tampa silex beds at Ballast Point, Tampa bay, Florida; Heilprin, Willcox, Burns, and Dall. U. S. Nat. Mus. No. 112984.

This species is not uncommon among the silicified fossils at Ballast Point, but rarely found in good condition, and, so far, always immature. That it must grow to a much larger size than any yet reported is certain, since Mr. Willcox found an operculum which measured in greatest diameter 31 mm., more than twice the size of any which fit the aperture of the largest shell yet found at the same locality.

Genus ASTRAEA Bolten.

Astraea BOLTEN, Mus. Boltenianum, 1798, p. 79. Type, *Trochus imperialis* Gmelin. Not *Astraea* Lamarck, 1801.
Astraea DALL, U. S. Geol. Surv., Prof. paper No. 59, p. 92, 1909.
Astralium LINK, 1807.
Imperator MONTFORT, 1810.

Subgenus LITHOPOMA Gray.

Lithopoma GRAY, Fig. Moll. An., vol. 4, p. 88, 1850. Type, *Trochus tuber* Linnaeus.

ASTRAEA (LITHOPOMA), sp. indet.

Astralium sp. indet. DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 385, 1892.

An indeterminate species of *Astraea* is represented by fragments and imperfect casts from the Tampa silex beds and the limestone of Wakulla County, near Wakulla, Florida; Dall and Vaughan. Also in the Chipola marl of Calhoun County, Florida; Burns.

Family TROCHIDAE.

Genus TEGULA Lesson.

Tegula LESSON, Ill. de Zool., livr., 17, 1834, pl. 51 (no pagination on the text). Type *T. elegans* Lesson,=*T. pellis-serpentis* Mawe.

Tegula, being the older name, takes precedence over *Chlorostoma* and *Omphalius* as subgenera, if the latter be accepted as valid groups.

TEGULA (OMPHALIUS) EXOLETA Conrad.

Plate 16, figs. 15, 16.

Monodonta exoluta (sic) Conrad, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 309, 1843 (*err. typ. pro exoleta*).

Monilia exoluta Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, p. 569, 1863.

Turbo helieiformis Heilprin, Trans. Wagner. Inst., vol. 1, p. 113, pl. 16, fig. 55, 1887.

Chlorostoma (Omphalius) exoletum Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 388, pl. 17, figs. 4, 4*a*, 1892.

Oligocene of the Tampa silex beds, Ballast Point, and of the lower bed at Alum Bluff, Chattahoochee River, northwest Florida, and Miocene of the Carolinas; Burns. U. S. Nat. Mus. No. 112572.

The *Monodonta kiawahensis* of Tuomey and Holmes should be compared with this species, which does not appear in the Pliocene of the Caloosahatchie, nor in the living fauna of Florida. A variety *limatum*[1] is reported from Alum Bluff and the Chipola marl.

Genus CALLIOSTOMA Swainson.

Calliostoma Swainson, Mal. pp. 218, 219, 351, 1840. Type, *Trochus zizyphinus* var. *conuloides* Lamarck.

Ziziphinus Gray, Syn. Brit. Mus., 1840. (nude name.)

CALLIOSTOMA METRIUM Dall.

Plate 15, fig. 8.

Calliostoma metrium Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 394, pl. 22, fig. 27, 1892.

Oligocene of the Tampa silex beds at Ballast Point, and of the Chipola marl, near the county bridge over the Chipola River, Calhoun County, Florida; Dall. U. S. Nat. Mus. No. 113025.

CALLIOSTOMA TAMPICUM, new species.

Plate 4, fig. 1.

Shell small, with 7 flattened whorls, an inconspicuous suture, and flattish base; the nucleus is smooth and projects perceptibly upward; the subsequent whorls show 5 subequal and equally spaced spiral ridges more or less distinctly beaded; on the last whorl and a half these ridges become reduced to small threadlike proportions, hardly rising above the surface of the whorl, not beaded, and separated by wide interspaces with occasional still smaller intercalary threadlets; the periphery of the whorl is bluntly rounded and produced backward; the base is flattened and spirally sculptured with 10 or 12 obscure spirals which might be regarded as flattened threads separated by narrow striae, the whole more or less obsolescent; (the aper-

[1] Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 388, 1892.

ture is obscured by matrix and the end of the pillar broken off). Height of shell 10.5, maximum diameter of base 10, minimum diameter of base 9 mm.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 166108.

This shell has, in miniature, some resemblance to *C. grammaticum* Dall, of the Chipola beds, but the latter is a much larger species.

Genus MARGARITES Leach.

Margarita LEACH, Thompson's Ann. Philos., vol. 14, p. 202, 1819; not of Leach, Zool. Misc., vol. 1, p. 107, 1815.

Margarites (Leach Ms.) GRAY, Ann. Mag. Nat. Hist., vol. 20, 1847, p. 268.—LEACH, Moll. Gt. Britain, 1852, pp. 147, 197. Type, *Helix margarita* Montagu, DALL, U. S. Geol. Survey, Prof. paper, No. 59, p. 97, 1909.

MARGARITES TAMPAËNSIS Dall.

Plate 3, fig. 11.

Margarita tampaënsis DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 406, pl. 18, fig. 5, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall and Burns. U. S. Nat. Mus. No. 112573.

The fine striation may or may not be present, especially on the later whorls.

Family DELPHINULIDAE.

Genus LIOTIA Gray.

Liotia GRAY, Synopsis Brit. Mus., 1840 and 1842, name only; Proc. Zool. Soc. London for 1847, p. 145. Type, *Delphinula cancellata* Gray.—H. and A. ADAMS, Gen. Rec. Moll., vol. 1, 1854, p. 404.—DALL, *Blake* Gastr. 1889, p. 385.

LIOTIA (ARENE) SOLARIELLA Heilprin.

Plate 16, figs. 4, 5.

Delphinula ? solariella HEILPRIN, Trans. Wagner Inst., vol. 1, p. 113, pl. 16, fig. 56, 1887.

Liotia (Arene) solariella DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 408, pl. 17, figs. 1, 1*a*, 1892.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; Heilprin, Dall and Burns, U. S. Nat. Mus. 165137.

LIOTIA (ARENE) CORONATA Dall.

Plate 16, figs. 6, 17.

Liotia (Arene) coronata DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 409, pl. 17, figs. 2, 2*a*, 1892.

Tampa silex beds, Ballast Point, Tampa Bay, Florida; Dall. U. S. Nat. Mus. No. 112575.

This species seems to be less abundant than the *L. solariella*, and only the original specimens have yet come under my observation.

Family HELICINIDAE.

Genus HELICINA Lamarck.

Helicina LAMARCK, Prodrome, 1799, p. 76 (no species mentioned); Syst. des Anim. s. Vert. 1801, p. 94. Type, *Helicina neritella* Lamarck after Lister, pl. 62, fig. 59 (Barbados); not of Roissy, Hist. Gen. des Moll., vol. 5, 1806, p. 275, pl. 54, fig. 1 (=*Umbonium* Link).—PFEIFFER, Pneumop. Viv., 1852, pp. 338, 362.

This genus was founded by Lamarck on a figure of a snail from Barbados given by Lister as above cited, and an unquestionable member of the genus as generally understood. However, Roissy, in adopting the genus a few years later, made the mistake of figuring a species of *Umbonium* (*Rotella* Lamarck) as an example of Lamarck's genus. This error misled Gray and some others, who probably did not take the trouble to look up the original figure in Lister, into regarding the type of *Helicina* as a marine shell.

HELICINA BALLISTA Dall.

Plate 15, figs. 9, 11.

Helicina ballista DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 3, pl. 1, figs. 2, 2*a*, 1890.

Tampa silex beds at Ballast Point and in the overlying Tampa limestone with *Orbitolites;* and in rock of the same age at Six-Mile Run, near Orient Station, east of Tampa City; all collectors. U. S. Nat. Mus. No. 111939.

HELICINA BALLISTA var. TAMPAE Dall.

Helcina ballista var. *tampae* DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 4, 1890.

With the last, and nearly as abundant. U. S. Nat. Mus. No. 111943.

This is similar to the typical form and has the same number of whorls, but is generally smooth and slightly flatter on the spire beside being constantly smaller. If we had it in its original condition, probably there might be specific differences of color which are lost in the fossil state, but as it stands the safer plan seems to be to regard it as a variety of the larger shell with which it is associated.

HELICINA POSTI, new species.

Plate 5, fig. 7.

Shell in form much resembling *H. ballista* var. *tampae*, but larger, proportionately more depressed, with a less thickened peristome, per-

fectly smooth surface except for incremental lines, about 5 whorls, the last near the aperture descending a little, and a smooth flat pad of callus over the umbilical region. The specimen collected has the peristome moderately thickened internally, but has no reflection of the edge or beveled margin as in the smaller species. There is a faint notch at the base of the pillar which has no parallel in the other species. Maximum diameter of shell, 11.5; minimum diameter of shell, 9.75; height, 9 mm.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida. One specimen collected by E. J. Post. U. S. Nat. Mus. No. 166093.

Family NERITIDAE.

Genus NERITA (Linnaeus) Lamarck.

Nerita (part) LINNAEUS, Syst. Nat., ed. 10, 1758, p. 776.
Nerita LAMARCK, Prodrome, 1799, p. 77. Type, *Nerita exuviae* Lamarck.

The name *Nerita* derives from the ancients and is mentioned (in its Greek form *Neritos*) by Aristotle. Among eighteenth-century naturalists it was used indiscriminately for *Natica*, *Nerita*, *Neritina*, and other gastropods of similar form, and it was not until the time of Lamarck that this very natural group was definitely segregated.

NERITA TAMPAËNSIS Dall.

Plate 16, fig. 2.

Nerita tampaënsis DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 421, pl. 17, fig. 3, 1892.

Tampa silex beds at Ballast Point, Tampa Bay, Florida, and in the overlying limestone at the same place and also at La Penotiere's Hammock, a mile and a half south of Orient Station and 6 miles eastward from Tampa City, on Six-Mile Run; Dall and Burns. U. S. Nat. Mus. No. 165138.

This is the first species of *Nerita* which has been described from the Atlantic Tertiary.

Family FISSURELLIDAE.

Genus FISSURIDEA Swainson.

Fissuridea SWAINSON, Malac., p. 356, 1840.—PILSBRY, in Nautilus, vol. 5, p. 104, 1892.—DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 425, 1892.
Glyphis CARPENTER, 1856; not of Agassiz, 1840, *Pisces*.

FISSURIDEA CHIPOLANA Dall.

Fissuridea chipolana DALL, Trans. Wagner Inst., vol. 3, pt. 2, p. 426, pl. 23, fig. 21, 1892.

Oligocene of the Tampa silex beds at Ballast Point; Post. Also in the Chipola marls near the county bridge, Calhoun County,

Florida, Dall; and in the equivalent lower bed at Alum Bluff on the Chattahoochee River. Also in the Miocene of Duplin County, North Carolina; Burns. U. S. Nat. Mus. No. 165140.

This appears to be the precursor of the recent *Fissuridea alternata* Say, but does not attain so large a size, judging by the specimens so far collected.

Genus FISSURELLA Bruguière.

Subgenus CREMIDES H. and A. Adams.

FISSURELLA (CREMIDES) CERYX, new species.

Plate 1, figs. 10, 11.

Shell small, thin, subconic, basal outline rounded quadrate, the anterior portion slightly wider; apex within the posterior third of the length; apical opening narrow, centrally slightly widened; sculpture of flattish radial riblets (about three to a millimeter) with subequal interspaces, in most of which there are traces of a single much finer radial thread; concentric sculpture of rather marked incremental lines, which are not close set and which feebly imbricate the riblets in passing over them; base (in the type) slightly arcuate, the ends more produced than the central portions; interior smooth except for a faint, muscular impression, the aperture not showing any callus on the interior margin; basal margin feebly crenulated by the ends of the riblets. Length 9.5 mm., height 4 mm., maximum diameter 7.1 mm.; the posterior margin of the aperture in front of the posterior end of the shell 2 mm.

Tampa silex beds, Ballast Point, Tampa Bay, Florida; one specimen collected by E. J. Post. U. S. Nat. Mus. No. 165109.

Order POLYPLACOPHORA.

Family CHITONIDAE.

Genus ISCHNOCHITON (Gray).

Ischnochiton Gray, Proc. Zool. Soc. London, 1847, p. 126.—Shuttleworth, Berner Mitth., 1853, p. 66.—Pilsbry, Man. Conch., vol. 14, p. 86, 1882.—Dall, Trans. Wagner Inst., vol. 3, pt. 2, p. 434, 1892. Type, *Chiton textilis* Gray, South Africa.

ISCHNOCHITON TAMPAËNSIS Dall.

Plate 3, figs. 8*a*, 8*b*.

Ischnochiton tampaënsis Dall, Trans. Wagner Inst., vol. 3, pt. 2, pl. 23, fig. 23, 1892.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida; Dall and Crosby. U. S. Nat. Mus. No. 112607.

In the absence of the tail valve and the armature of the girdle this species can not be referred to its particular section of the genus.

It has been assumed, since there are no obvious discrepancies, that the two valves figured belong to the same species, though collected by different persons and at different times.

Order PRIONODESMACEA.

Superfamily NUCULACEA.

Family NUCULIDAE.

Genus NUCULA Lamarck.

Nucula LAMARCK, Prodrome Nouv. Class. Coq., p. 87, 1799. Type, *Arca nucleus* Linnaeus.

Nuculana LINK, Beschr. Rostock Samml., p. 155, 1807 (modification of Lamarck's name to suit the taste of Link).

Glycymeris DA COSTA, Brit. Conch., p. 170, 1778, *part.*

The name *Nuculana*, by some writers erroneously utilized for the group first discriminated by Schumacher under the name of *Leda*, was proposed by Link as a more desirable form of the name *Nucula*, proposed by Lamarck for shells of the type of *Arca nucleus* Linnaeus.

Link changed many names to suit his own fancy, and in the present case *Nuculana* is simply an exact synonym of *Nucula*.

NUCULA TAMPAE, new species.

Plate 21, figs. 13, 14.

Shell small, rounded trigonal, solid, very inequilateral; beaks low, adjacent; anterior end produced, rounded, with the dorsal margin flattened, but no circumscribed lunule; posterior end short, subtruncate, with a flattened ill-defined area, but no distinct escutcheon; ligament rather large for the size of the shell and situated internally directly behind the beaks; surface concentrically finely rugose, the sculpture crossed by fine radial striae, with wider interspaces (too fine to be shown in the figures); margins finely crenulate internally. Length 7.3 mm., height 6 mm., maximum diameter 4.75 mm.

Tampa silex beds, Ballast Point, Tampa Bay, Florida. Collected by Dall, Burns, and Post. Type-specimen U. S. Nat. Mus. No. 165169, from the Post collection.

The sculpture in some of the pseudomorphs is so faint that the valves appear nearly smooth, but this is probably only an incident of fossilization.

Family LEDIDAE.

Genus LEDA Schumacher.

Leda SCHUMACHER, Essai, pp. 55, 172, 1817.—DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 579, 1898. Type, *Leda rostrata* Gmelin (not Montagu)=*Mya pernula* Muller, Zool. Danica, 1779.

LEDA FLEXUOSA Heilprin.

Plate 23, figs. 8, 10.

Leda flexuosa HEILPRIN, Trans. Wagner Inst., vol. 1, p. 119, pl. 16, fig. 66 (two views) 1887.—DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 589, pl. 38, figs. 5, 5*a*, 1898.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Heilprin and Dall. U. S. Nat. Mus. No. 165170.

Since the original figures were very obscure, better ones are now provided.

LEDA POSTI, new species.

Plate 21, figs. 6, 9.

Shell small, thin, equivalve, inequilateral, slender, rounded in front, attenuated and bluntly pointed behind; basal profile gently arcuate, anterior dorsal slope slightly convex, posterior slope nearly direct; beaks low, much incurved, opisthocoelous; no distinct lunule, but a narrow impressed space in front; behind the beaks a long narrow escutcheon extending to the end of the valve with the cardinal margins pouting; sculpture of incremental lines more prominent near the beaks and base, nearly obsolete on the middle of the valve; near the base these become sparse and sublamellose in the type-specimen; interior smooth; the muscular scars small, not thickened; hinge with about 20 anterior and 19 posterior V-shaped small teeth separated by a well-marked subtriangular resiliifer, wholly internal and just below the beaks. Length of valve 14 mm., of posterior end 8 mm., height 6.7 mm., maximum diameter 5 mm.

Tampa silex beds Ballast Point, Tampa Bay, Florida. Type-specimen from the Post collection. U. S. Nat. Mus. No. 165171.

Genus YOLDIA Möller.

Yoldia MÖLLER, Index Moll. Groenl., 1842, p. 18. First species, *Yoldia arctica* Gray, as *Nucula*.

Yoldia DALL, Trans. Wagner Inst., vol. 3, pt. 4, pp. 593–4, 1898. Type, *Y. glacialis* Wood.

YOLDIA FRATER Dall.

Plate 4, fig. 5.

Yoldia frater DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 596, pl. 32, fig. 1, 1898.

Oligocene of the Chipola marls in Calhoun and Walton Counties, Florida; and of the Oak Grove sands at Oak Grove, Santa Rosa County, northwest Florida; Dall. U. S. Nat. Mus. No. 165172.

A small *Yoldia* obtained at Ballast Point from the Tampa silex beds appears to be the young of this species.

Family ARCIDAE.

Subfamily ARCINAE.

Genus ARCA (Linnaeus) Lamarck.

Arca Linnaeus, Syst. Nat., ed. 10, p. 693, 1758.—Lamarck, Prodrome, p. 87, 1799. Type, *Arca noae* Linnaeus.

Arca Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 613, 1898.

ARCA UMBONATA Lamarck.

Plate 17, figs. 6, 8.

Arca umbonata Lamarck, An. s. Vert., ed. 2, vol. 6, p. 37, 1819.—Deshayes, vol. 6, p. 432, 1835 (*syn. part. exclus.*).—Philippi, Abb. und Beschr., vol. 3, p. 13, pl. 17*b*, figs. 3*a–c*, 1847.—Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 620, pl. 38, figs. 4, 4*a*, 1898.

Arca noae Stimpson, Smith Inst., Checkl. E. Am. Marine Shells, p. 2, 1860; not of Linnaeus.

Arca imbricata Heilprin, Trans. Wagner Inst., vol. 1, p. 118, 1887.

Arca listeri Heilprin, Trans. Wagner Inst., vol. 1, p. 118, 1887, after Tryon.

Barbatia bonaeayi Gabb, Geol. Santo Domingo, p. 254, 1873.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay; of the Chipola marls, Calhoun County; and of the Oak Grove sands, Santa Rosa County, Florida. Pleistocene of south Florida and the Keys. Living from the vicinity of Cape Hatteras, North Carolina, south to Brazil and throughout the Antilles. U. S. Nat. Mus. No. 165174.

This is a very widespread species, both in time and in geographical distribution at the present day. It seems to have retreated from Florida waters to warmer regions during the Miocene and returned there about the end of the Pliocene epoch.

ARCA GRAMMATODONTA, new species.

Plate 20, figs. 1, 2; plate 22, fig. 3.

Shell resembling *Arca paratina*, but more inflated, relatively wider, with the anterior end of the shell projecting before the angle where the hinge line ends, and with the latter rounded off; the posterior angle is similarly less conspicuous and the posterior truncation of *A. paratina* is replaced by a rounded-lanceolate profile; the area of the present species is relatively wider, and the triangle formed by the resiliary grooves is shorter and more equilateral; the anterior radial sculpture is alternated, the stronger ribs conspicuously beaded, while in *A. paratina* they are nearly plain, and a similar difference characterizes all the radial sculpture; the most marked difference occurs in the hinge teeth, which in the present species are sharply grooved vertically, while the teeth of *A. paratina*

are smooth and rather smaller; length of figured specimen 35, height 15, maximum diameter 20 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; E. J. Post. U. S. Nat. Mus. No. 165175.

Like the other typical Arks this species has a marked byssal gape, and being a nestler shows more or less individual variation of form due to *situs*.

ARCA PARATINA Dall.

Arca paratina, Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 623, pl. 33, fig. 14, 1898.

Oligocene of the Tampa silex beds at Ballast Point, E. J. Post; of the Chipola River marls, near the Calhoun County bridge, and of the lower bed at Alum Bluff, on the Chattahoochee River, Florida, Dall and Burns. U. S. Nat. Mus. No. 165177.

Subgenus **BARBATIA** (Gray) Adams.

Barbatia Gray, Syn. Brit. Mus., 1840, nude name; Proc. Zool. Soc. London, for 1847, p. 197.—H. and A. Adams, Gen. Rec. Moll., vol. 2, p. 534, 1857. Type, *Arca barbata* Linnaeus.—Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 615, 1898.

Section **CALLOARCA** Gray.

Calloarca (Gray) H. and A. Adams, Gen. Rec. Moll., vol. 2, 1857, p. 535. Sole example, *Arca alternata* Reeve.—Dall, Trans. Wagner Inst., vol. 3, pt. 4, pp. 615, 623, 1898.

BARBATIA (CALLOARCA) MARYLANDICA Conrad.

Plate 4, fig. 3.

Byssoarca marylandica Conrad, Fossils Medial Tert., p. 54, pl. 29, fig. 1, 1840.

Barbatia marylandica Conrad, Proc. Acad. Nat. Sci. Phila., for 1862, p. 580, 1863.

Barbatia (Calloarca) marylandica Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 623, 1898.

Oligocene of the Tampa silex beds at Ballast Point; of the lower bed at Alum Bluff, Chattahoochee River; of the Chipola marls, Calhoun County, Florida; and of the marls of Jericho, Cumberland County, New Jersey. Miocene of Plum Point, Calvert Cliffs, and Centerville, Maryland; Willcox, Burns, Dall, and Harris. U. S. Nat. Mus. No. 165176.

This species may possibly occur also in the Jacksonian Eocene of Mississippi.

BARBATIA (CALLOARCA) IRREGULARIS Dall.

Plate 17, fig. 4.

Barbatia (Calloarca) irregularis Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 623, pl. 33, fig. 5, 1898.

Oligocene of the Tampa silex beds at Ballast Point (fragment); Pliocene marls of the Caloosahatchie River, Alligator Creek, and Shell Creek, south Florida; Dall and Burns. U. S. Nat. Mus. No. 148949.

The fragment from Ballast Point collected by Mr. Willcox appears to accord specifically with the typical Pliocene form.

BARBATIA (CALLOARCA) ARCULA Heilprin.

Plate 17, fig. 5.

Area arcula HEILPRIN, Trans. Wagner Inst., vol. 1, p. 118, pl. 16, fig. 65, 1887.
Barbatia (Calloarca) arcula DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 624, pl. 33, fig. 4, 1898.

Tampa silex beds at Ballast Point, Tampa Bay; Willcox and Post. U. S. Nat. Mus. No. 107718.

Section ACAR (Gray) Adams.

Acar (Gray) H. and A. ADAMS, Gen. Rec. Moll., vol. 2, p. 535, 1857; *Area donaciformis* Reeve.—DALL, Trans. Wagner Inst., vol. 3, pt. 4, 1898, p. 615.
Daphnoderma MÖRCH, 1853, not of Poli, 1795.

BARBATIA (ACAR) RETICULATA Gmelin.

Area reticulata GMELIN, Syst. Nat., vol. 6, p. 3311, 1792.—CHEMNITZ, Conch. Cab., vol. 2, p. 193, pl. 54, fig. 540.
Area squamosa LAMARCK, Anim. s. Vert., vol. 6, p. 35, 1819.
Area domingensis LAMARCK, Anim. s. Vert., p. 40, 1819.
Area clathrata LAMARCK, Anim. s. Vert., p. 46, 1819.
?*Area gradata* BRODERIP and SOWERBY, Zool. Journ., vol. 4, p. 365, 1829.
Area divaricata SOWERBY, Proc. Zool. Soc., 1833, p. 18.—REEVE, Conch. Icon. *Area*, pl. 16, fig. 108, 1844.
Barbatia (Acar) reticulata DALL, Trans. Wagner Inst., vol 3, pt. 4, p. 629, 1898.

Eocene of the Jacksonian at Moody's branch, Jackson, Mississippi; Oligocene of the Bowden beds, Jamaica, West Indies, of the island of Trinidad, at Matura; of the Tampa silex beds at Ballast Point, Tampa Bay, and of the Chipola River marls; Pliocene of the Caloosahatchie River, Florida, and of Limon, Costa Rica; Pleistocene of the Antilles, generally; and living from Cape Hatteras, North Carolina, North Carolina, south to Barbados and the Gulf of Campeche, Mexico. U. S. Nat. Mus. No. 165178.

The fossils are identical with the living shells, and there can be no doubt that the species has existed, with its mutations essentially as at present, in the Antillean region since the upper Eocene.

Section **FOSSULARCA** Cossmann.

Fossularca Cossmann, Cat. Illustr., 1887, p. 142. Type, *Arca quadrilatera* Lamarck. Eocene of Paris.

BARBATIA (FOSSULARCA) ADAMSI E. A. Smith.

Arca coelata Conrad, Fossils Medial Tert., p. 61, pl. 32, fig. 2, 1845; not of Reeve, Conch. Icon. *Arca*, 1844.

Arca lactea C. B. Adams, Manuscript; not of Linnaeus.

Arca adamsi (Shuttleworth Ms.) Smith, Journ. Linn. Soc. London, Zool., vol. 20, p. 499, pl. 30, figs. 6, 6*a*, 1888.—Dall, Bull. Mus. Comp. Zool., vol. 12, p. 243, 1886.

Barbatia (*Fossularca*) *adamsi* Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 629, 1898.

Oligocene of the Tampa silex beds at Ballast Point, of the Chipola marls and Oak Grove sands of Florida; of the Bowden beds, Jamaica, West Indies. Miocene of Duplin County, North Carolina. Pliocene of Waccamaw River, South Carolina; of the Caloosahatchee River, Shell Creek, and Alligator Creek, Florida. Living from North Carolina to Brazil, in 5 to 116 fathoms. U. S. Nat. Mus. No. 165179.

Subgenus **SCAPHARCA** Gray.

Scapharca Gray, Proc. Zool. Soc. London, 1847, p. 198. Type, *Arca inaequivalvis* Bruguière.—H. and A. Adams, Gen. Rec. Moll., vol. 2, p. 538, 1857.—Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 618, 1898.

SCAPHARCA HYPOMELA Dall.

Plate 17, fig. 7; plate 21, figs. 17, 18.

Scapharca (*Scapharca*) *hypomela* Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 637, pl. 33, fig. 1, 1898.

Oligocene of the Tampa silex beds at Ballast Point, of the lower bed at Alum Bluff, Chattahoochee River, and of the Chipola marls, Calhoun County, Florida. U. S. Nat. Mus. Nos. 165180, 165181.

SCAPHARCA LATIDENTATA Dall.

Plate 25, fig. 2.

Scapharca (*Scapharca*) *latidentata* Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 638 pl. 32, fig. 15, 1898.

Oligocene of the Tampa silex beds at Ballast Point; of the lower bed at Alum Bluff, Chattahoochee River; of the Chipola marls, Chipola River, Calhoun County, Florida; and probably of the Oak Grove sands, Santa Rosa County, Florida. U. S. Nat. Mus. No. 149010.

The young of *Anadara aresta* Dall look a good deal like this species, but have the beaks more central and prominent and not mesially impressed.

Genus GLYCYMERIS Da Costa.

Glycymeris Da Costa, Brit. Conch., p. 170, 1778; Mus. Calonnianum, p. 50, 1797. Type, *Arca glycymeris* Linnaeus.

Tucetа Bolten, Mus. Boltenianum, p. 172, 1798, ed. 2, p. 120, 1819. First species, *Arca pilosa* Linnaeus.

Axinea+Axinocderma Poli, Test. Utr. Siciliae, vol. 1, p. 32, 1791; vol. 2, p. 254, 1795 (not binomial).

Pectunculus Lamarck, Prodrome, p. 87, 1799. Type, *Arca pectunculus* Linnaeus.—Lamy, Journ. de Conchyl., Feb., 1912, p. 84. Not of Huddesford, App. to Lister Conch. Index to Anat. plates, p. 5, pl. 13, fig. 1, 1760.=*Cardium edule* Linnaeus.

Glycymeris Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 607, 1898; Proc. Mal. Soc. London, vol. 10, pt. 3, p. 255, 1912. Not *Glycymeris* Lamarck, 1799 or 1801.

GLYCYMERIS LAMYI, new species.

Plate 20, figs. 11, 13.

Shell small, solid, moderately convex, equivalve, and nearly equilateral; beaks small, low, pointed, median, separated by a narrow diamond-shaped area with about half a dozen ligamentary grooves divaricating from a central imaginary line perpendicular to the beak in each valve; external sculpture of about 20 low, slightly convex, primary radiating riblets, with from one to three smaller intercalary close-set threads in the interspaces; the primary ribs extend over the anterior and middle portions of the shell, but cease near the posterior end, which is sculptured on the posterior area only by threads of the secondary type of which there are about a dozen; these radial ribs are crossed by concentric lines, sometimes rather pronounced, in harmony with the lines of growth and better developed near the margin; profile slightly attenuated toward the beaks and at the lower end of the posterior dorsal area slightly subangular; interior smooth, the margin crenulate as figured; muscular impressions small, distinct; disk smooth; hinge with about 10 teeth on each side of the median line, symmetrically arranged. Height 16.5 mm., breadth 17.5 mm., diameter 8 mm.

Tampa silex beds Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection. U. S. Nat. Mus. No. 165173.

This form is nearest *G. arctata* Conrad of the Vicksburg horizon in which the radial sculpture is strongest on the beaks and the coarse ribs divide later, while in the present species the radials are smaller on the beaks and stronger distally. The Vicksburg species is also generally higher and somewhat shorter.

Family OSTREIDAE.

Genus OSTREA (Linnaeus) Lamarck.

Ostrea Linnaeus, Syst. Nat., ed. 10, p. 696, 1758.—Lamarck, Prodrome, p. 81, 1799. Type, *Ostrea edulis* Linnaeus.

OSTREA SELLAEFORMIS Conrad var. RUGIFERA Dall.

Ostrea sellaeformis Conrad var. *rugifera* Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 678, 1898.

Oligocene of the Tampa silex beds, Ballast Point; of the Chipola marls and the lower bed at Alum Bluff, Chattahoochee River, Florida. U. S. Nat. Mus. No. 114825.

The typical *O. sellaeformis*, as is well known, is Eocene in distribution; the middle Oligocene form is that I have called *rugifera*, but which is not yet represented by any really well-preserved specimens in the material I have seen; the last term of the series in the upper Oligocene, at Oak Grove, Santa Rosa County, Florida, is that to which I have given the name of variety *pauciplicata*.

OSTREA MAURICIENSIS Gabb?

Ostrea mauriciensis Gabb, (part) Journ. Acad. Nat. Sci. Phila., ser. 2, p. 376, pl. 67, 1860.

Oligocene of the mixed marls of southern New Jersey, of the layers above the Altamaha grit of Georgia, and of the Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 153851.

Part of Gabb's *O. mauriciensis* seems to be young *O. georgiana* Conrad; part approaches very closely the *O. virginica* Gmelin; but in nearly all cases the superficial layers of the shell have been destroyed, and the specific identifications must be merely guesswork. Whether there is a really distinct species in the complex remains uncertain.

OSTREA VAUGHANI, new species.

Plate 19, fig. 6.

Shell solid, heavy, with the external sculpture of both valves similar, composed of closely adjacent concentric imbrications or overlapping lamellae corresponding to the incremental lines, with no trace of any radial sculpture; upper valve moderately convex; beak strongly recurved, with a deep wide medial ligamentary sulcus; the inner margins of the valves near the hinge, with a sparse denticulation, especially on the anterior margin. Length 120, width 85, depth of paired valves 60 mm.

Ballast Point, Tampa Bay, either from the silex beds or the limestone immediately above them; E. J. Post. U. S. Nat. Mus. No. 166092.

This fine oyster does not agree with any of the described species of the Oligocene of the coastal plain, and is named in honor of Dr. T. Wayland Vaughan, who has been in charge of the geological exploration of that region for some years.

Family PECTINIDAE.

Genus PECTEN Müller.

Pecten (Klein, 1753) Müller, Zool. Dan. Prodr., p. 248, 1766.—Da Costa, Brit. Conch., p. 140, 1778.—Bolten Mus. Bolt., p. 165, 1798.—Lamarck, Prodrome d'un Nouveau Class. Coq., p. 88, 1799.—Verrill, Trans. Conn. Acad. Sci., vol. 10, pp. 41–47, 1897.—Dall, Trans. Wagner Inst., vol. 3, pt. 4, pp. 689–758, 1898. Type *P. maximus* Müller (=*Ostrea maxima* Linnaeus).

Subgenus CHLAMYS Bolten.

Chlamys Bolten, Mus. Bolt., p. 161, 1798. Type, *Pecten islandicus* Müller.

Section AEQUIPECTEN Fischer.

Aequipecten Fischer, Man. de Conchyl., p. 944, 1886. Type, *Pecten opercularis* Linnaeus.

PECTEN (AEQUIPECTEN) CHIPOLANUS Dall.

Plate 23, fig. 2.

Pecten (*Aequipecten*) *chipolanus* Dall, Trans. Wagner Inst., vol. 3, p. 733, pl. 29, fig. 9, 1898.

Oligocene of the Tampa silex beds at Ballast Point; of the lower bed at Alum Bluff, Chattahoochee River; and the Chipola marl of the Chipola River, Calhoun County, Florida; Dall and Burns. U. S. Nat. Mus. No. 114784.

Family SPONDYLIDAE.

Genus SPONDYLUS Linnaeus.

Spondylus Linnaeus, Syst. Nat., ed. 10, p. 690, 1758. Type, *Spondylus gaederopus* Linnaeus.

SPONDYLUS BOSTRYCHITES Guppy.

Plate 19, fig. 4.

Spondylus bifrons Sowerby, Quart. Journ., Geol. Soc. Lond., vol. 6, p. 53, 1849; not of Goldfuss, Petref., vol. 2, p. 99, pl. 106, figs. 10 *a–c*, 1835.

Spondylus bostrychites Guppy, Proc. Sci. Soc. Trinidad, p. 176, 1867.—Gabb, Geol. Santo Domingo, p. 257, 1873.—Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 758, 1898.

Oligocene of the Tampa silex beds and of the limestone of White Beach, near Osprey, Florida; of Santo Domingo at Ponton; the Bowden beds of Jamaica and of Anguilla, West Indies. U. S. N. Mus. No. 165182.

SPONDYLUS CHIPOLANUS Dall.

Plate 19, fig. 1.

Spondylus (*bostrychites* var. ?) *chipolanus* Dall, Trans. Wagner Inst., pt. 4, p. 758, 1898.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, of the lower beds at Alum Bluff, Chattahoochee River; of the Chipola marls of Calhoun County, near the county bridge over the Chipola River; and of the sands at Oak Grove, Santa Rosa County, Florida. U. S. Nat. Mus. No. 114817.

This species at first suspected from poor material to be a variety of *S. bostrychites*, has no radial striation on the minor ribs, but rather a concentric sculpture, also a greater number of spinose ribs, and more oval and inflated form.

Genus PLICATULA Lamarck.

Plicatula Lamarck, Syst. An. s. Vert., p. 132, 1801. Type, *Plicatula gibbosa* Lamarck An. s. Vert., *P. ramosa* Lamarck 1819.—Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 761, 1898.

Harpax Parkinson, Org. Rem., vol. 3, pl. 12, 1811.—Brooks, Intr. Conch., p. 83, 1815. Type, *H. parkinsonii* Bronn.

Ostreonomia Conrad, Proc. Acad. Nat. Sci. Phila., for 1872, p. 216. Type, *O. carolinensis* Conrad.

PLICATULA DENSATA Conrad.

Plicatula densata Conrad, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 311, 1843. Medial Tert., p. 75, pl. 43, fig. 6, 1845; Proc. Acad. Nat. Sci. Phila., vol. 14, p. 582, 1863.—Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 763, 1898.

Spondylus inornatus Whitfield, Miocene Pal. N. J., p. 34, pl. 5, figs. 1, 2, 1895.

Oligocene of the Peninsular limestone of Archer, Florida, and the Nummulitic horizon at Ocala, Florida, Dall and Willcox; of the Tampa silex beds at Ballast Point; the Chipola marls of Calhoun County; of the lower bed at Alum Bluff on the Chattahoochee River, and of the Oak Grove sands, Santa Rosa County, Florida; also of the Bowden beds of Jamaica, West Indies, and the Guallava beds of Costa Rica. Also in the lower Miocene marls of Cumberland County, New Jersey, at Shiloh and Jericho. U. S. N. Mus. No. 165183.

This species is distinguished from the later *P. marginata* Say, by its usually rounder form and more numerous and less prominent plications. Occasional specimens when attached to a flat surface by a considerable area of the attached valve, do not develop plications, and one such served as the type of Whitfield's *Spondylus inornatus*.

Family ANOMIIDAE.

Genus ANOMIA (Linnaeus) Müller.

Anomia (part) LINNAEUS, Syst. Nat., ed. 10, p. 700, 1758.

Anomia MÜLLER, Prodr. Zool. Dan., pp. xxx, 248, 1776.—RETZIUS, Diss. Phillips., p. 9, 1788.

Echion+Echionoderma POLI, Test. Utr. Sicil., vol. 1, p. 34; vol. 2, p. 255, 1791. (Not binomial.)

Cepa (Hwass Ms) ANONYMOUS, Mus. Calonnianum, p. 45, 1797.

Fenestella BOLTEN, Mus. Boltenianum, p. 193, 1798; ed. 2, p. 134, 1819.

Anomya AGASSIZ, Moules des Moll., vol. 1, p. 23, 1839.

Diploschiza CONRAD, Amer. Journ. Conch., vol. 2, pp. 77, 105, 1866.

Not *Anomia* DA COSTA, Elem. Conch., p. 292, pl. 6, figs. 3, 10, 1776; nor of Bolten, Mus. Boltenianum, p. 134, 1798 (Brachiopoda).

ANOMIA MICROGRAMMATA Dall.

Plate 23, fig. 6.

Anomia microgrammata DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 783, pl. 35, fig. 11, 1898.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, Dall, Burns, and Willcox; of the lower bed at Alum Bluff, Chattahoochee River, and of the Chipola River marls, Calhoun County, Florida. Also of the Bowden horizon, Jamaica, West Indies; Henderson and Simpson (var. *indecisa*). U. S. Nat. Mus. No. 114824.

This species is recognized by its fine almost divaricate striation, which does not break into pustules near the beak as in the larger and more coarsely sculptured *A. ephippioides* Gabb.

The Bowden form[1] has a still finer and often partially obsolete striation.

Family MYTILIDAE.

Genus MODIOLUS Lamarck.

Modiolus LAMARCK, Prodr. Nouv. Class. Coq., p. 87, 1799. Type, *Mytilus modiolus* Linnaeus.—Bosc, Hist. Coq., vol. 3, p. 158, 1802.—LINK, Beschr. Rostock Samml., vol. 3, p. 146, 1807.—CUVIER, Règne Anim., vol. 2, p. 471, 1817.—GOLDFUSS, Zool., p. 611, 1820.—RISSO, Hist., vol. 4, p. 323, 1826.—FLEMING, Hist. Brit. Anim., p. 408, 1828.—FORBES, Mal. Monensis, p. 43, 1838.—HERRMANNSEN, Ind. Gen. Mal., suppl., p. 84, 1852.—DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 790, 1898.

Modiola LAMARCK, Syst. An. s. Vert., p. 113, 1801. Type, *M. papuana* Lamarck, Encycl. Méth., pl. 219, fig. 1.—ROISSY, Moll., vol. 6, p. 273, 1805.—LAMARCK, Anim. s. Vert., vol. 6, p. 119, 1819.—FISCHER, Man. de Conchyl., p. 968, 1886.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 38, 1889.

Mytilus SCOPOLI, Intr. ad Hist. Nat., 1777, p. 397, No. 81; not of Linnaeus. Not *Volsella* Scopoli, Intr. ad Hist. Nat., 1877, No. 84, =*Mytilus* Linnaeus.

[1] Var. *indecisa* Guppy Ms. in Trans. Wagner Inst., vol. 3, pt. 4, p. 783, 1898.

MODIOLUS SILICATUS Dall.

Plate 24, fig. 11.

Modiolus silicatus DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 793, pl. 27, fig. 28, 1898.

Modiolus tampaënsis DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 922, by inadvertence.

Tampa silex beds, Ballast Point, Tampa Bay, Florida; Willcox and Dall. U. S. Nat. Mus. No. 154349.

MODIOLUS BLANDUS, new species.

Plate 20, figs. 3, 6, 12.

Shell of moderate size, thin, rounded in front and behind, dorsally subalate, margins entire with hardly any byssal gape; valves inflated, surface smooth except for incremental lines.

Length 44, height 23, maximum diameter 21 mm.

Ballast Point, Tampa Bay, Florida; E. J. Post, probably from the limestone overlying the silex beds. U. S. Nat. Mus., No. 165226.

The specimen is a well preserved internal cast.

Section BRACHYDONTES Swainson.

Brachidontes SWAINSON, Malac., p. 384, 1840. Type, *Modiola sulcata* Lamarck (1819 not 1807).

Brachydontes FISCHER, Man. de Conchyl., p. 968, 1886.—DALL, Bull. U. S. Nat. Mus. No. 37, p. 138, 1889.

Semimodiola COSSMANN, Cat. Illustr., vol. 2, p. 158, 1887. Type, *Modiola hastata* Deshayes.

Semimodiola COSSMANN, Cat. Illustr., vol. 2, p. 158, 1887. Type, *Modiola sulcata* Lamarck, not Risso.

Brachydontes DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 791, 1898.

MODIOLUS (BRACHYDONTES) GRAMMATUS Dall.

Plate 26, fig. 4.

Modiolus (*Brachydontes*) *grammatus* DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 794, pl. 30, fig. 2, 1898.

Tampa silex beds at Ballast Point, Tampa Bay, Florida, Dall, U. S. Nat. Mus. No. 165184. A variety *curtulus* Dall, was obtained by Burns from the lower bed at Alum Bluff, Chattahoochee River, Florida.

The variety is stouter than the type-species, more triangular, with coarser and more nodulous ribs and stronger crenulations of the margin.

Section GREGARIELLA Monterosato.

Gregariella Monterosato, Nom. Con. Medit., p. 11, 1884.—Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 91, 1898. Type, *Mytilus petagnae* Scacchi.

Botulina Dall, Bull. U. S. Nat. Mus. No. 37, p. 38, 1889. Sole example, *Modiola opifex* Say=*Mytilus coralliophagus* Gmelin, and *Modiola semen* Lamarck.

MODIOLUS (GREGARIELLA) MINIMUS Dall.

Plate 24, fig. 6.

Modiolus (*Gregariella*) *minimus* Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 797, pl. 35, fig. 26, 1898.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 165185.

Based on an imperfect but characteristic pseudomorph. The complete external features of this species are still to be discovered.

MODIOLUS (GREGARIELLA) cf. OPIFEX Say.

An internal cast strongly recalling the form of *M. opifex* Say was obtained by Mr. Post, but is without the surface characters by which its specific identity might be determined. U. S. Nat. Mus. No. 214741.

Section BOTULA Mörch.

Botula Mörch, Yoldi Cat., pt. 2, p. 55, 1853 (no type cited).—H. and A. Adams, Gen. Rec. Moll., vol. 2, p. 519, 1857.—Fischer, Man. de Conchyl., p. 969, 1886. Type, *M. cinnamomeus* Lamarck.

MODIOLUS (BOTULA) CINNAMOMEUS Lamarck.

Modiola cinnamomea Lamarck, Anim. s. Vert., vol. 6, p. 114, 1819; ed. Deshayes, vol. 7, p. 25, 1835; after Chemnitz, Conchyl. Cab., vol. 8, p. 152, pl. 82, fig. 731, 1785.

Modiolus (*Botula*) *cinnamomeus* Dall, Trans. Wagner Inst., vol. 3, p. 797, 1898.

Oligocene of the Tampa silex beds at Ballast Point, of the marl of the Chipola River, Calhoun County, Florida, and of the island of Trinidad, West Indies. U. S. Nat. Mus. No. 165186.

Also in Pliocene marl of the Caloosahatchie beds of Florida, and widely distributed in the warmer waters of the United States and the West Indies in the recent state, usually as a borer in coral or other soft and limy substances. A similar if not identical shell, *M. fuscus* Gmelin, has been reported from the Indo-Pacific region.

Genus LITHOPHAGA Bolten.

Lithophaga Bolten, Mus. Boltenianum, p. 156, 1798; ed. 2, p. 109, 1819.—Mörch, Cat. Yoldi, p. 55, 1853.

Lithodomus Cuvier, Règne Anim., vol. 2, p. 471, 1817.

Lithophagus Megerle, Entwurf., p. 69, 1811.

Lithophaga Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 798, 1898.

LITHOPHAGA ANTILLARUM Orbigny.

Lithodomus antillarum ORBIGNY, Moll. Cubana, vol. 2, p. 332, pl. 28, figs. 12, 13, 1847 (French edition; Spanish edition, with atlas, 1845).
Modiola corrugata PHILIPPI, Abbild. und Beschr., vol. 2, p. 147, pl. 1, fig. 1, 1846.
Lithodomus corrugatus REEVE, Conch. Iconica, vol. 10, pl. 1, fig. 1, 1858.
Lithophagus dactylus MÖRCH, Cat. Yoldi, vol. 2, p. 55, 1853; not of Sowerby, 1824.
Lithophagus caribæus DALL, Bull. U. S. Nat. Mus., No. 37, p. 38, No. 81, 1889; not of Philippi.
Lithophaga antillarum DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 799, 1898.

Tampa silex beds, Ballast Point, Tampa Bay, Florida; Willcox and Dall. Living from Florida southward, throughout the Antilles, usually as a borer in corals. U. S. Nat. Mus. No. 154861.

The casts of the borings due to this and the other species are rather common in the silex beds, often being hollow and the cavity partly filled with water, in which state they are sold as curios to tourists.

LITHOPHAGA NIGRA Orbigny.

Lithodomus niger ORBIGNY, Moll. Cubana, vol. 2, p. 331, pl. 28, figs. 10, 11, 1847 (French edition; Spanish edition, 1845).
Modiola caribæa PHILLIPPI, Abbild. und Beschr., vol. 3, p. 20, pl. 2, fig. 5, 1847; Zeitschr. f. Malak. for 1847, p. 116.
Modiola antillarum PHILIPPI (not Orbigny), Abbild. und Beschr., vol. 3, p. 20, pl. 2, fig. 4, 1847; Zeitschr. f. Malak. for 1847, p. 116 (young shell).
Mytilus lithophagus GIBBES, S. Car. Cat., p. 22, 1848, not of Linnaeus.
Lithophagus nigra MÖRCH, Cat. Yoldi, vol. 2, p. 56, 1853.
Lithodomus antillarum REEVE, Conch. Iconica, vol. 10, pl. 2, fig. 7, 1858.
Lithophaga nigra DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 799, 1898.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Living from South Carolina southward through the West Indies and to Rio Janeiro, Brazil. U. S. Nat. Mus. No. 154360.

LITHOPHAGA NUDA Dall.

Plate 24, fig. 4; plate 26, fig. 7.

Lithophaga nuda DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 800, pl. 11, fig. 7, pl. 35, fig. 27, 1898.

Tampa silex beds at Ballast Point, where it and the casts of the burrows are very common, but rarely well preserved. U. S. Nat. Mus. Nos. 165187, 165189.

Few of the specimens retain the thin outer coating of the valves, but those that do are easily recognized by their smooth surface and distinguished from the species of *Diberus* by the cylindrical form and absence of the calcareous mantle outside of the shell. The burrow cast is represented by figure 4.

Section **MYOFORCEPS** Fischer.

Myoforceps Fischer, Man. de Conchyl., p. 969, 1886.—Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 799, 1898.

It is one of the puzzles of malacology how the appendages, composed of the dust of their borings, are applied to the outside of their shell by these mollusks and permanently fixed there.

LITHOPHAGA (MYOFORCEPS) ARISTATA Dillwyn.

Mytilus aristatus (Solander MS.) Dillwyn, Cat. Rec. Sh., vol. 1, p. 303, 1817.

Modiola caudigera Lamarck, Anim. s. Vert., vol. 6, p. 116, 1819; Encycl. Meth., pl. 201, fig. 8.—Philippi, Abbild. und Beschr., vol. 2, p. 149, pl. 1, fig. 5, 1846.

Mytilus caudigerus Gibbes, Cat. S. Car., p. 22, 1848.

Lithodomus aristatus Forbes and Hanley, Brit. Moll., vol. 2 ,p. 212, 1851.

Lithodomus caudigerus Sowerby, Genera, Lithodomus, fig. 4, 1824.—Reeve, Conch. Iconica, vol. 10, pl. 3, fig. 16, 1857.

Lithophagus aristatus Stimpson, Checkl. Rec. Sh., p. 2, 1860.

Lithophagus forficatus Ravenel, Proc. Acad. Nat. Sci. Phila., for 1861, p. 44.—Tryon, Amer. Marine Conch., p. 188, 1873.—Dall, Bull. U. S. Nat. Mus. No. 37, p. 38, 1889.

Lithophaga (*Myoforceps*) *aristata* Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 800, 1889.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Living widely distributed over the tropical seas of both hemispheres. U. S. Nat. Mus. No. 165188.

Section **DIBERUS** Dall.

Diberus Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 799, 1898. Type, *Lithophaga plumula* Hanley.

LITHOPHAGA (DIBERUS) BISULCATA Orbigny.

Lithodomus bisulcatus Orbigny, Moll. Cubana, vol. 2, p. 333, pl. 28, figs. 14–16, 1847 (Spanish edition, 1845).

Modiola appendiculata Philippi, Abbild. und Beschr., vol. 2, p. 150, pl. 1, fig. 4, 1846.

Mytilus attenuatus Gibbes, Cat. S. Car., p. 22, 1848, not of Deshayes.

Lithophagus appendiculatus Mörch, Cat. Yoldi., vol. 2, p. 56, 1853.

Lithodomus appendiculatus Reeve, Conch. Iconica, vol. 10, pl. 4, fig. 21, 1857.

Lithodomus biexcavatus Reeve, Conch. Iconica, vol, 10, fig. 22 *a–b*, 1857.

Lithophaga (*Diberus*) *bisulcata* Dall, Trans. Wagner Inst., vol. 3, pt. 4, p. 801, 1898.

Tampa silex beds, Ballast Point, Tampa Bay, Florida; Dall. Living from South Carolina south to Rio Janeiro and throughout the West Indies. U. S. Nat. Mus. No. 154362.

This species was found with a siliceous pseudomorph of the calcareous mantle as well as the shell.

Family PLEUROPHORIDAE.

Genus CORALLIOPHAGA Blainville.

Coralliophaga BLAINVILLE, Man. Malac., p. 560, 1825.
Lithophagella (Gray Ms. ?) *fide* H. and A. ADAMS, Gen. Rec. Moll., vol. 2, p. 439, 1857.
Cypricardia (sp.) LAMARCK, Anim. s. Vert., vol. 6, pt. 1, p. 28, No. 4, 1819.
Coralliophaga DALL, Trans. Wagner Inst., vol. 3, pt. 6, pp. 1497, 1498, Oct., 1903.

CORALLIOPHAGA ELEGANTULA Dall.

Plate 23, figs. 11, 13.

Coralliophaga elegantula DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1499, pl. 25, figs. 2, 2*a*, 1903.
Coralliophaga elegans DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 920, pl. 25, figs. 2, 2*a*, 1898; not Deshayes, 1824.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, and of the Chipola River marls, Calhoun County, Florida; Dall and Crosby. U. S. Nat. Mus. No. 155710.

This can be discriminated from any other American species by its surface—smooth, except for faint incremental lines.

Family CRASSATELLITIDAE.

Genus CRASSATELLITES Krüger.

Crassatellites KRÜGER, Arch. neuest. Entd. Urwelt, vol. 2, p. 466, 1823. Type, *Crassatella gibbosula* Lamarck.—DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1468, 1903.
Crassatella (sp.) LAMARCK, Syst. Anim. s. Vert., p. 119, 1801, not of Lamarck, Prodrome, p. 85, 1799.

Section SCAMBULA Conrad.

Scambula CONRAD, Amer. Journ. Conch., vol. 5, p. 51, 1869 (part). Type, *S. perplana* Conrad, Amer. Journ. Conch., vol. 5, p. 48, pl. 9, figs. 7, 8, 1869.—DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1467, 1903.

CRASSATELLITES DEFORMIS Heilprin.

Plate 22, figs. 6, 7.

Crassatella deformis HEILPRIN, Trans. Wagner Inst., vol. 1, p. 117, pl. 16, fig. 63, 1887.
Crassatellites (*Scambula*) *deformis* DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1471, 1903.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Willcox, Heilprin, Post, and Dall. U. S. Nat. Mus. No. 165191.

Family CARDITIDAE.

Genus VENERICARDIA Lamarck.

Venericardia LAMARCK, Syst. des. Anim. s. Vert., 1801, p. 123. Type. *V. imbricata* Lamarck. Eocene.

Cardissa OKEN, Lehrb. d. Naturg., vol. 3, 1815, pp. viii, 232, 234; not of Megerle, 1811.

Megacardita SACCO, Moll. Piem. Lig., vol. 27, 1899, p. 9. Type, *V. jouanneti* Basterot.

Venericardia DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1416, 1903.

VENERICARDIA SERRICOSTA Heilprin.

Plate 26, fig. 6.

Cardita (*Carditamera*) *serricosta* HEILPRIN, Trans. Wagner Inst., vol. 1, p. 117, pl. 16, fig. 64, 1887.

Cardita serricosta DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1194, pl. 38, fig. 9, 1900.

Venericardia serricosta DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1428, 1903.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, and of Bailey's Mill Creek Sink, in Jefferson County, Florida. U. S. Nat. Mus. No. 165192.

All collectors who have visited the silex beds have obtained this species, which is one of the most common bivalves of that horizon, and, when silicified, one of the most elegant.

VENERICARDIA HIMERTA Dall.

Cardita (sp.) DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1196, pl. 40, fig. 16, 1900.

Venericardia himerta DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1430, pl. 53, fig. 12, 1903.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, and of the Oak Grove sands at Oak Grove, Santa Rosa County, Florida. U. S. Nat. Mus. No. 166109.

Genus CARDITA (Bruguière) Lamarck.

Cardita (*part*) BRUGUIÈRE, Encycl. Méth., vol. 1, p. 401, 1792.

Cardita LAMARCK, Prodr. Nouv. Class Coq., 1799, p. 86. Sole example, *C. calyculata* Bruguière.—DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1411, 1903.

Section CARDITAMERA Conrad.

Carditamera CONRAD, Foss. Medial. Tert., p. 11, 1838. Type, *Cypricardia arata* Conrad, 1832.—DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1412, 1903.

Lazaria GRAY, Ann. Mag. N. Hist., vol. 14, p. 22, 1854. Type, *L. radiata* Reeve.

Lazariella SACCO, Moll. Piem. e Lig., 1899, p. 112. Type, *Cardita subalpina* Michelotti.

CARDITA (CARDITAMERA) TEGEA Dall.

Plate 17, fig. 1.

Cardita (*Carditamera*) *recta* Dall, Trans. Wagner Inst., vol. 3, pt. 1, p. 189, pl. 11, fig. 4, 1890; not of Conrad, 1868.

Cardita (*Carditamera*) *tegea* Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1412, 1903.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay; of the lower bed at Alum Bluff, Chattahoochee River; and of the Chipola marls near the county bridge, Chipola River, Calhoun County, Florida; Shepard, Burns, and Dall. U. S. Nat. Mus. No. 165194.

The figure is taken from a pseudomorph which was formed after a specimen perhaps somewhat worn before fossilization. The fresher specimens from Calhoun County are less smooth.

CARDITA SHEPARDI, new species.

Plate 21, figs. 10, 12.

Shell small, inflated, solid, subquadrate; beaks moderately elevated, situated in the anterior third of the shell; sculpture of (on the left valve about 21) elevated rounded ribs with deep, equal, or wider channeled interspaces; the ribs are ornamented with numerous prominent nodules rather sparsely distributed and on the posterior slope becoming more prominent and imbricated; anterior end rounded posterior subtruncate; base medially compressed; hinge as usual in the genus, rather delicate; inner margins of the valves crenulated by the sculpture. Length 9.75, height 6, diameter 6 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Post collection, U. S. Nat. Mus. No. 165193.

This little species is closely related to the recent *C. domingensis* of the West Indies.

Family CYRENIDAE.

Genus CYRENA Lamarck.

Cyrena (part) Lamarck, Anim. s. Vert., vol. 5, p. 551 *bis*, 1818.—Bowdich, Elem. Conch., vol. 2, p. 9, 1822.—Anton, Verz. Conch., p. 13, 1839.

Cyrena Sowerby, Gen. Shells, fasc. 5, 1822.—Swainson, Malac., p. 370, fig. 119*a*, 1840.—Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1441, 1903. Type, *Cyrena bengalensis* Lamarck.

Section POLYMESODA Rafinesque.

Polymesoda Rafinesque, Ann Gén. Sci. Phys. Bruxelles, 1820, p. 319. Type, *Cyclas caroliniana* Bosc=*Cyrena carolinensis* Hanley.—Morch, Malak. Blätt., vol. 7, p. 193, 1861; Journ. de Conchyl., vol. 9, p. 348, 1861.—Pilsbry, Nautilus, vol. 15, p. 48, 1901.—Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1442, 1903.

Leptosiphon FISCHER, Ann. Lyc. Nat. Hist. N. Y., vol. 10, p. 195, 1872. Type, *Cyrena carolinensis* Hanley.

Cyprinella GABB, Pal. Cal., vol. 1, p. 170, 1864; not of Girard, 1856.

Diodus GABB, Pal. Cal., vol. 2, p. 242, 1868; new name for *Cyprinella* Gabb *not* Girard.

CYRENA (POLYMESODA?) POMPHOLYX Dall.

Plate 22, figs. 4, 5, 8.

Cyrena pompholyx DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1194, pl. 38, figs. 7, 8, 1900; pt. 6, p. 1445, 1903.

Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dill, Willcox, and Post. U. S. Nat. Mus. No. 165190.

This neat species is not at all uncommon in the silex beds and frequently beautifully preserved in a pseudomorph of translucent silex.

Genus VILLORITA Gray.

Villorita GRAY, in Griffith's Cuvier, Moll., p. 601, pl. 31, fig. 5, 1833. Type, *Cyrena cyprinoides* Wood.

Villorita DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1451, 1903.

Villarita PHILIPPI, Handb. d. Conch., p. 315, 1853.

Velorita GRAY, Syn. Brit. Mus., pp. 75, 91, 1842 (nude name), *fide* Gray, Proc. Zool. Soc. Lond., 1847, p. 184; Ann. Mag. Nat. Hist., ser. 2, vol. 11, p. 38, 1853.—DESHAYES, Cat. Conch. Brit. Mus., vol. 2, p. 219, 1854.

VILLORITA FLORIDANA Dall.

Plate 17, figs. 9, 10; plate 18, figs. 8, 10, 11.

Velorita floridana DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1199, pl. 43, figs. 8, 13, 1900.

Villorita floridana DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1452, 1903.

Tampa silex beds, from the ship channel off Ballast Point, Tampa Bay, Florida, from rock dredged up in deepening the channel, containing fossils which have not been silicified. Dall and Post. U. S. Nat. Mus. Nos. 107737, 214304.

As was stated in my original publication, this fossil has the conchological features of the recent species, the *V. cyprinoides* of Asia, but the combination is one which is probably due to dynamic causes operating upon a species of *Cyrena*, and which might occur sporadically anywhere within the distribution of the genus *Cyrena*. The Asiatic or African forms have probably no more intimate connection with the American fossils than that thus indicated, and the same is true of the fossil *Batissa* from the Puget Group and its South Sea analogues. The "genus" *Hinnites* is another form in which it is unlikely that there is any genetic connection between the species occurring in different horizons except what is furnished by the genus *Pecten*, from which *Hinnites* species are probably mere "sports."

Family CHAMIDAE.

Genus CHAMA (Linnaeus) Bruguière.

Chama LINNAEUS (part) Syst. Nat., ed. 10, p. 691, 1758. First species, *C. lazarus* Linnaeus (not of Lamarck).

Chama BRUGUIÈRE, Hist. Nat. des Vers., vol. 1, pt. 2, Encycl. Méth., vol. 6, pp. xiii, 1789, and 385, 1792.

Psilopus OKEN, Lehrb. d. Naturg, p. 231, 1815.

Maceris MODEER, K. Vet. Ak. nya Handl., vol. 14, pp. 174, 182, 1793.

Planospirites LAMARCK, Anim. s. Vert., p. 400, 1801. Sole example, *P. ostracina* Lamarck (Cretaceous).

Goossensia COSSMANN, Journ. de Conchyl., vol. 33, p. 113, 1885; Cat. Illustr. bassin de Paris, vol. 2, p. 102, 1887. Type, *Cardita irregularis* Deshayes (=*Chama* sp. junior).

Chama DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1393, 1903.

CHAMA CHIPOLANA Dall.

Plate 25, figs. 9, 11.

Chama chipolana DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1398, pl. 56, figs. 19, 20, 1903.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay; of the lower bed at Alum Bluff, Chattahoochee River, Calhoun County; and of the Oak Grove sands, Santa Rosa County, Florida. Dall, Burns, and Aldrich. U. S. Nat. Mus. No. 165196.

CHAMA TAMPAËNSIS Dall.

Plate 24, fig. 1.

Chama tampaënsis DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1398, pl. 54, fig. 6, 1903.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Dall and Burns. U. S. Nat. Mus. No. 165195.

Rather common, but usually badly worn.

Family LUCINIDAE.

Genus CODAKIA Scopoli.

Codakia SCOPOLI, Intr. ad Hist. Nat., p. 396, 1777. (Type, *Chama codok* Adanson.).—DALL, Synopsis Lucinacea, 1901, p. 797; Trans. Wagner Inst., vol. 3, pt. 6, 1903, p. 1344.

Lentillaria SCHUMACHER, Essai, p. 147, 1817. Type, *Venus punctata* Chemnitz.

Orbiculus (sp.) MEGERLE, 1811, not *Orbicula* Lamarck 1799.

Lenticularia GRAY, Proc. Zool. Soc. London, 1847, p. 196.

Antilla DE GREGORIO, Bull. Soc. Malac. Ital. Pisa, vol. 10, p. 217, 1885. Type, *Venus tigrina* Linnaeus. Not *Antillia* Duncan (corals), 1864.

Codokia FISCHER, Man. de Conchyl., 1887 p. 1143.

Lintellaria BUCQUOY, DOLLFUS, and DAUTZENBERG, Moll. Roussillon, vol. 2, p. 635, 1898.

Section JAGONIA Recluz.

Jagonia Recluz, Melanges Malac., p. 14, 1869; Actes Soc. Linn. de Bordeaux, vol. 27, p. 39 1870. Type, *Le jagon* Adanson, =*Venus orbiculata* Montagu, +*Lucina pecten* Lamarck.

CODAKIA (JAGONIA), sp. indet.

Codakia (*Jagonia*), sp. indet. Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1349, 1903.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 165198*a*.

Specimens too young to be positively identified specifically were obtained as above.

CODAKIA (JAGONIA) SCURRA Dall.

Plate 21, figs. 15, 16.

Shell small, rounded quadrate, moderately inflated, with low beaks nearly at the posterior third; a short lanceolate lunule and longer sulcus for the ligament; sculpture of numerous rounded close-set radial ribs, crossed by incremental lines, which rise to low arched imbrications where they override the ribs, especially distally; interior closed by matrix. Length 12, height 8, maximum diameter 6 mm.

Tampa silex beds, at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 165198.

This has much the same sculpture as several of the recent species, though most of the Chipola Jagonias are much smoother and more rounded in shape.

Genus MYRTAEA Turton.

Myrtaea Turton, Dithyra Brit., p. 133, 1822. Sole example, *Venus spinifera* Montagu.—Gray, List Brit. An., p. 98, 1851.—H. and A. Adams, Gen. Rec. Moll., vol. 2, p. 468, 1857.—Dall, Trans. Wagner. Inst., vol. 3, pt. 6, p. 1356, 1903.

Cyrachæa Leach, Moll. Gt. Brit., p. 314, 1852.

Ortygia (sp.) Brown, Ill. Conch. Gt. Britain, pl. 19, figs. 14, 15, 1827.

Myrteopsis Sacco, Moll. Terz. Piem. e Lig., vol. 29, p. 96, 1901. Type, *M. taurolaevis* Sacco.

Section EULOPIA Dall.

Eulopia Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1357, 1903. Type, *Lucina sagrinata* Dall, Proc. U. S. Nat. Mus., vol. 12, p. 263, pl. 14, fig. 11, 1887.

MYRTAEA (EULOPIA) VERMICULATA Dall.

Plate 23, fig. 14.

Myrtaea (*Eulopia*) *vermiculata* Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1359, pl. 52, fig. 5, 1903.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, Florida, and of the Bowden marl of Jamaica, West Indies. Dall, Henderson, and Simpson. U. S. Nat. Mus. No. 157639.

Genus PHACOIDES Blainville.

Phacoides Blainville, Man. Malac., vol. 1, p. 540, 1825. Sole example, *Lucina jamaicensis* Lamarck.

Lucina Lamarck, Syst. An. s. Vert., p. 124, 1801; not of Lamarck, Prodr. 1799.

Phacoides Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1359, 1903.

PHACOIDES DOMINGENSIS Dall.

Plate 23, fig. 9.

Phacoides domingensis Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1363, pl. 50, fig. 11, 1903.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, Florida; of the Bowden marl of Jamaica, West Indies; and of the same horizon on the island in Lake Henriquillo, Santo Domingo. U. S. Nat. Mus. No. 165199.

This is the Oligocene precursor of the recent *P. pectinatus* Gmelin (*P. jamaicensis* Lamarck) and has been identified with the latter by Gabb and Guppy. It is, however, smaller, more inflated, with the notch in front of the anterior dorsal area more indented and angular, the concentric lamellation more distant and more evenly spaced, and the posterior dorsal area shorter in proportion and more triangular.

Subgenus HERE Gabb.

Here Gabb, Pal. Cal., vol. 2, pt. 1, p. 29, 1866; pt. 2, p. 100, 1869. Type, *Lucina richthofeni* Gabb, Pal. Cal., vol. 2, pt. 1, p. 29, 1866.—Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1361, 1903.

Linga De Gregorio, Bull. Soc. Malac. Ital., vol. 10, p. 217, 1885. Type, *Lucina columbella* Lamarck.

Cardiolucina Sacco, Moll. Terz. Piem. e Lig., vol. 29, p. 89, 1901. Type, *Lucina agassizii* Michaux.

PHACOIDES (HERE) WACISSANUS Dall.

Plate 23, fig. 12.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, and of the limestone at Wacissa, Jefferson County, Florida. U. S. Nat. Mus. No. 165200.

Rather common at Ballast Point.

Section **BELLUCINA** Dall.

PHACOIDES (BELLUCINA) TAMPAËNSIS, new species.

Plate 21, figs. 1, 2.

Shell small, truncate-ovate, moderately plump, equivalve, slightly inequilateral, strongly sculptured; beaks small, low, closely adjacent, slightly prosocoelous; anterior dorsal slope excavated with a deeply impressed cordate lunule, smooth and large for the size of the shell; posterior slope direct, with a narrow, hardly depressed lanceolate escutcheon; posterior dorsal area compressed, bordered below by a shallow wide sulcus which is indicated at the posterior margin by a shallow excavation; anterior end broadly rounded, posterior subtruncate, base evenly arcuate; beaks slightly nearer the posterior end of the shell; radial sculpture of (on the type-specimen eleven) rather wide, low, convex, feeble ribs separated by narrower intervals, the ribs sometimes duplex and then narrower; concentric sculpture of low, elevated, narrow lamellae, more crowded on the beaks and near the base, more distant on the middle of the valves, overriding the ribs and intervals; interior of the valves with a strongly crenulate margin; the hinge inaccessible. Length of shell 5 mm., beaks behind the anterior end 2.7 mm., height 4 mm., diameter 2.5 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida.

Type-specimen from the Post collection, U. S. Nat. Mus. No. 165202.

Section **CAVILUCINA** Fischer.

Cavilucina Fischer, Man. de Conchyl., 1887, p. 1143. Type, *Lucina sulcata* Lamarck.—Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1361, 1903.

PHACOIDES (CAVILUCINA) RECURRENS Dall.

Plate 24, fig. 3.

Phacoides (*Cavilucina*) *recurrens* Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1369, pl. 52, fig. 11, 1903.

Oligocene of the silex beds at Miami; of the lower bed at Alum Bluff, Chattahoochee River; of the Chipola marl on the Chipola River, Calhoun County, Florida; and of the Bowden beds, Jamaica, West Indies. U. S. Nat. Mus. No. 114685.

Subgenus **LUCINISCA** Dall.

Lucinisca Dall, Synopsis Lucinacea, Proc. U. S. Nat. Mus., vol. 23, No. 1237, p. 805, 1901. Type, *Lucina nassula* Conrad.—Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1361, 1903.

PHACOIDES (LUCINISCA) PLESIOLOPHUS Dall.

Phacoides (*Lucinisca*) *plesiolophus* Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1371, pl. 40, figs. 2, 5, 1903.

Oligocene sands of Oak Grove, Florida, and the Tampa silex beds. U. S. Nat. Mus. No. 166110.

PHACOIDES (LUCINISCA) CALHOUNENSIS Dall.

Plate 24, fig. 5.

Phacoides (*Lucinisca*) *calhounensis* DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1371, pl. 52, fig. 16, 1903.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, and of the Chipola marl at the county bridge, Chipola River, Calhoun County, Florida. U. S. Nat. Mus. No. 165201.

The Ballast Point specimens were badly worn before fossilization, and present a different aspect from the perfectly preserved specimens from the Chipola marl.

Subgenus MILTHA H. and A. Adams.

Miltha H. and A. ADAMS, Gen. Rec. Moll., vol. 2, p. 468, 1857. Sole example, *Lucina childrenae* Gray.—DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1374, 1903.

PHACOIDES (MILTHA) HILLSBOROËNSIS Heilprin.

Plate 19, fig. 5.

Lucina hillsboroënsis HEILPRIN, Trans. Wagner Inst., vol. 1, pp. 117, 120, pl. 16, fig. 62, 1887.

Phacoides (*Miltha*) *hillsboroënsis* DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1376, 1903.

Oligocene of the Tampa silex beds, Ballast Point, Tampa Bay; of the lower bed at Alum Bluff, Chattahoochee River; and of the Chipola marl, Chipola River, Calhoun County, Florida. Heilprin, Burns, and Dall. U. S. Nat. Mus. No. 114706.

PHACOIDES (MILTHA) HERACLEUS Dall.

Phacoides heracleus DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1376, pl. 51, fig. 10, 1903.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, and of the lower bed at Alum Bluff, Chattahoochee River, Calhoun County, Florida. Dall and Burns. U. S. Nat. Mus. No. 114425.

This is a large species, recalling the *Pseudomiltha gigantea* of the Parisian Eocene, but the teeth are developed. Only one right valve and a fragment have been so far collected.

Family DIPLODONTIDAE.

Genus DIPLODONTA Bronn.

Diplodonta BRONN, Ital. Tert. gebirg., p. ix, 1831. Type, *Venus lupinus* Brocchi, not *Diplodon* Spix, 1827.

Mysia BROWN, Zool. Textb., p. 454, pl. 90, fig. 6, 1833; also of Sowerby, 1842, and Conrad, 1838, but not of Leach, in Lamarck, 1818.

Glocomene LEACH, Moll. Gt. Britain, p. 313, 1852.

Cycladicama VALENCIENNES, Voy. au Pole Sud, vol. 5, p. 116, 1854.

Mitrca GRAY, Fig. Moll. An., vol. 5, p. 35, 1857.

?*Taras* RISSO, Hist. Nat. Eur. Mér., vol. 4, 1826, p. 344, pl. 12, fig. 167. Type, *T. antiquatus* Risso (Tertiary).

Diplodonta DALL, Proc. U. S. Nat. Mus., vol. 23, No. 1237, p. 792, 1901; Trans. Wagner Inst., vol. 3, pt. 6, pp 1178, 1179, 1903

DIPLODONTA ALTA Dall.

Plate 24, fig 8.

Diplodonta alta DALL, Trans. Wagner Inst., vol. 3, pt. 1, p. 189, pl. 11, figs. 9*a*, 9*b*, 1890 (poor); pt. 6, p. 1183, pl. 44, fig. 19 (good), 1903.

Oligocene of the Tampa silex beds, Ballast Point, Tampa Bay; of the lower bed at Alum Bluff, Chattahoochee River; and of the marl of the Chipola River, near the county bridge, Calhoun County, Florida. U. S. Nat. Mus. No. 155745.

The first figures of this species were made from a defective specimen that was discarded in favor of a more perfect one from the Chipola marl.

DIPLODONTA CATOPOTIUM, new species.

Plate 18, fig. 9.

Shell small, thin, almost spherical, smooth except for concentric incremental lines, which are irregular and rude; beaks almost central, low, smooth, with hardly any trace of a lunular depression in front of them and only a very narrow chink for the ligament behind them; interior inaccessible, but from what can be seen of the margins they are probably entire. Height of shell 8 mm., length 8 mm., diameter 7 mm.

Tampa silex beds, one specimen. U. S. Nat. Mus. No. 166111.

This species has much the form of *D. turgida* Conrad (not Verrill), but its beaks are lower and the impressed lunular area of *D. turgida* is wanting.

Section PHLYCTIDERMA Dall.

Phlyctiderma DALL, Journ. Conch. (Leeds), vol. 9, No. 8, 1899, p. 246. Type, *Diplodonta semiaspera* Philippi (recent, Havana, Cuba); Proc. U. S. Nat. Mus., vol. 23, No. 1237, p. 792, 1901.

DIPLODONTA (PHLYCTIDERMA) PUNCTURELLA Dall.

Diplodonta puncturella DALL, Journ. Conch. (Leeds), vol. 9, No. 8, Oct., 1899, pp. 245–6.

Diplodonta (*Phlyctiderma*) *puncturella* DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1183, pl. 45, fig. 26, 1903.

Oligocene of the Bowden beds, Jamaica, West Indies, and of the Tampa silex beds at Ballast Point, Tampa Bay, Florida. Recent, Jamaica, Porto Rico, and St. Thomas, West Indies. U. S. Nat. Mus. No. 165203.

The punctuation of the surface of this small species is very close and regular, not pustulose like most of the species of this section.

Family LEPTONIDAE.

Genus ERYCINA (Lamarck) Recluz.

Erycina (part) Lamarck, Ann. du Museum, vol. 6, p. 413, 1806 (heterogeneous assembly). Not *Erycina* Fabricius, 1808.

Erycina Recluz, Revue Zool., vol. 7, pp. 291, 325, 1844. Type, *E. pellucida* Lamarck. Not *Erycina* Philippi, 1836. (=*Abra*) nor *Erycina* Brown, 1833, (=*Atactodea*).

Neacromya Gabb, Trans. Amer. Philos. Soc., vol. 15, p. 247, 1873; Proc. Acad. Nat. Sci. Phila. for 1872, p. 274, 1873. Type, *N. quadrata* Gabb, Trans. Amer. Philos. Soc., vol. 15, pl. 10, figs. 4, 4^a, 4^b.

Erycina Dall, Trans. Wagner Inst., vol. 3, pt. 5, p. 1140, 1900.

ERYCINA? INDECISA, new species.

Plate 21, figs. 3, 8.

Shell small, smooth, inflated, somewhat recalling *Lasea rubra* in form but more elongate behind; anterior end shorter and more inflated than the longer portion behind the prominent beaks; interior obscured by matrix. Length 4, height 3, maximum diameter 2 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida, one specimen. U. S. Nat. Mus. No. 165197.

This has the aspect of an *Erycina*, but from the fact that the interior and the hinge are unknown, its true relations must remain in doubt pending the receipt of more material.

Genus BORNIA Philippi.

Bornia Philippi, Moll. Sicil., vol. 1, p. 13, 1836. Type, *Bornia corbuloides* (Bivona) Philippi.

BORNIA TAMPAE, new species.

Plate 18, fig. 6.

Shell small, rounded-quadrate, with low, nearly central umbones; the base gently arcuate, the ends subequally rounded, surface smooth, valves rather compressed, the interior inaccessible. Length of shell 6, height 5, maximum diameter 3 mm.

Tampa silex beds, one specimen. U. S. Nat. Mus. No. 166112.

This species recalls *B. triangula* (Lea) Dall, but is more rounded and has more prominent beaks.

Family CARDIIDAE.

Genus CARDIUM (Linnaeus) Bruguière.

Cardium Linnaeus, Syst. Nat., ed. 10, p. 678, 1758; Mus. Lud. Ulricae, p. 483, 1764. No type selected.

Pectunculus Huddesford, in Lister, Conch. Index, Anat., p. 5, expl. pl. 13, fig. 1, 1770. Sole example, *Cardium edule* Linnaeus (=*Cardium* Linnaeus).

Cardium MÜLLER, Zool. Dan. Prodr., p. 246, 1776.—BOLTEN, Mus. Boltenianum, ed. 1, p. 189, 1798; ed. 2, pp. 132–34, 1819.—BRUGUIÈRE, Encycl. Méth., vol. 1, pp. 203, 235, 1789.—LAMARCK, Prodrome, p. 86, 1799, sole example, *C. aculeatum* Linnaeus.—DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1069, 1900.

Subgenus **TRACHYCARDIUM** Mörch.

Trachycardium MÖRCH, Yoldi Cat., vol. 2, p. 34, 1853. Type, *C. isocardia* Linnaeus.

Granocardium GABB, Pal. Cal., vol. 2, p. 266, 1868, *C. sabulosum* Gabb.

CARDIUM (TRACHYCARDIUM) DELPHICUM Dall.

Plate 25, fig. 12.

Cardium (*Trachycardium*) *delphicum* DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1084, pl. 48, fig. 18, 1900.

Oligocene of the Tampa silex beds, Ballast Point, Tampa Bay, and of the Oak Grove sands, Oak Grove, Santa Rosa County, Florida. U. S. Nat. Mus. No. 157526.

The type of the species is the Oak Grove fossil; those supposed to be specifically the same from the silex beds are poorly preserved and are referred to this species with some doubt.

The figure is taken from an Oak Grove specimen.

CARDIUM (TRACHYCARDIUM) PROPECILIARE Dall.

Plate 18, fig. 7.

Cardium propeciliare DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1080, pl. 48, fig. 12, 1900.

Tampa silex beds at Ballast Point, Tampa Bay, and in the Oligocene marl of the Chipola River, Calhoun County, Florida. Post and Dall. U. S. Nat. Mus. No. 165205.

CARDIUM (TRACHYCARDIUM) CESTUM Dall.

Plate 4, fig. 13.

Cardium (*Trachycardium*) *cestum* DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1083, pl. 48, fig. 14, 1900.

Tampa silex beds, at Ballast Point, Tampa Bay, and in the Oligocene marl of the Chipola River, Calhoun County, Florida. Post and Burns. U. S. Nat. Mus. No. 165206.

This profusely ornamented species was first found at Chipola, but later Mr. Post sent specimens from the silex beds which proved to be identical though in less perfect condition.

CARDIUM (TRACHYCARDIUM) BOWDENENSE Dall.

Cardium muricatum GUPPY, Geol. Mag., dec. 2, vol. 1, p. 450, 1874; not of Linnaeus, 1758.

Cardium (*Trachycardium*) *bowdenense* DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1087, 1900.

Oligocene of the Bowden beds, Jamaica, West Indies, and of the Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 165204.

This species resembles *C. muricatum* in general characters and has about the same number of ribs, but all its characters are as it were in miniature; the shell is smaller and all the details are smaller. The true *C. muricatum* is more inflated proportionally and has the ribs less crowded and compressed. Moreover, it does not appear as a fossil earlier than the Pleistocene so far as known.

CARDIUM (TRACHYCARDIUM) PARILE Dall.

Plate 4, fig. 6.

Cardium (*Trachycardium*) *parile* DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1086, pl. 48, fig' 17. 1900.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay; of the lower bed at Alum Bluff, Chattahoochee River; and of the marls of the Chipola River near the county bridge, Calhoun County, Florida. U. S. Nat. Mus. No. 165208.

CARDIUM (TRACHYCARDIUM), spp. indet.

Fragments of what appear to be two undetermined species of *Trachycardium* have been found at Ballast Point, but not in a condition to be named.

Subgenus CERASTODERMA Mörch.

Cerastoderma MÖRCH, Yoldi Cat., vol. 2, p. 34, 1853.—ROEMER, Conchyl. Cabinet, ed. 2 (*Cardium*), p. 4, 1868.—MEEK, Pal. Upper Missouri, p. 166, 1876; *C. edule* Linnaeus.

Cardium GRAY, List Brit. Anim., p. 25, 1851; not of Lamarck, 1799.

Parvicardium MONTEROSATO, Sin. Conch. Medit., p. 19, 1884.

Pectunculus HUDDESFORD, in expl. to plate 13, of Lister, Conch. ed. of 1770. Sole example, *Cardium edule*.

If the rules of nomenclature were strictly observed it may be that the name *Pectunculus* might have to be adopted for the group typified by *Cardium edule*, as his use of it is probably the earliest binomial adoption of this name which was applied by the classic writers to any rounded inflated bivalve. But this name has been so much used for different groups of bivalves and has created so much nomenclatorial confusion that, considering that Huddesford's

conception of the genus would probably have been synonymous with *Cardium* Linnaeus in its broad sense, it seems better to ignore this instance of its use.

Section **DINOCARDIUM** Dall.

Dinocardium DALL, Trans. Wagner Inst., vol. 3, pt. 5, pp. 1074, 1097, 1900. Type, *Cardium robustum* Solander (*C. magnum* Born not Linnaeus).

CARDIUM (CERASTODERMA) PHLYCTAENA Dall.

Plate 25, fig. 10.

Cardium (*Cerastoderma*) *phlyctaena* DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1097, pl. 48, fig. 13, 1900.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Willcox and Dall. U. S. Nat. Mus. No. 165207.

CARDIUM (CERASTODERMA) TAPHRIUM Dall.

Plate 19, fig. 3.

? *Cardium* (*Cerastoderma*) *taphrium* DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1098, pl. 40, fig. 9, 1900.

Oligocene of the Tampa silex beds ? and of the Oak Grove sands of Oak Grove, Santa Rosa County, Florida. U. S. Nat. Mus. No. 157576.

The species and figure are based on Oak Grove specimens, the pseudomorph from the silex beds being so poorly preserved that identification is doubtful.

Subgenus **FRAGUM** Bolten.

Fragum BOLTEN, Mus. Boltenianum, ed. 1, p. 189, 1798; ed. 2, p. 131, 1819 (*C. unedo* Linnaeus).—MÖRCH, Yoldi Cat., vol. 2, p. 35, 1853.—DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1074, 1900.

Hemicardium SWAINSON, Mal., p. 373, 1840, after Cuvier, Règne Anim., vol. 2, p. 479, 1817, emend.

Bucardium GRAY, Ann. Mag. Nat. Hist., 1853, p. 40; not of Megerle, 1811.

Loxocardium COSSMANN, Cat. Illustr., p. 160, 1887.

Section **TRIGONIOCARDIA** Dall.

Trigoniocardia DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1075, 1900. Type, *Cardium graniferum* Sowerby.

CARDIUM (TRIGONIOCARDIA) ALICULA Dall.

Plate 25, fig. 8.

Cardium (*Trigoniocardia*) *alicula* DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1103, pl. 40, fig. 12 (only), 1900.

Oligocene of the Tampa silex beds, Ballast Point, Tampa Bay, and of the lower bed at Alum Bulff, Chattahoochee River, Florida. Dall and Burns. U. S. Nat. Mus. No. 165209.

CARDIUM (TRIGONIOCARDIA) BERBERUM, new species.

Cardium (*Trigoniocardia*) *alicula* (part) DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1103, pl. 48, fig. 5, 1900 (not pl. 40, fig. 12).

Oligocene of Tampa silex beds and of the lower bed at Alum Bluff, Florida, and of the Chipola River marl, Calhoun County, Florida. U. S. Nat. Mus. No. 166113.

When first described it was thought that the Ballast Point specimen of *C. alicula* was worn and that its differences from the Chipola form were due to erosion. The recovery of a well-preserved valve from the silex beds, together with specimens of the Chipola form, has enabled a more exact comparison to be made, which shows that the form from the Chipola marl beds is distinct. It may be recognized by its more narrow form and by the very conspicuous denticulation of the margin of the truncated end of the valves. *C. alicula*, so far as known, is confined to the Ballast Point horizon, but the present species is present also at Chipola. The Ballast Point specimens are U. S. Nat. Mus. No. 166113.

Family VENERIIDAE.

Genus DOSINIA Scopoli.

Dosinia SCOPOLI, Intr. ad Hist. Nat., p. 399, 1777. Type, *Le dosin* Adanson, =*Dosinia africana* Hanley.

Arthemis OKEN, Lehrb. der Naturg., p. 229, 1815. *Venus exoleta* Linnaeus.

Artemis CONRAD, Fos. Tert. Form., p. 20, 1832.

Arctoë RISSO, Eur. Mérid., vol. 4, p. 361, 1826. *Venus exoleta* Linnaeus.

Exoleta BROWN, Ill. Conch. Gt. Brit., pl. 20, figs. 2, 3, 1827. *Venus exoleta* Linnaeus.

Cerana GISTEL, Naturg. Thierr., p. 8, 1848.

Amphithaea LEACH, Syn. Brit. Moll., p. 312, 1852.

Dosinia DESHAYES, Cat. Brit. Mus., p. 5, 1853.—DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1226, 1903; not *Dosinia* Gray, 1838.

Section DOSINIDIA Dall.

Dosinidia DALL, Proc. U. S. Nat. Mus., vol. 26, No. 1312, p. 347, 1902. Type, *Venus concentrica* Born; Trans. Wagner Inst., vol. 3, pt. 6, p. 1229, 1909.

DOSINIA (DOSINIDIA) CHIPOLANA Dall.

Plate 24, fig. 10.

Dosinia (*Dosinidia*) *chipolana* DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1229, pl. 54, fig. 4, 1903.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay; and of the Chipola marl, near the county bridge, Chipola River, Calhoun County, Florida. U. S. Nat. Mus. No. 214408.

Genus MACROCALLISTA Meek.

Macrocallista MEEK, Pal. Upper Missouri, p. 179, 1876. Type, *Venus nimbosa* Solander.—DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1251, 1903.

Section PARADIONE Dall.

Paradione DALL, Proc Mal. Soc. London, vol. 8, p. 197, Apr. 1909; U. S. Geol. Survey, Prof. paper 59, 1909, p. 120, new name for *Chionella* Cossmann.

Chionella COSSMANN, Cat. Illustr., bassin de Paris, vol. 1, p. 105, 1886. Type, *Cytherea ovalina* Deshayes; not *Chionella* Swainson, Malac., p. 335, note, 1840.

MACROCALLISTA (PARADIONE) ACUMINATA Dall.

Plate 20, figs. 8, 9, 10; plate 24, figs. 2.

Macrocallista acuminata DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1255, pl. 57, fig. 3, 1903.

Oligocene of the Tampa silex beds, Ballast Point, Tampa Bay; and of the lower bed at Alum Bluff, Chattahoochee River, Florida. U. S. Nat. Mus. Nos. 165211 and 163313.

This species resembles *M. reposta* Conrad, of the Miocene, but is smaller, more inequilateral, and more acute behind.

Genus CALLOCARDIA A. Adams.

Callocardia A. ADAMS, Ann. Mag. Nat. Hist., ser. 3, vol. 13, p. 307, 1864; *C. guttata* Adams.

Caryatis ROEMER (part) Mal. Blat., vol. 9, p. 58, 1852; not *Caryatis* Hubner, 1816.

Veneriglossa DALL, Bull. Mus. Comp. Zool., vol. 12, p. 275, Sept. 1886; *Cytherea vesica* Dall.

Atopodonta COSSMANN, Cat. Illustr. bassin de Paris, vol. 1, p. 98, Oct. 1886; *A. coniformis* Deshayes.

Callocardia DALL, Proc. U. S. Nat. Mus., vol. 26, No. 1312, p. 353, 1902; Trans. Wagner Inst., vol. 3, pt. 6, p. 1259, 1903.

Subgenus AGRIOPOMA Dall.

Agriopoma DALL, Proc. U. S. Nat. Mus., vol. 24, p. 509, 1902. Type, *Cytherea texasiana* Dall, 1892; Trans. Wagner Inst., vol. 3, pt. 6, p. 1259, 1903.

CALLOCARDIA (AGRIOPOMA) SINCERA Dall.

Plate 25, fig. 7.

Callocardia (*Agriopoma*) *sincera* DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1260, pl. 55, fig. 12, 1903.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay; of the lower bed at Alum Bluff, Chattahoochee River; and of the

Chipola marl, near the county bridge, Chipola River, Calhoun County, Florida. U. S. Nat. Mus. Nos. 166114, 114747.

This species, though smaller and with more sharply cut sculpture, may be regarded as the precursor of the Miocene *C. sayana*.

? CALLOCARDIA NUX, new species.

Plate 18, fig. 3.

Shell small, equivalve, the beaks near the anterior third, moderately convex, short-ovate, the surface smooth except for faint incremental lines; beaks low, pointed, prosocoelous, a large lanceolate lunule in front of them which is not impressed but circumscribed by a sharply incised line; there is no escutcheon; anterior slope roundly descending, ends of the shell evenly rounded, base prominently arcuate; anterior inaccessible. Height of shell 12, length 14, diameter 7 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 166115.

This simple little shell has no pronounced characteristics but is distinct from any of the other Veneridae known from this or adjacent formations.

Genus ANTIGONA Schumacher.

Cytherea Bolten, (part) Mus. Boltenianum, ed. 1, p. 177, 1798; ed. 2, p. 124, 1819. *Venus puerpera* Linnaeus. Not *Cytherea* Fabricius (*Diptera*) 1795, Lamarck, 1806, nor H. and A. Adams, 1856.

Dosina Gray, Analyst, vol. 8, p. 308, 1838; Proc. Zool. Soc. London, for 1847, p. 183. *Venus verrucosa* Linnaeus.

Clausina Brown, Ill. Conch. Gt. Brit., expl. pl. 19, 20, 1827; ed. 2, 1844, pp. 90, 91. *V. verrucosa* Linnaeus.

Omphaloclathrum Mörch, Yoldi Cat., vol. 2, p. 25, 1853.

Venus Swainson, Mal., p. 372, fig. 119c, 1840. *V. verrucosa* Linnaeus, not of Lamarck, 1799.

Callista Fischer, Man. de Conchyl., p. 1084, 1887, *V. verrucosa* Linnaeus, not *Callista* Mörch, 1853.

Cytherea Dall, Proc. U. S. Nat. Mus., vol. 26, No. 1312, p. 354, 1902; Trans. Wagner Inst., vol. 3, pt. 6, p. 1271, 1903. Type, *Venus puerpera* Linnaeus.

ANTIGONA TARQUINIA Dall.

Plate 26, figs. 1, 2.

Venus magnifica Heilprin, Trans. Wagner Inst., vol. 1, p. 116, 1886; not of Sowerby, 1853.

Venus tarquinia Dall, Trans. Wagner Inst., vol. 3, pt. 5, p. 1194, pl. 38, figs. 2, 2*a*, 1900.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, Florida (Willcox and Dall), and of Santo Domingo (Gabb). U. S. Nat. Mus. No. 109233.

Subgenus **ANTIGONA** sensu strictu.

Antigona SCHUMACHER, Essai, pp. 51, 154, 1817. Sole example, *A. lamellaria* Schumacher, Essai, pl. 14, fig. 2, *Dosinia lamarckii* Gray, 1838; not *Antigonus* Hubner. 1820 (*Lepidoptera*).—DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1273, 1903.

Artena CONRAD, Amer. Journ. Conch., vol. 6, p. 76, 1870. *Venus staminea* Conrad.—FISCHER, Man. de Conchyl., p. 1084, 1887.

Artenia TRYON, Syst. Conch., vol. 3, p. 178, 1884.

In my discussion of this group in the Wagner Transactions I did not regard the difference of termination between *Antigona* and *Antigonus* as creating a synonym, but the usage has become fixed that it is inadmissible. The name of Schumacher will take precedence for the genus, while for the section the name of Conrad may be retained.

ANTIGONA GLYPTOCONCHA Dall.

Plate 25, fig. 1.

Cytherea (*Artena*) *glyptoconcha* DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1277, pl. 55, fig. 24, 1903.

Cytherea staminea HEILPRIN, Trans. Wagner Inst., vol. 1, p. 116, 1887, not of Conrad, 1839.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Willcox, Burns, and Dall. U. S. Nat. Mus. No. 165213.

This rather abundant species has the general aspect of *Lirophora*, the minute sculpture of *Artena*, and the hinge of *Antigona*. It varies remarkably in outline, as I have shown in the Wagner Transactions.

Section **ARTENA** sensu strictu.

ANTIGONA (ARTENA) SHEPARDI Dall.

Plate 25, fig. 4.

Cytherea (*Artena*) *shepardi* DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1278, pl. 55, fig. 16, 1903.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, and of the limestone of Hillsboro Bay near by, in Florida. Shepard, Willcox, Post, and Dall. U. S. Nat. Mus. Nos. 165212, 166116.

This species recalls *C. ucuttana* in sculpture, but has the *Chione*-shape of *Artena*.

Genus CHIONE Megerle von Muhlfeldt.

Chione MEGERLE, Mag. Ges. Naturf. Freunde zu Berlin, vol. 5, p. 51, 1811. *Venus cancellata* (Linnaeus) Lamarck. Not *Chione* Desvoidy, 1830, nor of Gray, 1838.

Chione DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1286, 1903.

Section **LIROPHORA** Conrad.

Lirophora Conrad, Proc. Acad. Nat. Sci. Phila. for 1862, pp. 575, 586, 1863; *Venus athleta* Conrad, Dall, Trans. Wagner Inst. vol. 3, pt. 6, pp. 1286, 1293, 1903.

CHIONE (LIROPHORA) BALLISTA Dall

Plate 25, fig. 3.

Chione (*Lirophora*) *ballista* Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1295, pl. 55, fig. 23, 1903.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Crosby, Burns, and Dall. U. S. Nat. Mus. No. 165216.

Section **CHAMELEA** Morch.

Chamelea Mörch, Cat. Yoldi, vol. 2, p. 23, 1853. *Venus gallina* Linnaeus. Dall, Trans. Wagner Inst., vol. 3, pp. 1289, 1300, 1903.

CHIONE (CHAMELEA) NUCIFORMIS Heilprin.

Plate 25, fig. 5.

Cytherea nuciformis Heilprin, Trans. Wagner Inst., vol. 1, p. 116, pl. 16, fig. 61, 1887.

Chione (*Chamelea*) *nuciformis* Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1300, pl. 55, fig. 9, 1903.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Shepard, Heilprin, and Dall. U. S. Nat. Mus. No. 165215.

One of the more common species of the locality.

CHIONE (CHAMELEA) SPADA Dall.

Plate 24, fig. 12.

Chione (*Chamelea*) *spada* Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1301, pl. 55, fig. 13, 1903.

Oligocene of the Tampa silex beds, Ballast Point, Tampa Bay (Burns, Dall, and Crosby), and of Bailey's Mill Creek sink, Florida (L. C. Johnson). U. S. Nat. Mus. No. 109240.

This species is less common than the preceding one.

CHIONE (CHAMELEA) RHODIA Dall.

Plate 25, fig. 6.

Chione (*Chamelea*) *rhodia* Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1301, pl. 55, fig. 10, 1903.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, and of the Oak Grove sands, Santa Rosa County, Florida. Dall and Burns. U. S. Nat. Mus. No. 109229. This species, though with a much greater range in time than the others, seems to be comparatively rare.

Genus ANOMALOCARDIA Schumacher.

Anomalocardia Schumacher, Essai, pp. 44, 134, 1817; *Venus fluctuosa* Linnaeus.—Gray, Proc. Zool. Soc. London, for 1847, p. 183.

Triquetra Anton, Verzeichn., p. 10, 1839, same type.

Cryptogramma Mörch, Yoldi Cat., vol. 2, p. 22, 1853. First species, *Venus subrugosa* Wood.

Anomalocardia Deshayes, Cat. Con. Brit. Mus., vol. 1, p. 115, 1853.—Dall, Proc. U. S. Nat. Mus., vol. 26, p. 359, 1902; Trans. Wagner Inst., vol. 3, pt. 6, p. 1301, 1903; not *Anomalocardia* H. and A. Adams, 1858 (*Areidae*).

ANOMALOCARDIA FLORIDANA Conrad.

Plate 23, figs. 4, 5.

Venus floridana Conrad, Amer. Journ. Sci., ser. 2, vol. 2, p. 400, fig. —, 1846.

Venus penita (part) Heilprin, Trans. Wagner Inst., vol. 1, p. 116, 1887.

Anomalocardia floridana Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1303, pl. 55, figs. 14, 15, 1903.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, and of the overlying Tampa limestone; of the limestone at Bailey's Mill Creek sink, and of the Sopchoppy, Forida, limestone. Figured specimen, U. S. Nat. Mus. No. 165214.

This is the most common, characteristic, and oldest known bivalve of the silex beds. Its numerous variations of form have been tabulated in the Wagner Transactions.

A. penita Conrad, described at the same time from a cast in the Tampa limestone, has not been recently identified, but Heilprin united it, possibly prematurely, with *A. floridana*, though Conrad's figure indicates some differences.

Genus VENUS (Linnaeus) Lamarck.

Venus (part) Linnaeus, Syst. Nat., ed. 10, p. 685, 1758; ed. 12, p. 1128, 1767.

Pectunculus Da Costa (part) Brit. Conch., p. 184, 1778, not of Huddesford, in Lister, Conch. Anat. Index, p. 5, expl. pl. 13, fig. 1, 1770.= *Cardium edule* Linnaeus.

Venus Lamarck, Prodrome, p. 84, 1799. Sole example, *V. mercenaria* Linnaeus.—Dall, Trans. Wagner Inst., vol. 3, pt. 6, p. 1306, 1903.

Mercenaria Schumacher, Essai, pp. 45, 135, 1817, same type. Not *Mercenaria* Cossmann, 1887.

Crassivenus Perkins, Proc. Boston Soc. Nat. Hist., vol. 13, p. 147, 1869, same type.

VENUS HALIDONA Dall.

Plate 26, figs. 3, 5.

Venus halidona Dall, Trans. Wagner Inst., vol. 3, pt. 5, p. 1194, pl. 38, figs. 1, 1*a*, 1900; pt. 6, p. 1307, 1903.

Oligocene of the Tampa silex beds at Ballast Point, and of the limestone of Hillsboro Bay in Tampa Bay, Florida. Dall, Burns, and Willcox. U. S. Nat. Mus. No. 165217.

This is one of the largest and least common of the silex bed fossils, and has the rough area of the hinge, characteristic of the genus, quite small, compared with the Miocene and recent species of which it is one of the precursors. A nearly allied but apparently distinct species is the *V. langdoni* of the lower bed at Alum Bluff.

Family TELLINIDAE.

Genus TELLINA (Linnaeus) Lamarck.

Tellina (part) LINNAEUS, Syst. Nat., ed. 10, p. 674, 1758; ed. 12, p. 1116, 1767.

Tellina LAMARCK, Prodrome, p. 84, 1799. Sole example *Tellina virgata* Linnaeus.—DALL, Proc. U. S. Nat. Mus., vol. 23, No. 1210, p. 289, 1900; Trans. Wagner Inst., vol. 3, pt. 5, p. 1004, 1900.

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

Subgenus TELLINA sensu strictu.

Tellina DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1009, 1903. Type, *Tellina virgata* Linnaeus.

TELLINA SEGREGATA Dall.

Plate 17, fig. 3, 11.

Tellina segregata DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1019, pl. 37, figs. 7, 8, 1900.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Dall. U. S. Nat. Mus. No. 157847.

This species seems to group with the following form, but the character of the sculpture is quite different.

TELLINA CHIPOLANA Dall.

Plate 22, figs. 1, 2.

Tellina chipolana DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1018, pl. 47, fig. 6, 1900.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay (Post); of the lower bed at Alum Bluff, Chattahoochee River; and of the Chipola marl, near the county bridge over the Chipola River, Calhoun County, Florida. U. S. Nat. Mus. No. 165219.

TELLINA DIRA, new species.

Shell small, thin, posterior end slightly bent to the right, elongate, with beaks slightly behind the middle of the shell; beaks not prominent, minutely projecting, smooth; remainder of the shell sculptured with low, sharp, elevated lamellae, which are obsolete on the posterior dorsal slope; the shell shows no radial sculpture; dorsal slopes about

equally descending; anterior end longer, evenly rounded into the base, which is arcuate and rather prominent mesially; posterior end bluntly rounded and attenuate; interior with the pallial markings obscured; hinge with two strong laterals and two adjacent cardinal teeth, of which the posterior is larger and grooved. Length 11, height 9, double diameter 2.75 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. E. J. Post. U. S. Nat. Mus. No. 165220.

A single right valve was received too late for figuring, but the species is well marked.

Section MACALIOPSIS Cossmann.

Macaliopsis COSSMANN, Cat. Illustr. bassin de Paris, p. 63, 1886. Type, *Tellina barrandei* Deshayes.—DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1010, 1900.

TELLINA (MACALIOPSIS) MERULA Dall.

Plate 24, fig. 7.

Tellina (*Macaliopsis*) (?) *merula* DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1019, pl. 46, fig. 4, 1900.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 157848.

The species recalls *T. mera* Say, but is of different form.

Subgenus ARCOPAGIA Leach.

Arcopagia LEACH, in Brown, Ill. Conch. Gt. Britain, p. ii, pl. 16, fig. 8, 1827; *Tellina crassa* Montague.—DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1011, 1900.

Cydippe LEACH, Moll. Gt. Brit., p. 314, 1852; same type.

Section MERISCA Dall.

Merisca DALL, Proc. U. S. Nat. Mus., vol. 23, No. 1210, p. 290. Type, *Tellina crystallina* Wood.—DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1012, 1900.

TELLINA (MERISCA) HALIDONA Dall.

Plate 23, figs. 1, 3.

Tellina (*Merisca*) *halidona* DALL, Trans. Wagner Inst., vol. 3, pt. 5, p. 1021, pl. 38, figs. 3, 3*a*, 1900.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 157856.

Only a single left valve of this species is known.

Subgenus ANGULUS (Megerle) Dall.

Angulus (part) Megerle von Muhlfeldt, Mag. der Ges. Naturf. Freunde zu Berlin, vol. 5, p. 47, 1811. *Tellina lanceolata* Linnaeus and *T. virgata* Linnaeus.

Angulus Dall, Trans. Wagner Inst., vol. 3, pt. 5, p. 1014, 1900. Type, *T. lanceolata* Linnaeus.

Fabulina Gray, Brit. Moll. Brach., p. 40, 1851; *Tellina fabula* Gronovius.

Tellinula Bucquoy, Dautzenberg, and Dollfus, Moll. Mar. de Roussillon, vol. 2, p. 654, 1898; same type.

TELINA (ANGULUS) ATOSSA Dall.

Plate 4, fig. 11.

Shell egg-ovate, thin, rather compressed, nearly equilateral, with low subcentral beaks; anterior end full, rounded; posterior end compressed, attenuated, almost rostrate; anterior dorsal slope moderately convex, posterior slope straight; surface nearly smooth except toward the margins where the incremental lines rise into low sharp lamellae with flattish interspaces; there is no radial sculpture, and neither lunule nor escutcheon; hinge of the right valve with two cardinal teeth the posterior large and bifid, an anterior larger lateral, and a more distant smaller posterior lateral tooth; pallial sinus large, coincident with the pallial line below, and not reaching the anterior adductor scar. Length of shell 21, height 14, diameter (estimated) 7 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida, one right valve. U. S. Nat. Mus. No. 166118.

This shell belongs to the type of *A. decumbens* Carpenter, a recent Panama form, and is very distinct from any other.

Genus MACOMA Leach.

Macoma Leach, in Ross Voy., app. 2, p. lxii, 1819 (*M. tenera* Leach); Journ. de Physique, vol. 88, p. 465, June, 1819.—Dall, Proc. U. S. Nat. Mus., vol. 23, No. 1012, p. 292, 1900; Trans. Wagner Inst., vol. 3, pt. 5, p. 1044, 1900. Type, *M. calcarea* Gmelin.

Limicola Leach, Moll. Gt. Brit., p. 296, 1852; not of Koch, *Aves*, 1816.

MACOMA IRMA Dall.

Plate 24, fig. 9.

Macoma irma Dall, Trans. Wagner Inst., vol. 3, pt. 5, p. 1047, pl. 46, fig. 15, 1900.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 157906.

The specimens, though imperfect, belong to this genus, and to a species distinct from any other in the present list.

Family SEMELIDAE.

Genus SEMELE Schumacher.

Semele SCHUMACHER, Essai, p. 165, 1817. Type, *Tellina reticulata* Spengler, *T. proficua* Pulteney.

Amphidesma LAMARCK, Anim. s. Vert., vol. 5, p. 489, 1818.—BOWDICH, Elem. Conch., vol. 2, p. 8, pl. 2, fig. 18, 1822. Type, *Tellina variegata* Lamarck (not Linnaeus). *Venus purpurascens* Gmelin.

Syndesmyella SACCO, Terz. Piem. e Lig., vol. 29, p. 122, 1901; *S. plio-ovoides* Sacco.

SEMELE SARDONICA, new species.

Plate 20, figs. 4, 7.

Shell small, ovate, the beaks behind the middle of the shell and inconspicuous; lunule deep and narrow; escutcheon confined to the left valve, very narrow, longer than the lunule; ends evenly rounded, subequal, passing smoothly into the arcuate base; sculpture of narrow, sharp low vertical concentric lamellae with much wider interspaces, which are more or less concentrically striated, especially toward the ends of the shell; the lamellae are more crowded toward the anterior end; pallial sinus rounded, high; not approaching the pallial line below; hinge normal, the chondrophore small. Length 16.5, height 11.5, diameter 5.7 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 165222.

SEMELE SILICATA Dall.

Plate 23, fig. 7.

Semele silicata DALL, Trans. Wagner Inst., vol 3, pt. 5, p. 987, pl. 38, fig. 6, 1900.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. Dall. U. S. Nat. Mus. No. 165221.

The specimen figured is one of the first found. Better preserved individuals were subsequently obtained, and show a sharper sculpture.

Family CORBULIDAE.

Genus CORBULA (Bruguière) Lamarck.

Corbula BRUGUIÈRE, Encycl. Méth., pl. 230, 1797 (not in Table 1792).—LAMARCK, Prodrome, p. 89, 1799.—DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 836, 1898. Type, *C. gallica* Lamarck. Not *Corbula* Bolten, 1798 (=*Asaphis* Modeer).

Bicorbula FISCHER, Man. de Conchyl., p. 1125, 1887.

Section CUNEOCORBULA Cossmann.

Cuneocorbula COSSMANN, Cat. Coq. Fos. bassin de Paris, vol. 1, p. 37, 1886. Type, *C. triangulata* Deshayes.—DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 838, 1898.

CORBULA (CUNEOCORBULA) BURNSII Dall.

Plate 18, figs. 4, 5.

Corbula (Cuneocorbula) engonata var. *burnsii* DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 847, 1898.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay; of the lower bed at Alum Bluff, Chattahoochee River; and of the Chipola marl, near the county bridge over the Chipola River, Calhoun County, Florida. Burns and Dall. U. S. Nat. Mus. Nos. 166119, and 154509.

This differs from *C. engonata*, from which it is probably descended, in its large size and more prominently arcuate base. The former is from the Eocene and Vicksburgian.

CORBULA (CUNEOCORBULA) SARDA Dall.

Plate 17, fig. 2.

Corbula (Cuncocorbula) sarda DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 847, pl. 36, fig. 14, 1898.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay, and of the lower bed at Alum Bluff, Chattahoochee River, Calhoun County, Florida. U. S. Nat. Mus. No. 165223.

This species, though more delicate, recalls *Corbula alabamiensis* Lea, but is less twisted and pointed behind.

CORBULA (CUNEOCORBULA) KAGHRIANA, new species.

Plate 21, figs. 4, 5.

Shell small, inequivalve, plump, behind pointed and almost rostrate; left valve smaller; beaks small pointed, prosocoelous, not prominent; there is no lunule; a wide, strongly concentrically striate posterior dorsal area is bounded by a strong keel on each side; both valves are sculptured by strong concentric rounded ridges with wider interspaces; the ridges anteriorly sharp and appear even slightly recurved toward the beaks; behind they cease at the keels; the margin of the right valve below is tortuous and folded over the margin of the left valve behind; the dorsal margins between the keels pout prominently. Length 10, height 6.2, maximum diameter 5 mm.

Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 165224. Also recent.

A species identical with this was sent by the late Professor C. B. Adams from Jamaica, West Indies, to the Smithsonian Institution under the above name, which appears never to have been published.

Family SAXICAVIDAE.

Genus PANOPE Menard.

Panope MENARD, Mem. Nouveau Genre Coq. Biv., p. 31, Jan. 1807. Type, *P. aldrovandi* Menard.—LAMARCK, Extr. d'un Cours, 1812, p. 108.

Panopea MENARD, Ann. du Mus. Paris, vol. 9, p. 131, May, 1807.

Panopea GOLDFUSS, Handb. d. Zool., p. 677, 1820.

Glycymeris LAMARCK, Prodrome, p. 83, 1799. Type, *Mya glycymeris* Born, Not *Glycymeris* Da Costa, 1778, nor of Lamarck, 1801, nor of Schumacher, 1817.

Panopaea LAMARCK, Anim. s. Vert., vol. 5, p. 456, 1818.—VALENCIENNES, Arch. du Museum de Paris, vol. 1, p. 3, 1838.

Panopia SWAINSON, Malac., p. 367, 1840.

Glycimeris H. and A. ADAMS, Gen. Rec. Moll., vol. 2, p. 350, 1856.—GRAY, Fig. Moll. Anim., vol. 5, p. 30, 1857.

Panope DALL, Proc. Mal. Soc., vol. 10, pt. 1, March, 1912, pp. 34–5.

I showed in 1912 that the first published and valid orthography of this name is *Panope* and not *Panopea* as usually printed, the latter form being printed at least three months later than the original separate issue of Menard's paper.

PANOPE WHITFIELDI Dall.

Plate 18, figs. 1, 2.

Panopea whitfieldi DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 829, 1898, new name for:

Panopea goldfussi WHITFIELD, Miocene marls of N. J., p. 89, pl. 16, figs. 9–13, 1895; not of Wagner, 1838.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay; of the Chipola River marl, Calhoun County; and of the Oak Grove sands at Oak Grove, Santa Rosa County, Florida. Also mixed with Miocene species in the rehandled marl of Jericho, Cumberland County, New Jersey. U. S. Nat. Mus. No. 135913.

This species differs from the typical Miocene *Panope goldfussii* of Wagner in its smaller size, more equilateral valves, and less expanded anterior region.

Family GASTROCHAENIDAE.

Genus GASTROCHAENA (Spengler) Cuvier.

Gastrochaena (part) SPENGLER, Nova acta Soc. Sci. Hafn., vol. 2, p. 174, 1783.—DESHAYES, Traite de Conchyl., vol. 1, p. 26, 1844.

Gastrochaena CUVIER, Règne Anim., vol. 2, p. 490, 1817.—LAMARCK, Anim. s. Vert., vol. 5, p. 446, 1818.

Rocellaria (Fleuriau Ms.) BLAINVILLE, Dict. Sci. Nat., vol. 57, p. 244, 1828.—TRYON, Mon. Pholadacea, p. 39, 1862.

Roxellaria MENKE, Syn., p. 121, 1830.

Gastrochaena FISCHER, Man. de Conchyl., 1887, p. 1128.—DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 823, 1898. Type, *G. dubia* Donovan (=*G. modiolina* Lamarck).

GASTROCHAENA ROTUNDA Dall.

Plate 19, fig. 2.

Gastrochaena (*ovata* Sowerby var.) *rotunda* DALL, Trans. Wagner Inst., vol. 3, pt. 4, p. 825, 1898.

Oligocene of the Tampa silex beds at Ballast Point, Tampa Bay; of the Chipola marl of the Chipola River, near the county bridge, Calhoun County, Florida; and of the Bowden beds at Bowden, Jamaica, West Indies. U. S. Nat. Mus. No. 114705.

This form resembles *G. ovata* of the same size, but does not attain so large a size as the adult *ovata*, and has a more rounded posterior end with a rather shorter gape, the myophore being decidedly larger, wider, and more conspicuous. Lon. 7.0, lat. 3.5, diam. 2.8 mm.

FORAMINIFERA.

Genus ORBITOLITES Lamarck.

Orbitolites LAMARCK, Syst. An. s. Vert., 1801, p. 376. First species, *O. complanata* Lamarck.

Orbulites DESHAYES, ed. An. s. Vert., 1836, vol. 2, p. 302.

Nemophora CONRAD, Proc. Acad. Nat. Sci. Phila., vol. 17, 1865, p. 74. Same type, *Nummulites floridana* Conrad.

ORBITOLITES FLORIDANUS Conrad.

Plate 20, fig. 5; plate 21, figs. 7, 11.

? *Orbitolites complanata* LAMARCK, Syst. An. s. Vert., 1801, p. 376. Fossil of Grignon.

? *Orbitulites complanata*, various AUTHORS.

Nummulites (*Assilina*) *floridanus* CONRAD, Amer. Journ. Sci., new ser., vol. 2, 1846, p. 399, fig. 3.

Cristellaria ? *floridana* ORBIGNY, Prodr. Paleont., vol. 2, p. 406, 1300, 1857.

Nemophora floridana CONRAD, Proc. Acad. Nat. Sci., vol. 17, 1865, p. 74.

Abundant in the Tampa silex beds, and in the overlying limestone, and in silicified rock from Martin Station, Florida. U. S. Nat. Mus. No. 165225.

This species was identified by Doctor Bagg with *O. complanatus*. It seems, however, that the identification is doubtful. I therefore retain Conrad's name, about which there is no doubt, until the question is cleared up. It is remarkable for its variations as indicated in the figures given herewith.

CORALS.

The corals of this formation have been put in the hands of Dr. T. Wayland Vaughan for description. They comprise many species of great interest. See list on page 18.

EXPLANATION OF PLATES.

PLATE 1.

FIG. 1. *Planorbis tampaënsis* Dall, lat. 12.5 mm., p. 30.
2. *Bulimulus tortilla* Dall, alt. 8 mm., p. 27.
3. *Bulimulus tampæ* Dall, alt. 13.7 mm., p. 26.
4. *Urocoptis floridana* Dall, alt. 8 mm., p. 30.
5. *Bulimulus ballistae* Dall, alt. 10.7 mm., p. 26.
6. *Pupoides pilsbryi* Dall, alt. 4 mm., p. 29.
7. *Amnicola adesta* Dall, alt. 3.2 mm., p. 102.
8. *Planorbis clisus* Dall, basal view, diam. 4 mm., p. 31.
9. The same specimen in profile.
10. *Fissurella ceryx* Dall, profile, lon. 9.5 mm., p. 115.
11. The same from above.
12. *Pleurodonte haruspica* Dall, upper surface, lat. 26 mm., p. 23.
13. The same in profile.
14. The same, basal surface, lat. 26 mm.
15. *Cerion anodonta* Dall, alt. 26.5 mm., p. 28.
16. *Microcerion floridanum* Dall, alt. 4.75 mm., p. 29.
17. The same in profile, showing the form of the reflected lip, lat. of shell 2.4 mm.
18. *Bulimulus remolina* Dall, alt. 9.2 mm., p. 27.

PLATE 2.

FIG. 1. *Bulimulus heilprinianus* Dall, alt. 11 mm., p. 25.
2. *Bulimulus floridanus* Conrad, alt. 10 mm., p. 25.
3. *Urocoptis floridana* Dall, alt. 11.5 mm., p. 30.
4. *Bulimulus stearnsii* Dall, alt. 13 mm., p. 27.
5. *Bulimulus americanus* Heilprin, alt. 17 mm., p. 26.
6. *Cepolis instrumosa* Dall, lat. 13.5 mm., p. 23.
7. *Polygyra adamnis* Dall, upper surface, lat. 9.1 mm., p. 24.
8. *Cepolis crusta* Dall, lat. 15 mm., p. 24.
9. *Polygyra adamnis* Dall, front view, p. 24.
10. Body whorl of *Bulimulus heilprinianus* enlarged to show form of subsutural sinus and lip, p. 25.
11. *Pleurodonte haruspica* Dall, lat. 24 mm., p. 23.
12. *Cepolis direpta* Dall, front view, lat. 15 mm., p. 23.
13. *Cepolis latebrosa* Dall, profile of imperfect specimen, p. 22.
14. *Cepolis direpta* Dall, basal view, lat. 15 mm., p. 23.
15. *Cepolis instrumosa* Dall, base, lat. 13.5 mm., p. 23.
16. *Cepolis crusta* Dall, base, lat. 15 mm., p. 24.
17. *Cepolis latebrosa* Dall, upper surface, lat. 16 mm., p. 22.
18. *Pleurodonte diespiter* Dall, base, lat. 18 mm., p. 24.
19. *Cepolis latebrosa* Dall, base, lat. 16 mm., p. 22.
20. *Pleurodonte diespiter* Dall, upper surface, lat. 18 mm., p. 24.

PLATE 3.

FIG. 1. *Cypraca tumulus* Heilprin, profile, lon. 34 mm., p. 84.
2. *Cypraca heilprini* Dall, profile, lon. 26.5 mm., p. 85.
3. *Bulimulus americanus* Heilprin, basal view, p. 26. (See also pl. 2, fig. 5.)
4. *Cerion anodonta* Dall, var. *floridana* Dall, alt. 22 mm., p. 28.
5. *Planorbis willcoxii* Dall, profile, lat. 6.5 mm., p. 31.
6. The upper surface of the same, lat. 6.5 mm.
7. *Cancellaria sublhomasiae* Dall, alt. 20 mm., p. 47.
8. *Ischnochiton tampačnsis* Dall, *a*, upper surface of middle valve; *b*, under surface of the same, lat. 6.5 mm., p. 115.
9. *Drillia newmani* Dall, profile of body whorl showing anal sinus; enlarged, p. 46.
10. *Ampullina solidula* Dall, alt. 16 mm., p. 108.
11. *Margarites tampačnsis* Dall, lat. 8 mm., p. 112.
12. *Cypraca tumulus* Heilprin, base, lon. 34 mm., p. 84.
13. *Melanella conoidea* Kurtz and Stimpson, alt. 13 mm., p. 82.
14. *Cypraca heilprinii* Dall, base, lon. 26.5 mm., p. 85.

PLATE 4.

FIG. 1. *Calliostoma tampicum* Dall, alt. 10.5 mm., p. 111.
2. *Astyris dicaria* Dall, alt. 4.3 mm., p. 72.
3. *Arca* (*Barbatia*) *marylandica* Conrad, lon. 37 mm., p. 119.
4. *Astyris acanthodes* Dall, alt. 6 mm., p. 73.
5. *Yoldia frater* Dall, lon. 13.5 mm., p. 117.
6. *Cardium* (*Trachycardium*) *parile* Dall, alt. 15 mm., p. 143.
7. *Drillia bclotheca* Dall, alt. 9 mm., p. 42.
8. *Pleurodonte cunctator* Dall, lat. 11 mm., p. 24.
9. *Pleurodonte cunctator* Dall.
10. *Actcon tampae* Dall, alt. 7 mm., p. 32.
11. *Tellina* (*Angulus*) *atossa* Dall, lon. 21 mm., p. 153.
12. *Bulimulus* (*Hyperaulax*) *partulinus* Dall, alt. 13.5 mm., p. 26.
13. *Cardium* (*Trachycardium*) *cestum* Dall, alt. 32 mm., p. 142.
14. *Bulimulus* (*Hyperaulax*) *laxus* Dall, alt. 15.5 mm., p. 26.

PLATE 5.

FIG. 1. *Turritella tripartita* Dall, alt. 43 mm., p. 97.
2. *Terebra* (*Oxymeris*) *dislocata* Say, var. alt. 25 mm., p. 36.
3. *Drillia cupora* Dall, alt. 16 mm., p. 42.
4. *Drillia severina* Dall, alt. 23 mm., p. 40.
5. *Cerithium precursor* Heilprin, alt. 12 mm., p. 90. (See also pl. 12, fig. 26.)
6. *Fusinus ? quinquespinus* Dall, alt. 33 mm., p. 66.
7. *Helicina posti* Dall, lat. 11.5 mm., p. 113.
8. *Sinum imperforatum* Dall, alt. 13.2 mm., p. 109.
9. *Assiminea aldra* Dall, alt. 2 mm., p. 101.
10. *Murex mississippiensis* Conrad, alt. 32 mm., p. 73.
11. *Amauropsis guppyi* Gabb var. *floridana* Dall, alt. 27 mm., p. 108.
12. *Drillia glyphostoma* Dall, alt. 15 mm., p. 45.
13. *Turris albida* Perry, alt. 75 mm., p. 38. (See also pl. 14, fig. 7.)
14. *Murex crispangula* Heilprin, alt. 42 mm., p. 75.
15. *Tritonalia scabrosa* Dall, alt. 22 mm., p. 77.
16. *Turris* (*Surcula*) *servata* Conrad, alt. 55 mm., p. 39.

PLATE 6.

FIG. 1. *Conus planiceps* Heilprin, alt. 41 mm., p. 37.
2. The same, upper surface.
3. *Conus illiolus* Dall, alt. 43 mm., p. 37.
4. *Conus designatus* Dall, alt. 23 mm., p. 37.
5. *Conus illiolus* Dall, from above, p. 37.
6. *Coralliophila magna* Dall, alt. 52.5 mm., p. 78. (See also pl. 7, fig. 7.)
7. *Fasciolaria petrosa* Dall, alt. 100 mm., p. 64.
8. *Actæocina squarrosa* Dall, alt. 11.5 mm., p. 33.
9. *Cypræa ballista* Dall, lon. 33.5 mm., p. 85.
10. The same in profile.
11. The same, basal view.

PLATE 7.

FIG. 1. *Ancilla shepardi* Dall, alt. 3475 mm., p. 51.
2. *Vasum subcapitellum* Heilprin, alt. 27 mm., p. 63.
3. *Drillia newmani* Dall, alt. 12.5 mm., p. 46. (See also pl. 3, fig. 9.)
4. *Muricidea heilprini* Cossmann, alt. 23 mm., p. 76.
5. *Cantharus pauper* Dall, alt. 11 mm., p. 69. (See also pl. 10, fig. 12.)
6. *Marginella tampae* Dall, alt. 19 mm., p. 54.
7. *Coralliophila magna* Dall, alt. 45 mm., p. 78. (See also pl. 10, fig. 6.)
8. *Latirus callimorphus* Dall, alt. 41 mm., p. 65.
9. *Purpura* (*Pteropurpura*) *posti* Dall, alt. 40 mm., p. 76.

PLATE 8.

FIG. 1. *Pyrazisinus cornutus* Heilprin, from type showing secondary lip (*a*) formed after injury; (*b*) original lip. Alt. 45 mm., p. 92.
2. *Latirus rugatus* Dall, alt. 42 mm., p. 65.
3. *Bittium priscum* Dall, alt. 7 mm., p. 88.
4. *Drillia lapcnotieri* Dall, alt. of fragment 27.5 mm., p. 40.
5. *Potamides hillsboroënsis* Heilprin, alt. 37.5 mm., p. 91.
6. *Latirus floridanus* Heilprin, alt. 38 mm., p. 64.
7. *Melongena sculpturata* var. *turricula* Dall, alt. 60 mm., p. 68.
8. *Fusinus nexilis* Dall, alt. 12 mm., p. 66.

PLATE 9.

FIG. 1. *Lyria musicina* Heilprin, alt. 40 mm., p. 59.
2. *Strigatella americana* Dall, alt. 27 mm., p. 61.
3. *Cerithium plectrum* Dall, alt. 4.6 mm., p. 90.
4. *Lyria musicina* Heilprin, alt. 40 mm., p. 59.
5. *Busycòn spiniger* var. *nodulatum* Conrad, alt. 37 mm., p. 67.
6. *Turritella systoliata* Dall, alt. 73 mm., p. 99.
7. *Murex trophoniformis* Heilprin, alt. 49 mm., p. 74.
8. *Strombus chipolanus* Dall, alt. 65 mm., p. 87.
9. *Polinices hemicryptus* Gabb, alt. 8.2 mm., p. 106.
10. *Strombus chipolanus* Dall, alt. 65 mm., p. 87.

PLATE 10.

FIG. 1. *Cancillaria subthomasiae* Dall, alt. 20 mm., p. 47. (See also pl. 3, fig. 7.)
2. *Conomitra staminea* Conrad, alt. 24 mm., p. 62.

FIG. 3. *Lyria silicata* Dall, alt. 27.2 mm., p. 59.
4. *Cancellaria depressa* Dall, alt. 17.5 mm., p. 48.
5. *Busycon spiniger* var. *tampaënsis* Dall, alt. 41 mm., p. 67.
6. *Coralliophila magna* Dall, alt. 52.5 mm., p. 78. (See also pl. 7, fig. 7.)
7. *Busycon stellatum* Dall, young, alt. 35 mm., p. 67.
8. *Marginella intensa* Dall, alt. 8 mm., p. 56.
9. *Busycon stellatum* Dall, upper surface, lat. 20.5 mm., p. 67.
10. *Olivella cutorta* Dall, alt. 12 mm., p. 50.
11. *Lyria pulchella* Sowerby, alt. 27.5 mm., p. 58.
12. *Cantharus pauper* Dall, alt. 11 mm., p. 69. (See also pl. 7, fig. 5.)
13. *Lyria heilprini* Dall, alt. 43.5 mm., p. 58.

PLATE 11.

FIG. 1. *Melongena sculpturata* Dall, alt. 60 mm., p. 68.
2. *Vasum engonatum* Dall, alt. 96 mm., p. 63.
3. *Vasum engonatum*, from above.
4. *Orthaulax inornatus* Gabb, fragment of adult, alt. 55 mm., p. 86.
5. *Ampullina* (*Ampullinopsis*) *amphora* Heilprin, alt. 55 mm., p. 108.
6. *Marginella tampae* Dall, alt. 19 mm., p. 54.
7. *Marginella limatula* Conrad, alt. 15 mm., p. 54.

PLATE 12.

FIG. 1. *Marginella mollitor* Dall, alt. 11.5 mm., p. 52.
2. *Marginella myrina* Dall, alt. 6 mm., p. 57.
3. *Marginella infecta* Dall, alt. 7.7 mm., p. 50.
4. *Marginella impagina* Dall, alt. 5 mm., p. 56.
5. *Lacuna precursor* Dall, alt. 5.75 mm., p. 94.
6. *Marginella posti* Dall, alt. 6.4 mm., p. 56.
7. *Mitra myra* Dall, alt. 8 mm., p. 61.
8. *Drillia spica* Dall, alt. 13 mm., p. 42.
9. *Olivella colleta* Dall, alt. 4.5 mm., p. 50.
10. *Drillia sella* Dall, alt. 11.4 mm., p. 41.
11. *Anachis eutheria* Dall, alt. 9 mm., p. 71.
12. *Astyris cluthera* Dall, alt. 8 mm., p. 72.
13. *Alectrion ursula* Dall, alt. 7.5 mm., p. 69.
14. *Eulima bowdichi* Dall, alt. 9 mm., p. 82.
15. *Mangilia illiota* Dall, alt. 8 mm, p. 46.
16. *Drillia eupatoria* Dall (immature), alt. 7 mm., p. 44.
17. *Mitra syra* Dall, alt. 15.5 mm., p. 60.
18. *Drillia tecla* Dall, alt. 10 mm., p. 43.
19. *Cerithiopsis silicata* Dall, alt. 7 mm., p. 93.
20. *Turbonilla* (*Ptycheulimella*) *ethellina* Dall, alt. 3.5 mm., p. 84.
21. *Drillia smilia* Dall, alt. 12.5 mm., p. 43.
22. *Drillia silfa* Dall (immature), alt. 7 mm., p. 46.
23. *Drillia tama* Dall, alt. 10 mm., p. 45.
24. *Oliva posti* Dall, alt. 21.5 mm., p. 49.
25. *Drillia condominia* Dall, alt. 25 mm., p. 39.
26. *Cerithium praecursor* Heilprin, alt. 12 mm., p. 90.
27. *Ampullina streptostoma* Heilprin, alt. 29.5 mm., p. 107.
28. *Morum domingense* Sowerby, alt. 26 mm., p. 85.
29. *Sinum chipolanum* Dall, alt. 14 mm., p. 109. (See also pl. 16, fig. 1.)

PLATE 13.

FIG. 1. *Rissoina supralaevigata*, alt. 5.5 mm., p. 101.
2. *Turritella litharia* Dall, alt. 20 mm., p. 99.
3. *Turritella (tampae* var. ?) *medioconstricta* Dall, alt. 48 mm., p. 98.
4. *Pyramidella crenulata* Holmes, alt. 12 mm., p. 83.
5. *Turritella atacta* Dall (var. ?), alt. 14 mm., p. 100.
6. *Strombus liocyclus* Dall, alt. 36.5 mm., p. 88.
7. The same, dorsal view.
8. *Rapana tampaënsis* Dall, alt. 35 mm., p. 78.
9. *Typhis siphonifera* Dall, alt. 10.5 mm., p. 77.
10. *Rapana biconica* Dall, alt. 41.5 mm., p. 79.
11. *Murex scrangula* Dall, alt. 22 mm., p. 74.
12. *Hipponix pygmaeus* Lea, alt. 5 mm., p. 104.
13. The same in profile.
14. The same, basal view.
15. *Pyrazisinus campanulatus* Heilprin, a somewhat immature specimen, alt. 40.7 mm., the peristome incomplete, p. 92.
16. *Bittium adela* Dall, immature, alt. 8.5 mm., p. 89.
17. *Alectrion ethelinda* Dall, alt. 11.2 mm., p. 70.
18. *Pyrazisinus campanulatus* Heilprin, adult, with completed peristome, alt. 47 mm., p. 92.

PLATE 14.

FIG. 1. *Turritella tampae* Heilprin, alt. 13.5 mm., p. 97.
2. *Mitra silicata* Dall, alt. 29 mm., p. 60.
3. *Potamides transecta* Dall, alt. 18 mm., p. 91.
4. *Serpulorbis ballistae* Dall, lon. of coral 70 mm., p. 95.
5. *Turritella atacta* Dall, alt. 28 mm., p. 100.
6. *Turritella megalobasis* Dall, alt. 65 mm., p. 98.
7. *Turris albida* Perry, alt. 75 mm., p. 38. (See also pl. 5, fig. 13.)
8. *Turritella pagodaeformis* Heilprin, alt. 50 mm., p. 98.

PLATE 15.

FIG. 1. *Xenophora conchyliophora* Born, lat. 39 mm., p. 105.
3. The same, basal view.
2. *Marginella incepta* Dall, alt. 5.5 mm., p. 53.
4. *Olivella lata* Dall, alt. 9.25 mm., p. 49.
5. *Orthaulax pugnax* Heilprin, the outer lip restored; alt. 80 mm., p. 87.
6. *Astyris turgidula* Dall, alt. 13 mm. This specimen is not quite mature, p. 72.
7. *Modulus turbinatus* Heilprin, alt. 21 mm., p. 94.
8. *Calliostoma metrium* Dall, alt. 18 mm., p. 111.
9. *Helicina ballista* Dall, alt. 8 mm., p. 113.
10. *Orthaulax pugnax* Heilprin, viewed from above, p. 87.
11. *Helicina ballista* Dall, basal view, lat. 10 mm., p. 113.

PLATE 16.

FIG. 1. *Sinum chipolanum* Dall, alt. 14 mm., p. 109. (See also pl. 12, fig. 29.)
2. *Nerita tampaënsis* Dall, alt. 10 mm., p. 114.
3. *Natica (Cryptonatica) floridana* Dall, alt. 7.5 mm., p. 106.

FIG. 4. *Liotia* (*Arene*) *solariella* Heilprin, view of upper surface, lat. 5.8 mm., p. 112.
5. The same in profile.
6. *Liotia coronata* Dall, upper surface, lat. 5 mm., p. 112.
7. *Hipponix willcoxii* Dall, lon. of base, 9 mm., p. 104.
8. *Vivipara* (*Lioplax*) *floridana* Dall, alt. 7.5 mm., p. 100.
9. *Marginella bellula* Dall, alt. 6.5 mm., p. 53.
10. *Marginella bella* Conrad, alt. 8 mm., p. 55.
11. *Marginella elegantula* Dall, alt. 11 mm., p. 53.
12. *Marginella ballista* Dall, alt. 18 mm., p. 54.
13. *Marginella newmani* Dall, alt. 5.5 mm., p. 57.
14. *Marginella faunula* Dall, alt. 8 mm., p. 53.
15. *Tegula excelsa* Conrad, lat. 12 mm., p. 111.
16. The same, basal view.
17. *Liotia coronata* Dall, lat. 5 mm., p. 112.

PLATE 17.

FIG. 1. *Cardita* (*Carditamera*) *tegea* Dall, lon. 33 mm., p. 133.
2. *Corbula sarda* Dall, lon. 12 mm., p. 155.
3. *Tellina segregata* Dall, lon. 17 mm., p. 151.
4. *Arca* (*Barbatia*) *irregularis* Dall, lon. 52 mm., p. 119.
5. *Arca* (*Barbatia*) *arcula* Heilprin, lon. 47 mm., p. 120.
6. *Arca umbonata* Lamarck, left valve from above, lon. 36 mm., p. 118.
7. *Arca* (*Scapharca*) *hypomela* Dall, lon. 50 mm., p. 121.
8. *Arca umbonata* Lamarck, interior of left valve, lon. 50 mm., p. 118.
9. *Villorita floridana* Dall, view of hinge of right valve, alt. 70 mm., p. 134.
10. The same, profile view, diam. 25 mm.
11. *Tellina segregata* Dall, from above, lon. 17 mm., p. 151.

PLATE 18.

FIG. 1. *Panope whitfieldi* Dall, lon. 88 mm., p. 156.
2. *Panope whitfieldi* Dall.
3. *Callocardia nux* Dall, lon. 14 mm., p. 147.
4. *Corbula burnsi* Dall, lon. 11 mm., p. 155.
5. *Corbula burnsi* Dall.
6. *Bornia tampae* Dall, lon. 6 mm., p. 141.
7. *Cardium* (*Trachycardium*) *propeciliare* Dall, lon. 20 mm., p. 142.
8. *Villorita floridana* Dall, alt. 70 mm., p. 134.
9. *Diplodonta catopotium* Dall, lon. 8 mm., p. 140.
10. *Villorita floridana* Dall, alt. 70 mm., p. 134.
11. *Villorita floridana*, showing the hinge of the right valve, lat. 65 mm.

PLATE 19.

FIG. 1. *Spondylus chipolanus* Dall, young valve, alt. 30 mm., p. 125.
2. *Gastrochaena rotunda* Dall, lon. 7 mm., p. 157.
3. *Cardium* (*Cerastoderma*) *taphrium* Dall, lon. 35 mm., p. 144.
4. *Spondylus bostrychites* Guppy, alt. 59 mm., p. 124.
5. *Phacoides hillsboroensis* Heilprin, alt. 60 mm., p. 139.
6. *Ostrea vaughani* Dall, lon. 120 mm., p. 123.

PLATE 20.

FIG. 1. *Arca grammatodonta* Dall, interior of right valve, lon. 30 mm., p. 118. (See pl. 22, fig. 3.)
2. The same, from above.
3. *Modiolus blandus* Dall, anterior view, lat. 20 mm., p. 127. (See fig. 6.)
4. *Semele sardonica* Dall, profile from in front, p. 154. (See fig. 7.)
5. *Orbitolites floridanus* Conrad, typical spiral form, p. 157. (See pl. 21, figs. 7, 11), diam. 12 mm.)
6. *Modiolus blandus* Dall, right side, the left valve overlapping a little below, lon. 43.5 mm., p. 127.
7. *Semele sardonica* Dall, right valve lon. 16 mm., p. 154.
8. *Macrocallista* (*Paradione*) *acuminata* Dall, interior of right valve, lon. 16 mm., p. 146.
9. The same, from in front.
10. The same, exterior of right valve, lon. 16.5 mm. (See also pl. 24, fig. 2.)
11. *Glycymeris lamyi* Dall, alt. 16.5 mm., p. 122.
13. The same, interior of the valve.
12. *Modiolus blandus* Dall, view from above; note the overlapping of the left valve; lon. 43.5 mm., p. 127.

PLATE 21.

FIG. 1. *Phacoides tampaënsis* Dall, lon. 5 mm., p. 138.
2. The same, from in front.
3. *Erycina* ? *indecisa* Dall, lon. 4 mm., p. 141. (See fig. 8.)
4. *Corbula kaghriana* Dall, anterior view, p. 155.
5. The same, in profile, lon. 10 mm.
6. *Leda posti* Dall, lon. 14 mm., p. 117. (See fig. 9.)
7. *Orbitolites floridanus* Conrad, orbicular (? sexual) form, diam. 6 mm., p. 157.
8. *Erycina* ? *indecisa* Dall, viewed from in front, p. 141. (See fig. 3.)
9. *Leda posti* Dall, interior of right valve, lon. 9.5 mm., p. 117.
10. *Cardita shepardi* Dall, interior of left valve, lon. 9.5 mm., p. 133.
11. *Orbitolites floridanus* Conrad, spiral form, p. 157. (See also pl. 20, fig. 5, for opposite side), diam. 12 mm.
12. *Cardita shepardi* Dall, exterior of left valve, lon. 9.5 mm., p. 133.
13. *Nucula tampae* Dall, from in front, p. 116.
14. The same, in profile, lon. 7.3 mm.
15. *Codakia* (*Jagonia*) *scurra* Dall, lon. 11 mm., p. 136.
16. The same, from above.
17. *Arca* (*Scapharca*) *hypomela* Dall, interior of right valve, lon. 31 mm., p. 121.
18. The same, exterior view.

PLATE 22.

FIG. 1. *Tellina chipolana* Dall, left valve, lon. 20 mm., p. 151.
2. The same, interior view.
3. *Arca grammatodonta* Dall, exterior of right valve, lon. 35 mm., p. 118. (See also pl. 20, figs. 1, 2.)
4. *Cyrena pompholyx* Dall, right valve, lon. 50 mm., p. 134.
5. The same, from above.

FIG. 6. *Crassatellites deformis* Heilprin, lon. 61 mm. Interior of left valve, p. 131.
7. The same, exterior of same valve.
8. *Cyrena pompholyx* Dall, from in front, p. 134.

PLATE 23.

FIG. 1. *Tellina (Merisca) halidona* Dall, interior of left valve, lon. 37 mm., p. 152.
2. *Pecten chipolanus* Dall, left valve, lat. 25.5 mm., p. 124.
3. *Tellina (Merisca) halidona* Dall, exterior of left valve, lon. 37 mm., p. 152.
4. *Anomalocardia floridana* Conrad, lon. 38 mm., p. 150.
5. The same, from above.
6. *Anomia micrographmata* Dall, interior of upper valve, showing scars; lon. 22 mm., p. 126.
7. *Semele silicata* Dall, lon. 23 mm., p. 154.
8. *Leda flexuosa* Heilprin, from above, lon. 14.25 mm., p. 117.
10. The same in profile.
9. *Phacoides domingensis* Dall, lon. 22 mm., p. 137.
11. *Coralliophaga elegantula* Dall, lon. 19 mm., p. 131.
13. The same, from above.
12. *Phacoides wacissanus* Dall, lon. 16 mm., p. 137.
14. *Myrtaca vermiculata* Dall, lon. 7.5 mm., p. 136.

PLATE 24.

FIG. 1. *Chama tampaënsis* Dall, upper valve, lat. 20 mm., p. 135.
2. *Macrocallista acuminata* Dall, left valve, lon. 28 mm., p. 146. (See also pl. 20, figs. 8, 9, 10.)
3. *Phacoides (Cavilucina) recurrens* Dall, lon. 5.7 mm., p. 138.
4. *Lithophaga nuda* Dall, cast of burrow, lon. 50 mm., p. 129. (See also pl. 26, fig. 7.)
5. *Phacoides (Lucinisca) calhounensis* Dall, lon. 10 mm., p. 139.
6. *Modiolus (Gregariella) minimus* Dall, from above, lon. 7 mm., p. 128.
7. *Tellina (Macaliopsis) merula* Dall, lon. 16 mm., p. 152.
8. *Diplodonta alta* Dall, alt. 27 mm., p. 140.
9. *Macoma irma* Dall, lon. 28 mm., p. 153.
10. *Dosinia chipolana* Dall, lat. 40 mm., p. 145.
11. *Modiolus silicatus* Dall, lon. 22.5 mm., p. 127.
12. *Chione spada* Dall, lon. 29 mm., p. 149.

PLATE 25.

FIG. 1. *Antigona (Melosia) glyptoconcha* Dall, lon. 26.5 mm., p. 148.
2. *Arca (Scapharca) latidentata* Dall, lon. 18 mm., p. 121.
3. *Chione (Lirophora) ballista* Dall, lon. 24 mm., p. 149.
4. *Antigona (Artena) shepardi* Dall, lon. 21 mm., p. 148.
5. *Chione (Chamelæa) nuciformis* Heilprin, lon. 24 mm., p. 149.
6. *Chione (Chamelaea) rhodia* Dall, lon. 18 mm., p. 149.
7. *Callocardia (Agriopoma) sincera* Dall, lon. 20.5 mm., p. 146.
8. *Trigoniocardia alicula* Dall (valve somewhat worn), alt. 12 mm., p. 144.
9. *Chama chipolana* Dall, upper valve, lon. 27 mm., p. 135.
10. *Cardium (Cerastoderma) phlyctæna* Dall, alt. 27 mm., p. 144.
11. *Chama chipolana* Dall, lower valve, lon. 27 mm., p. 135.
12. *Cardium (Trachycardium) delphicum* Dall, alt. 34 mm., p. 142.

PLATE 26.

FIG. 1. *Antigona tarquinia* Dall, left valve, lon. 49 mm., p. 147.
2. The same, from above.
3. *Venus halidona* Dall, right valve, lon. 37 mm., p. 150.
4. *Modiolus* (*Brachydontes*) *grammatus* Dall, left valve, lon. 20 mm., p. 127.
5. *Venus halidona* Dall, right valve, from above, lon. 37 mm., p. 150.
6. *Venericardia serricosta* Heilprin, interior of left valve, lon. 32 mm., p. 132.
7. *Lithophaga nuda* Dall, from above specimen defective behind, lon. 56 mm., p. 129. (See also pl. 24, fig. 4.)


1


2


3


4


5


6


7


8

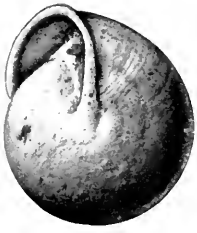

10


11


9


12


13


14


15

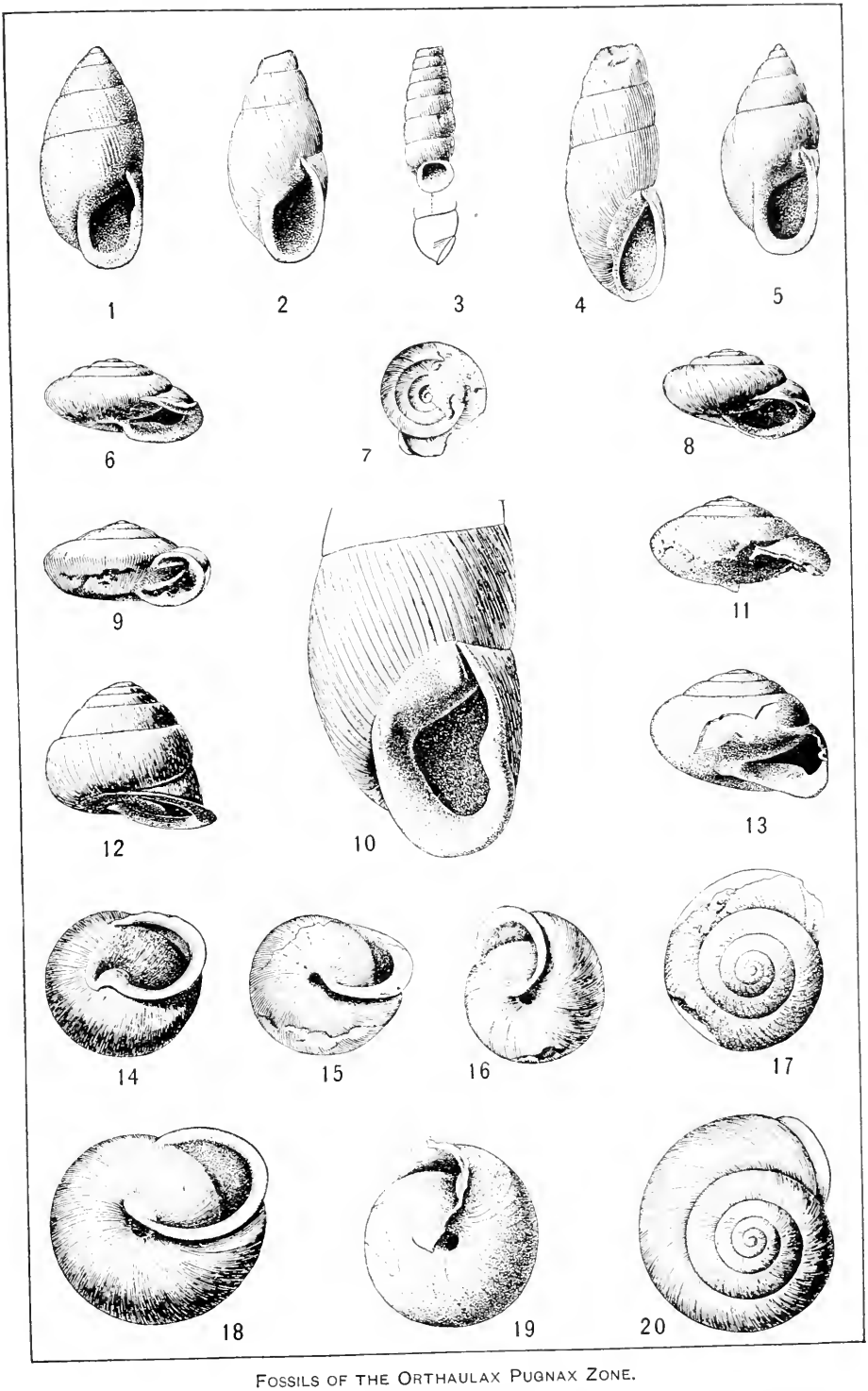

16


17


18

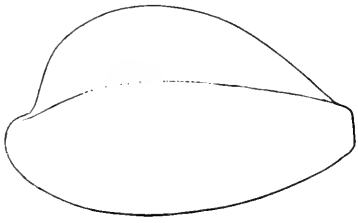
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 159.

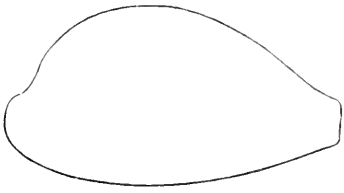


FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 159.



1



2

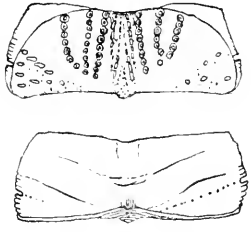
3

4

5

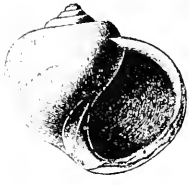
6

7



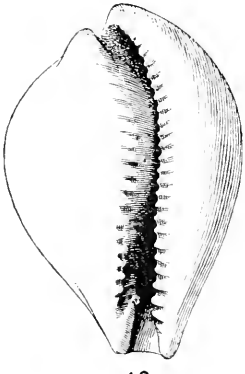
8

9



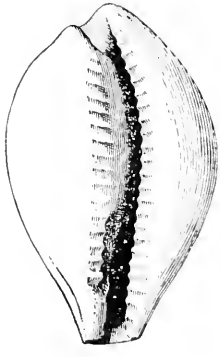
10

11



12

13



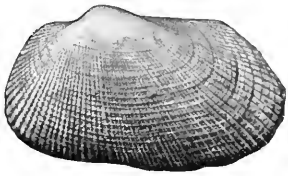
14

FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

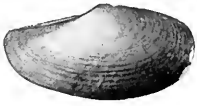
FOR EXPLANATION OF PLATE SEE PAGE 160.


1


2


3


4


5

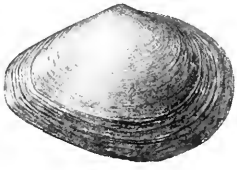

6


7

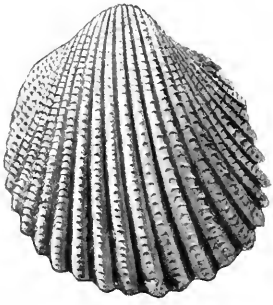

8


9


10


11

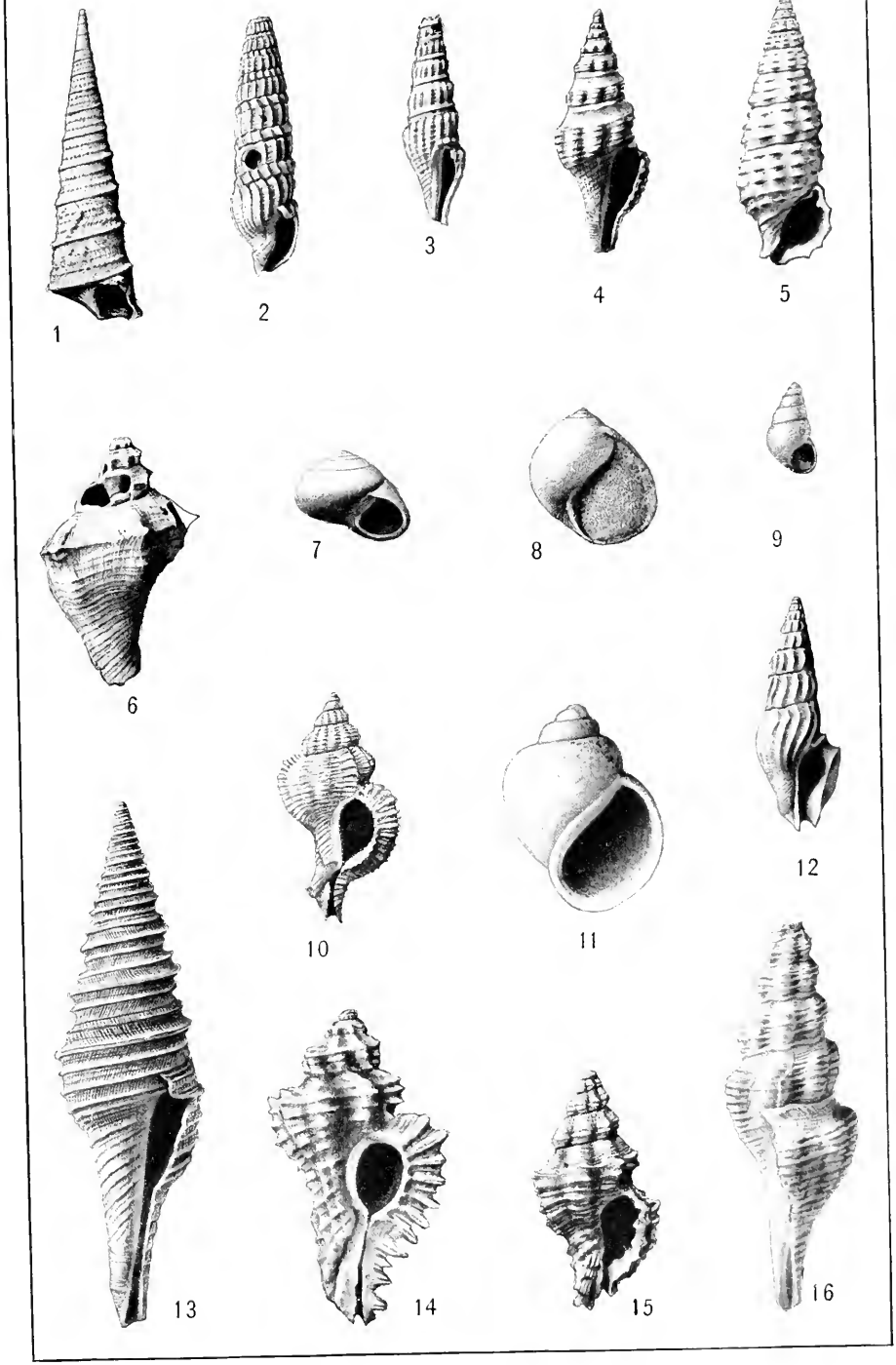

12


13


14

FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 160.



FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

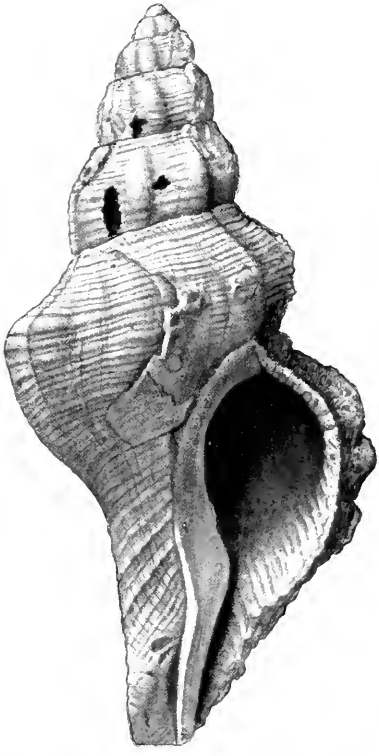
FOR EXPLANATION OF PLATE SEE PAGE 160.

1

2

3

4



7

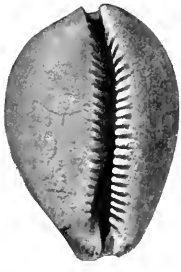
5

6

8

9

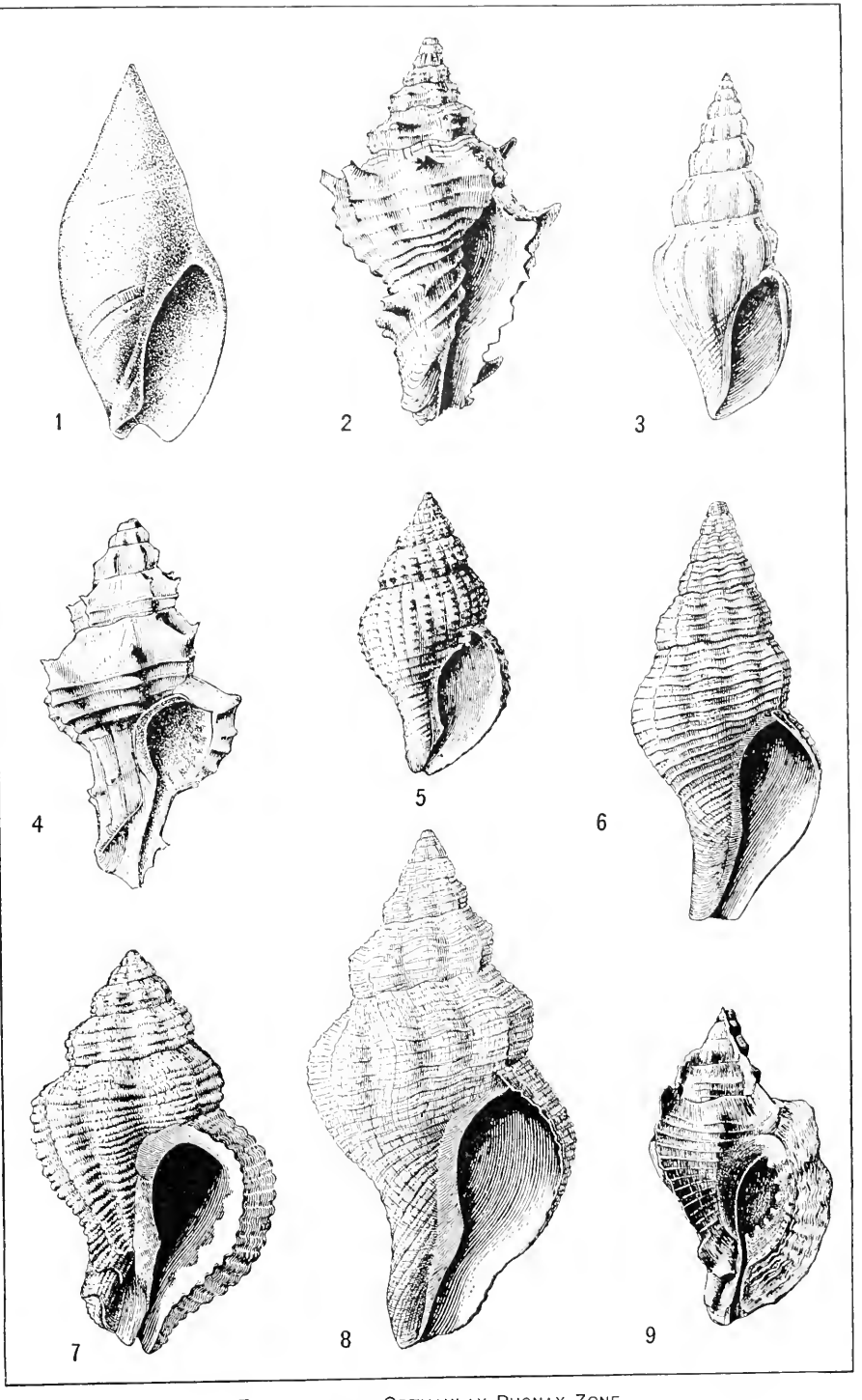
10



11

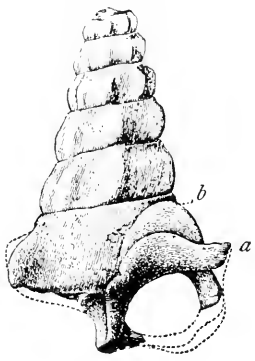
* FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 161.

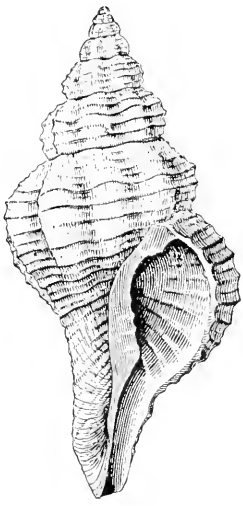


FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

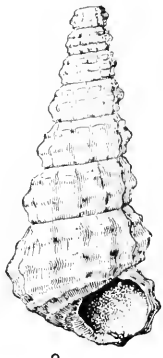
FOR EXPLANATON OF PLATE SEE PAGE 161.



1



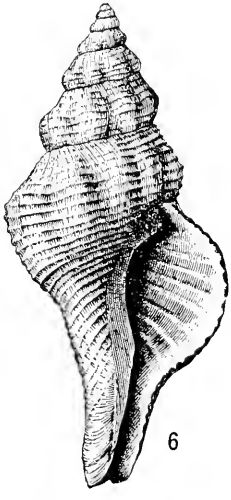
2



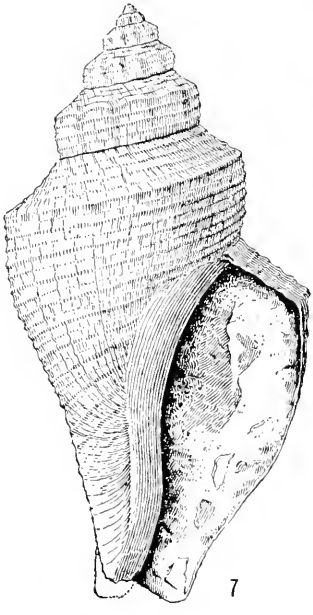
3

4

5



6

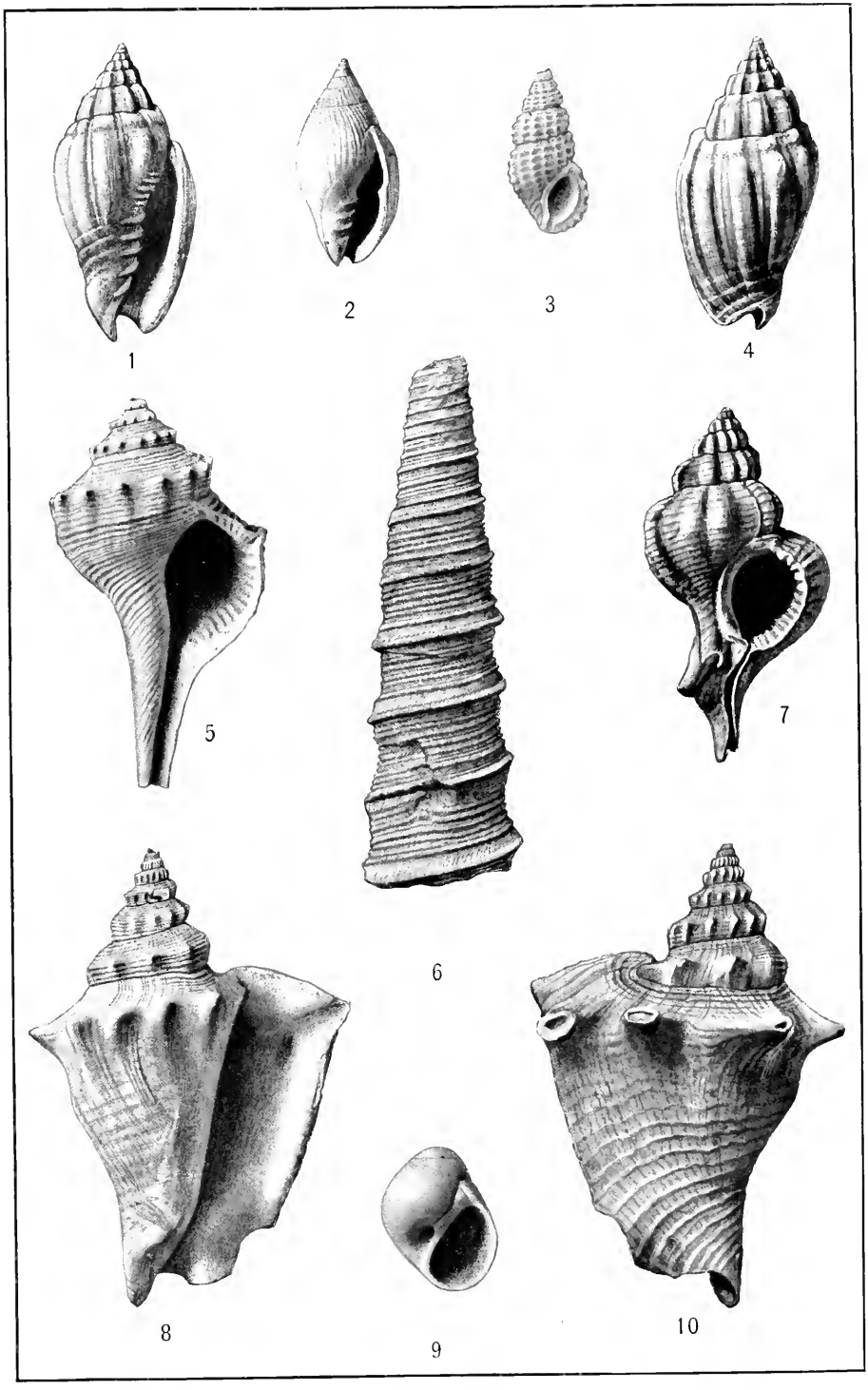


7

8

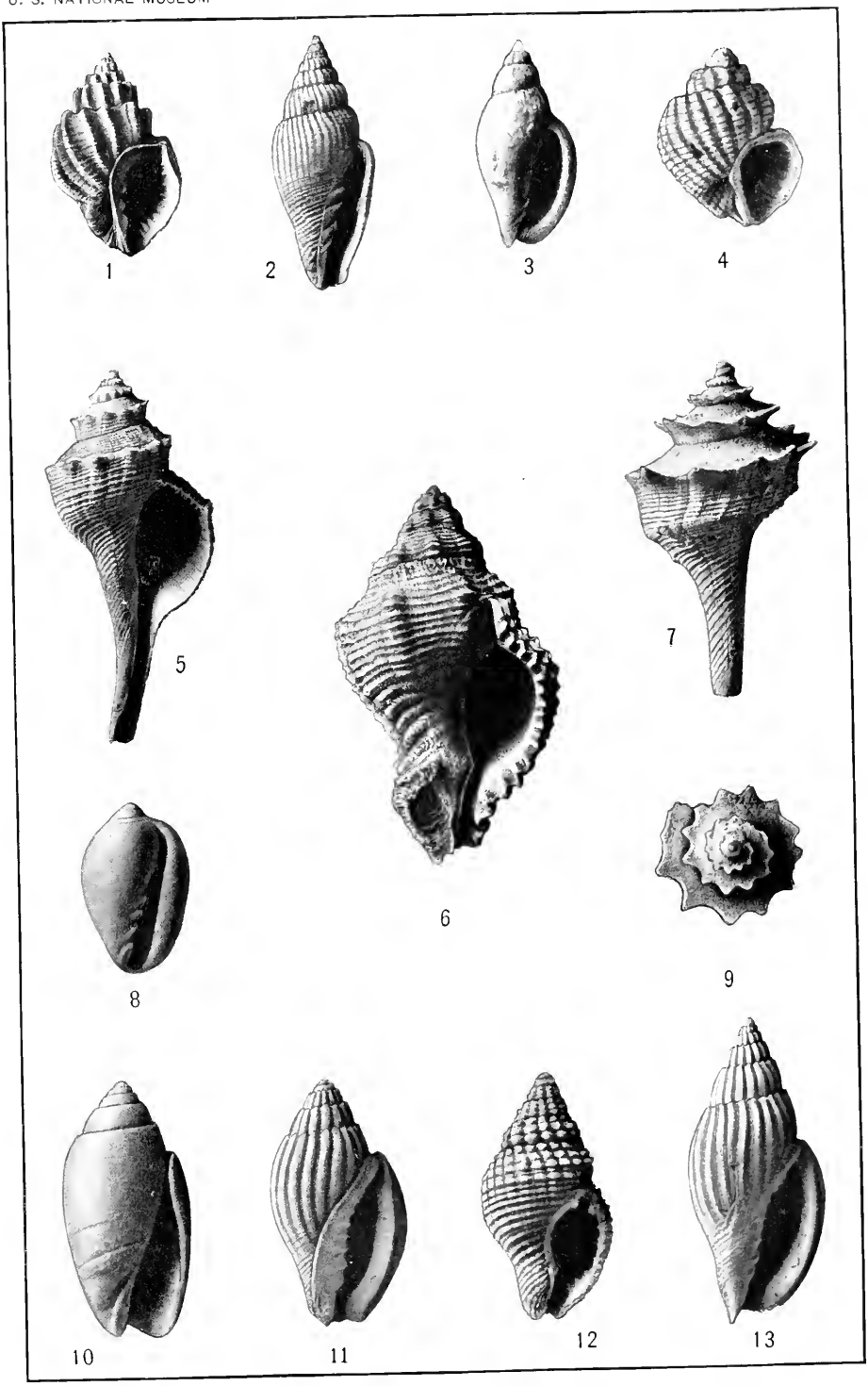
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 161.



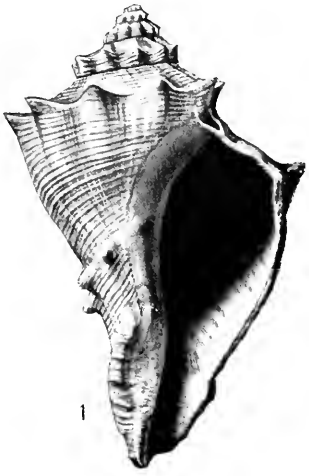
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 161.



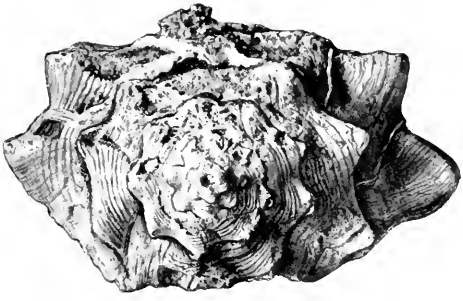
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGES 161, 162.

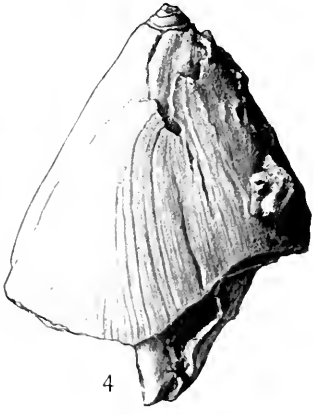


1

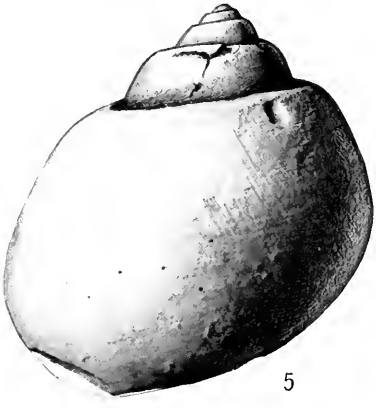
2



3



4



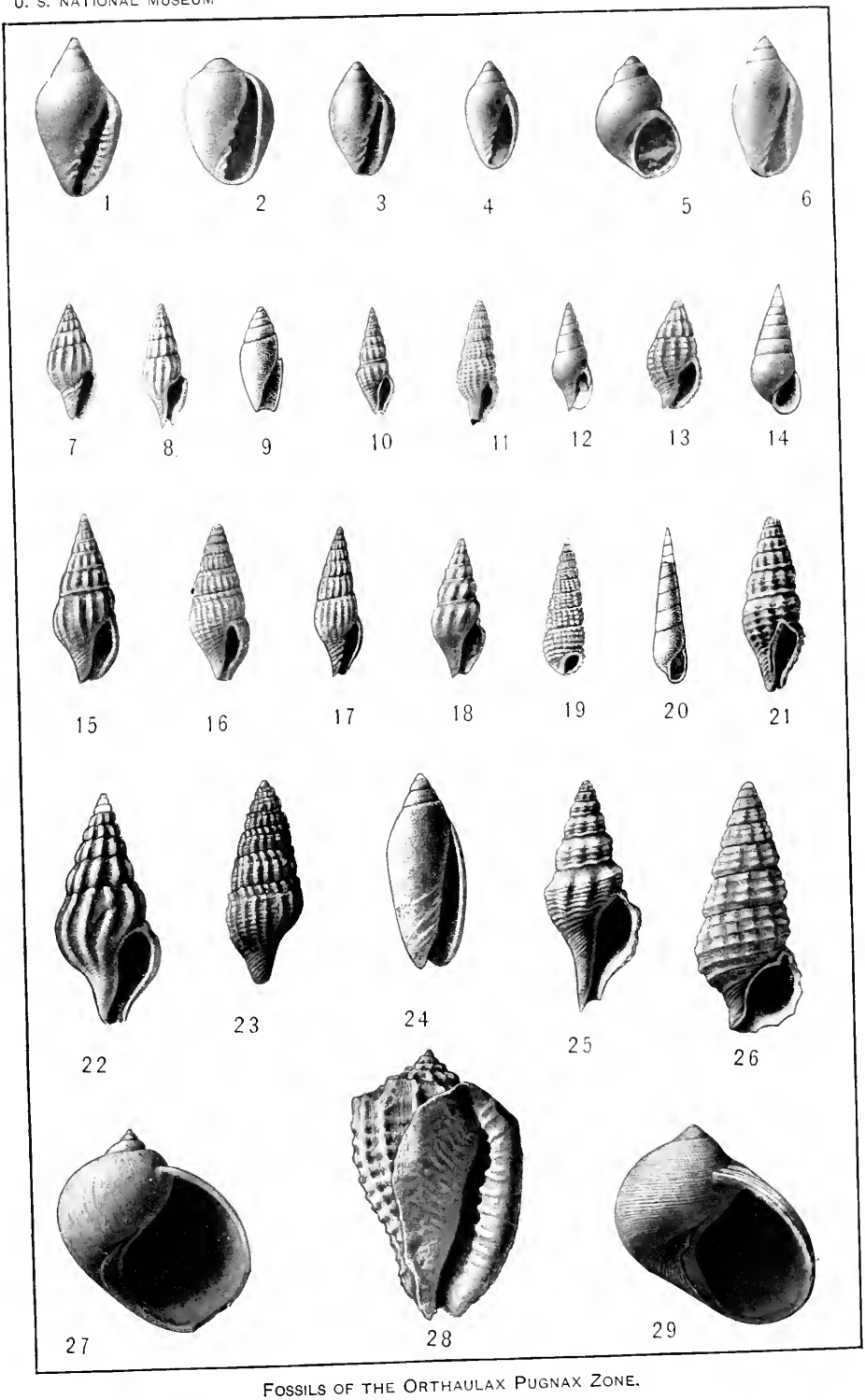
5

6

7

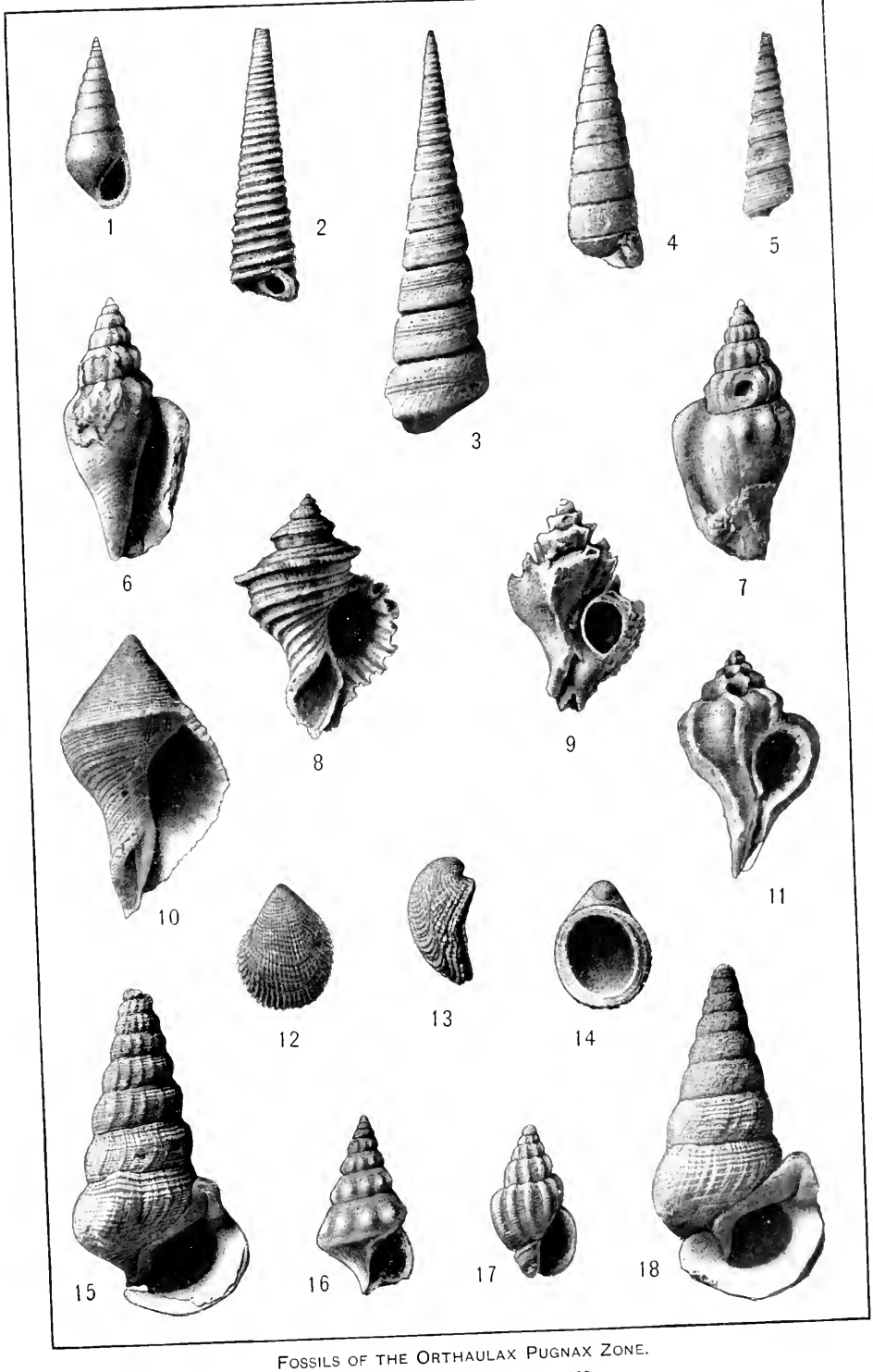
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 162.



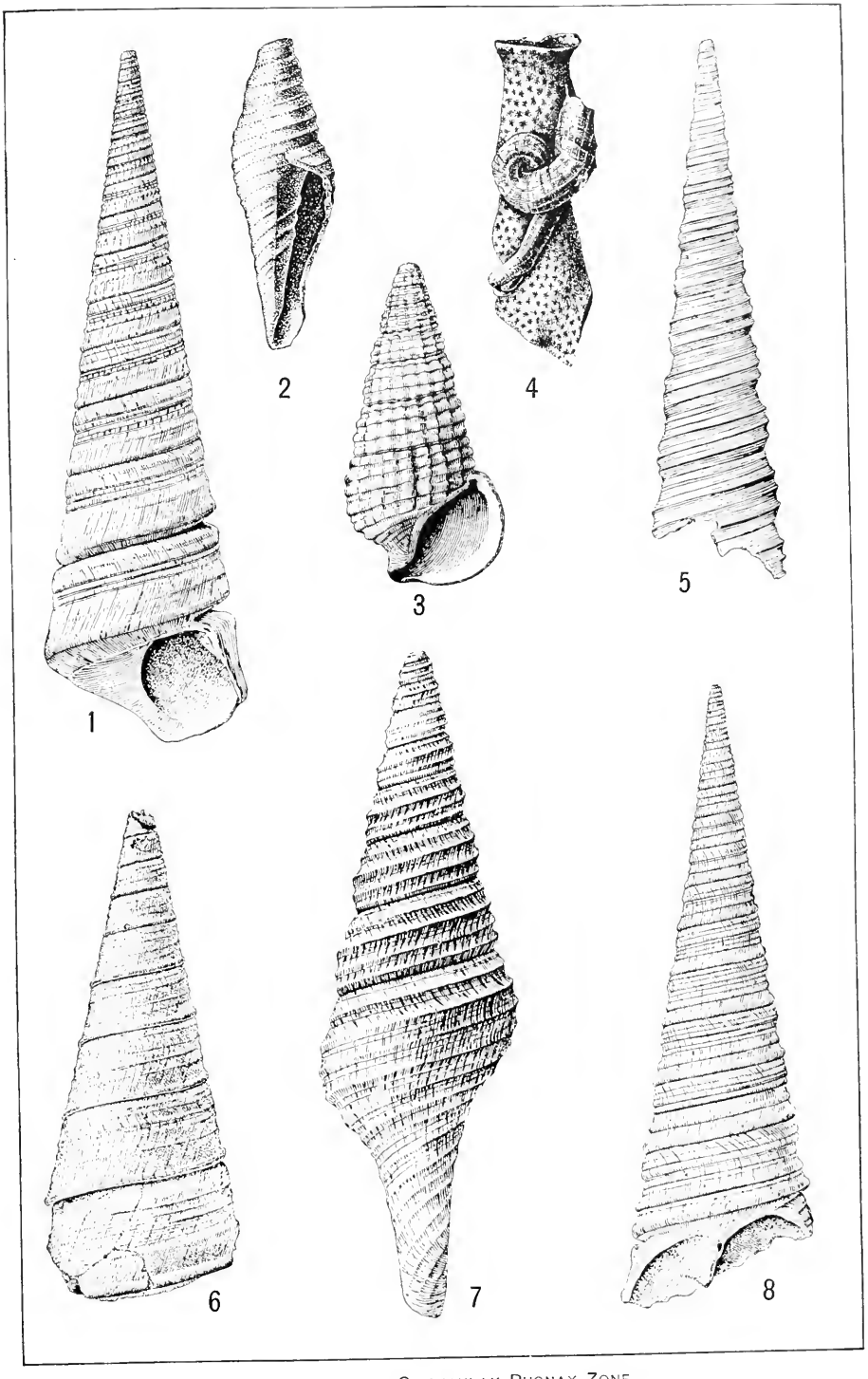
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 162.



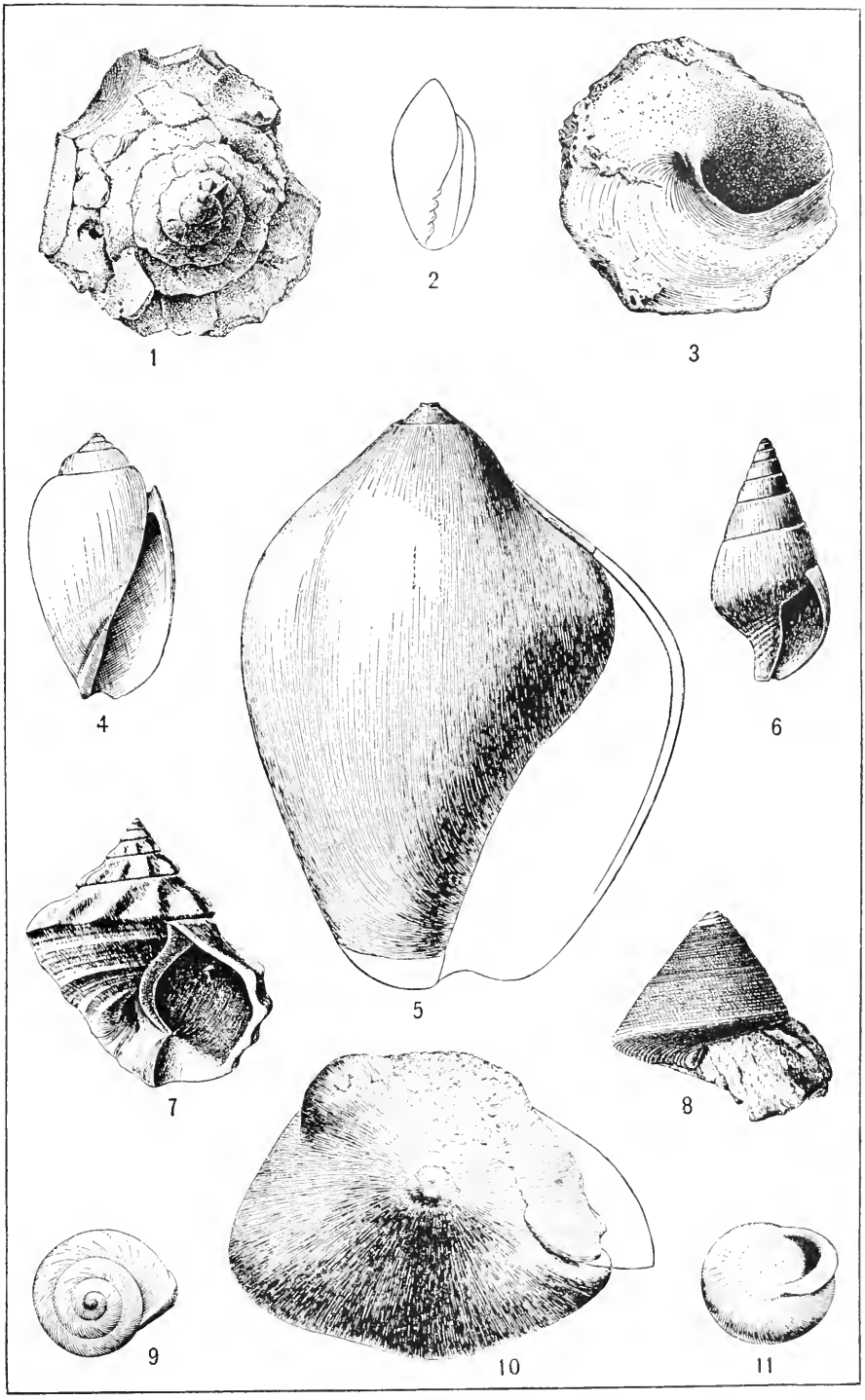
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 163.



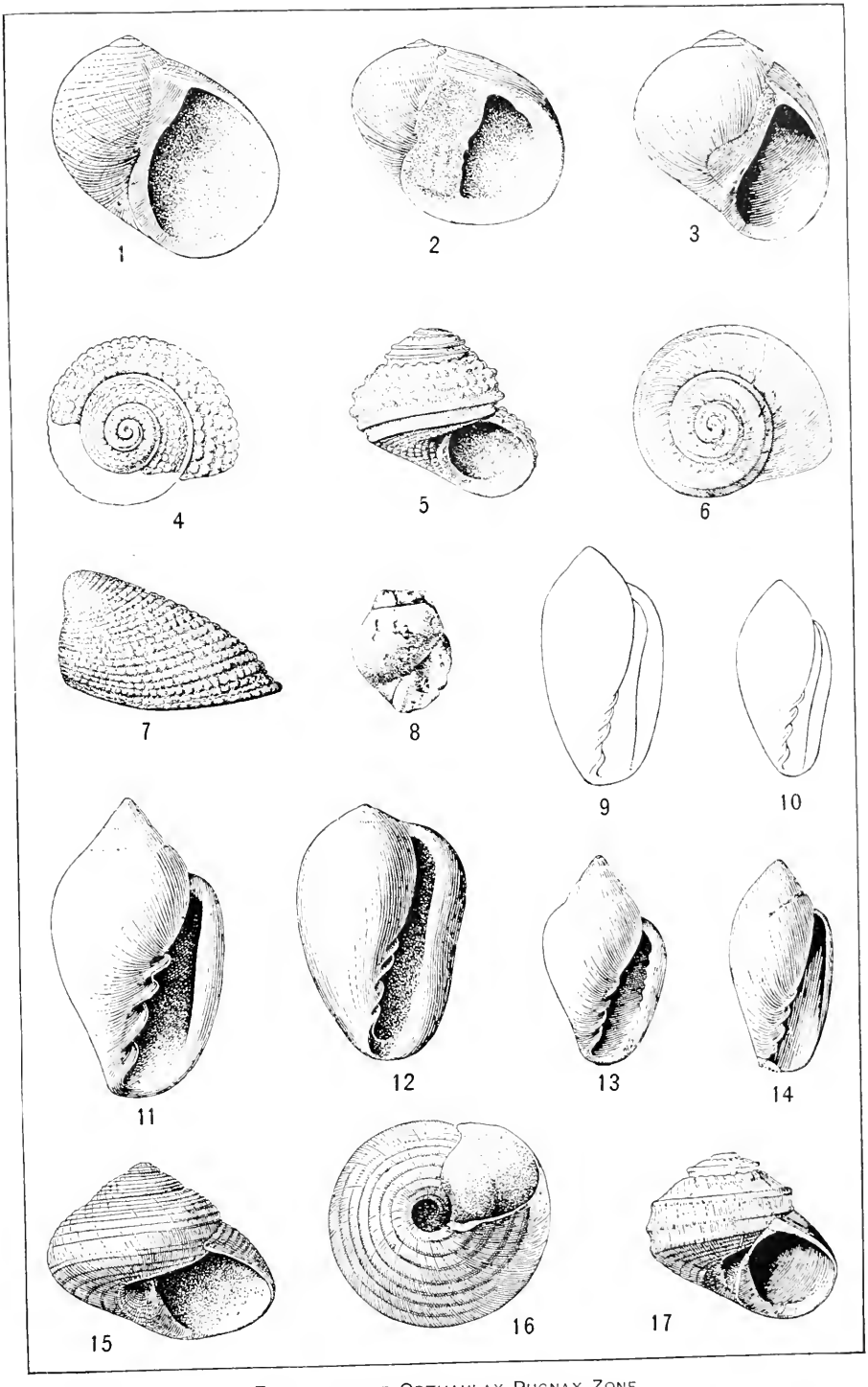
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 163.



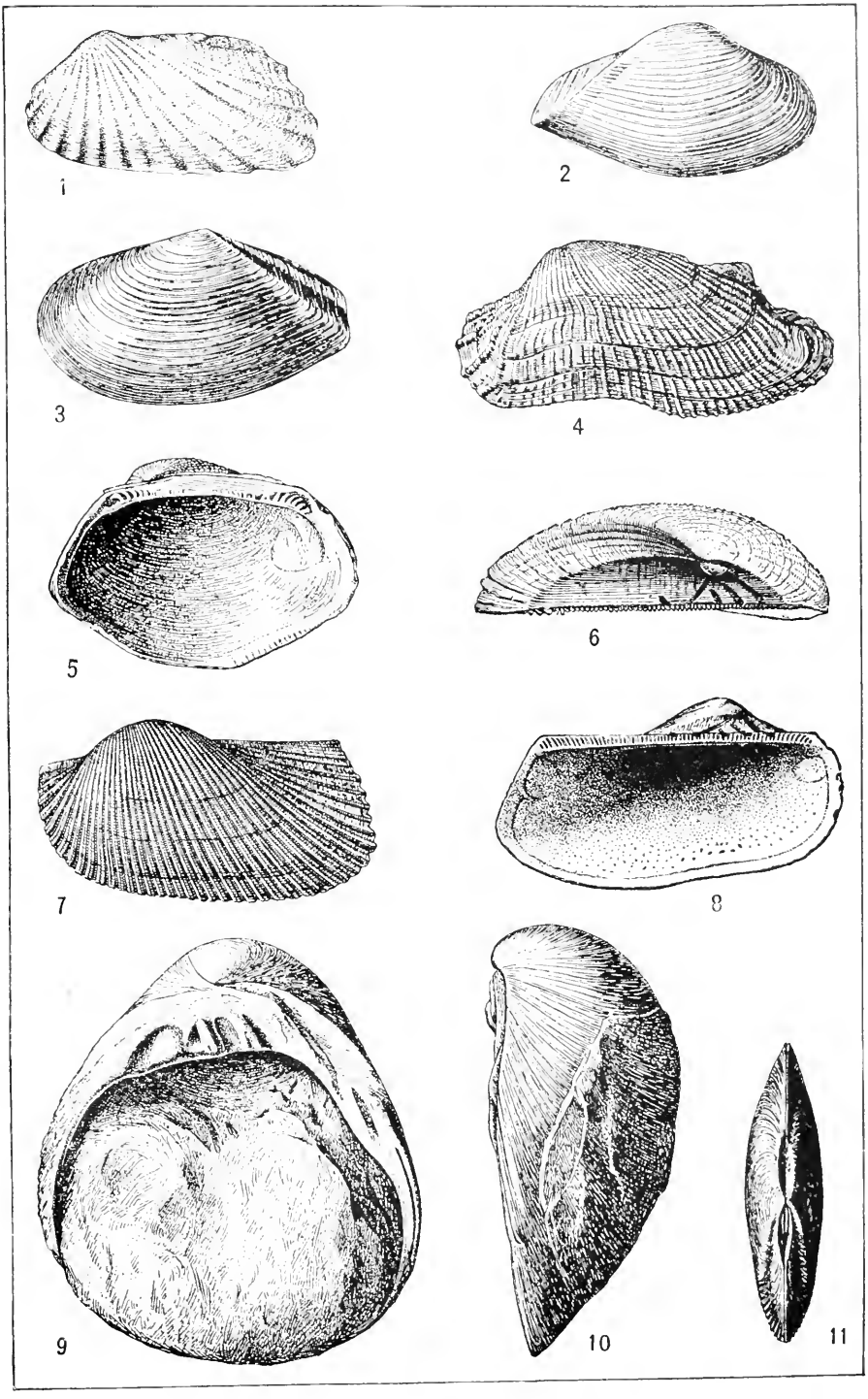
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 163.



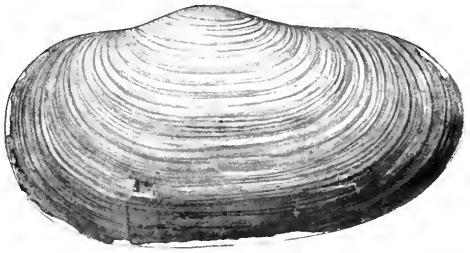
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGES 163, 164.



FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 164.



1

2

4

3

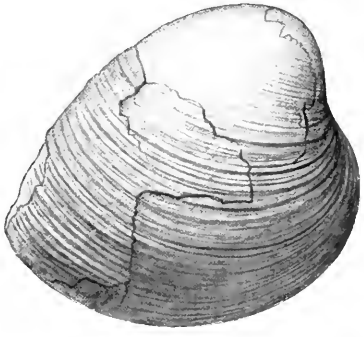
5

6

7

8

9

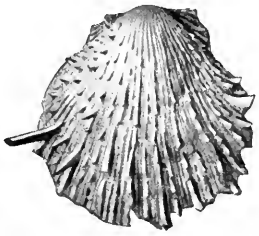


10

11

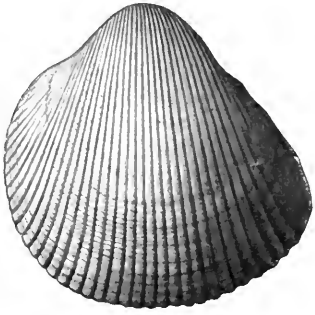
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 164.

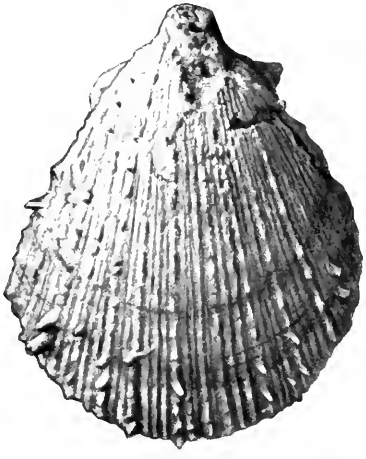


1

2

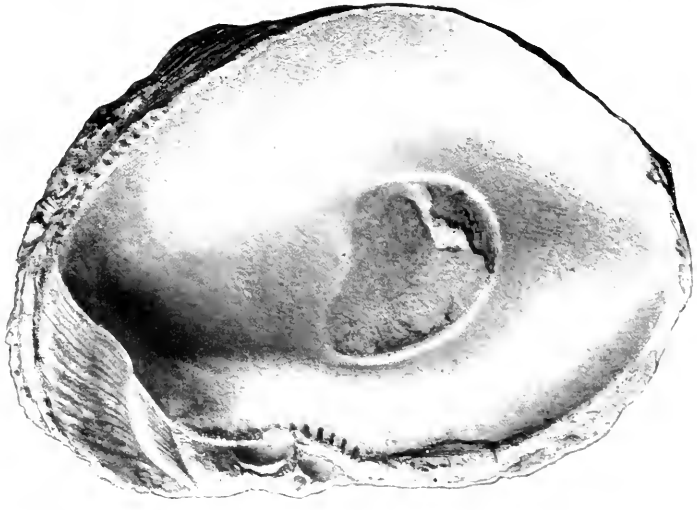


3



4

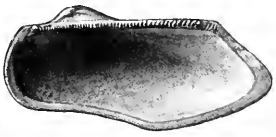
5



6

FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 164.



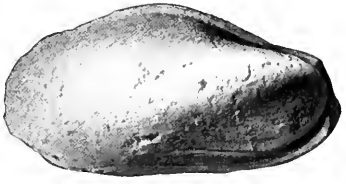
1

2

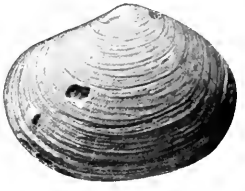
3

4

5

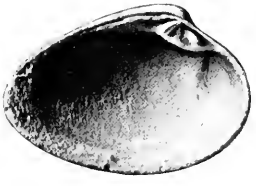


6



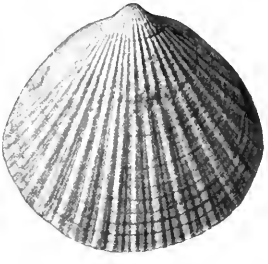
7

9



8

10



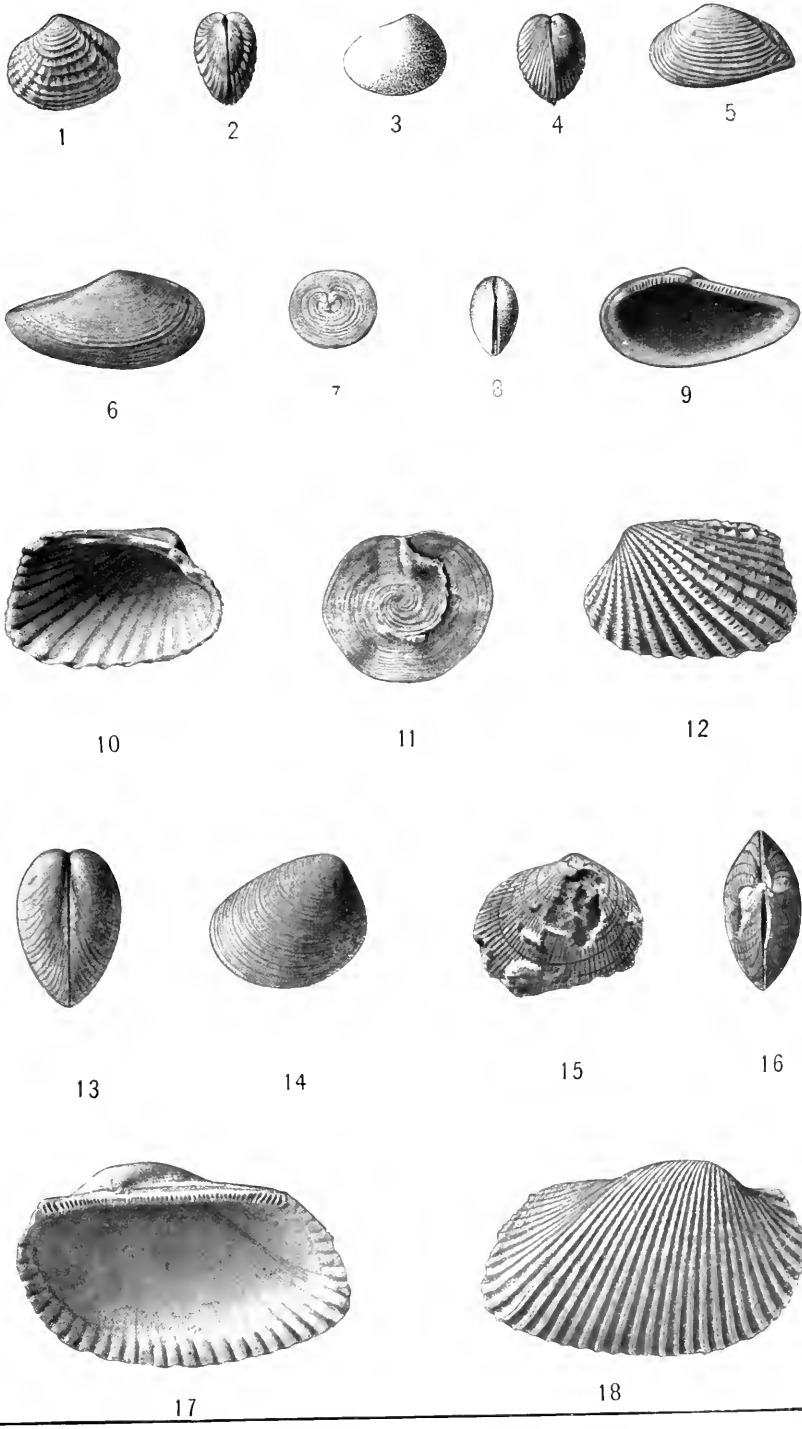
11

12

13

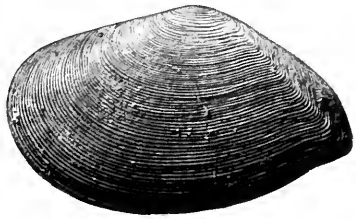
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 165.



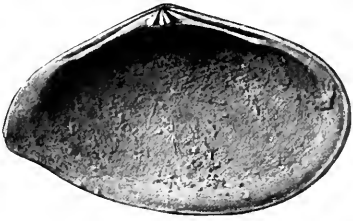
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 165.



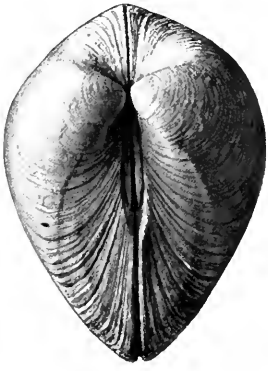
1

3

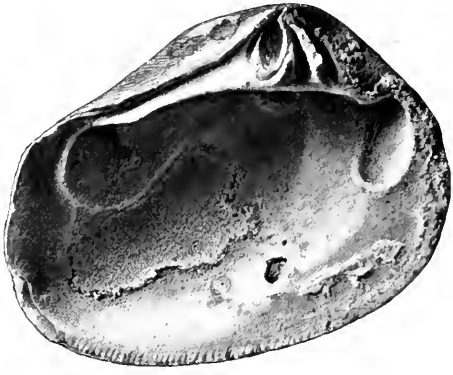


2

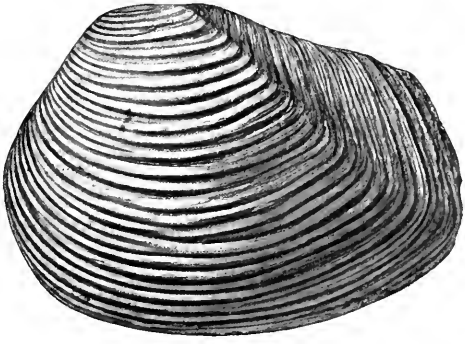
4



5



6

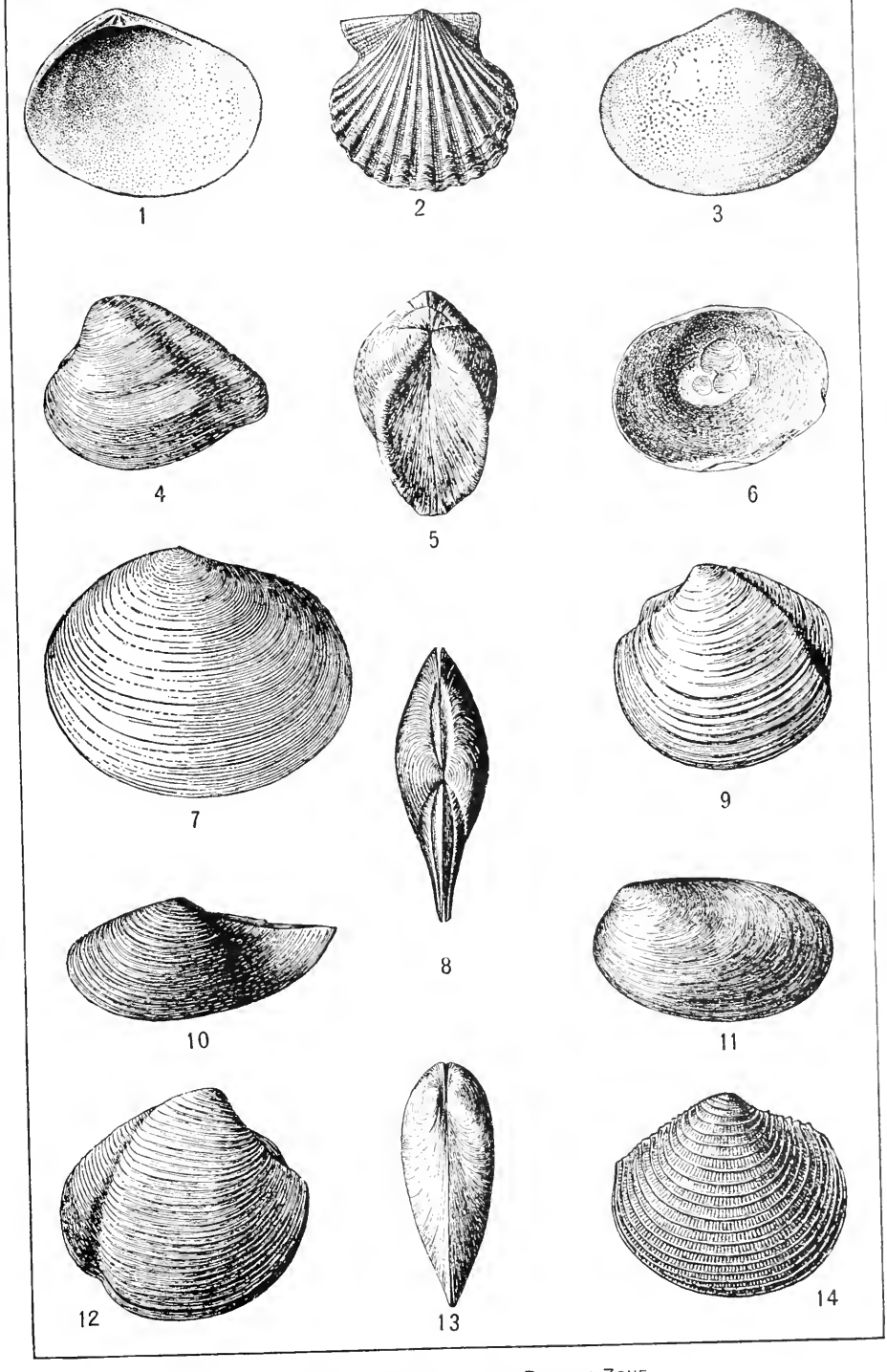


7

8

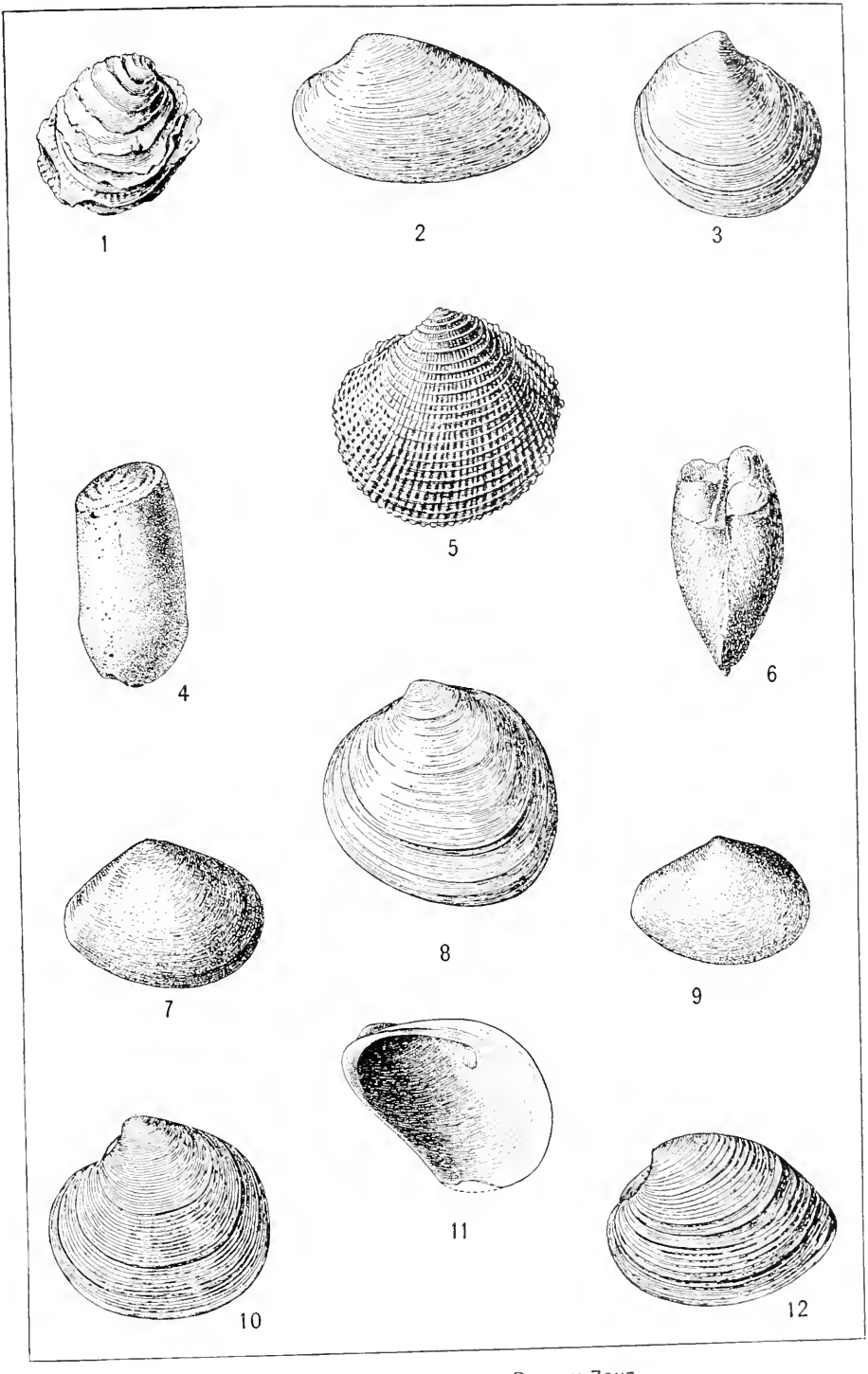
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGES 165, 166.



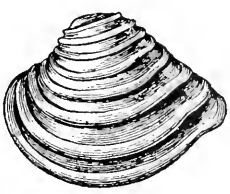
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

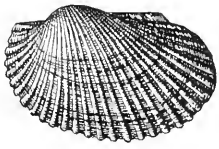
FOR EXPLANATION OF PLATE SEE PAGE 166.

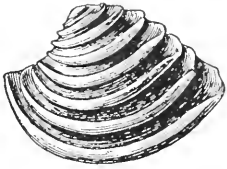


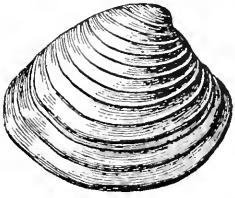
FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 166.


1

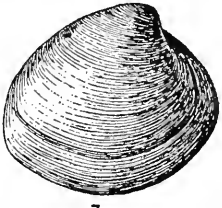

2

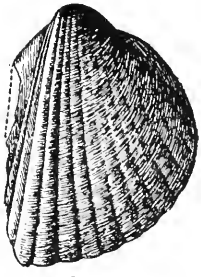

3

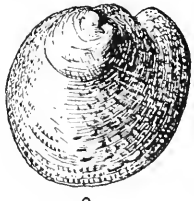

4

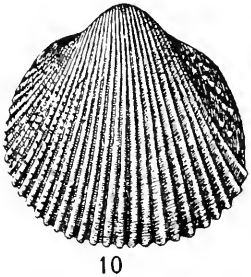

5

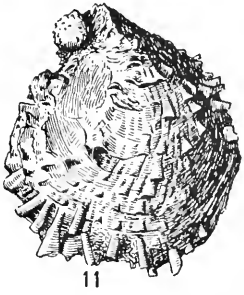

6

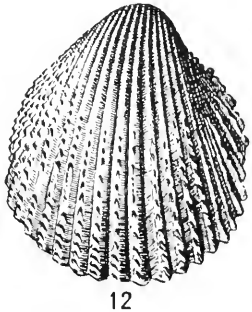

7


8


9

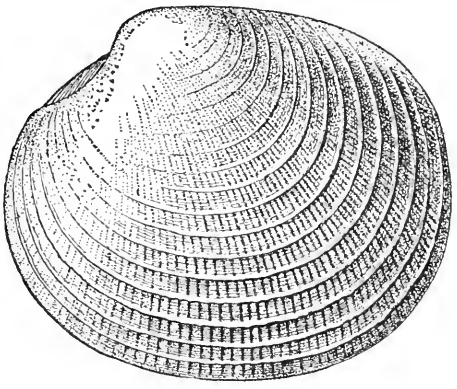

10


11

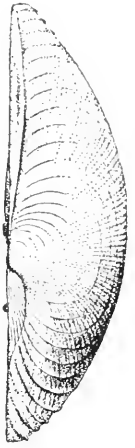

12

FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

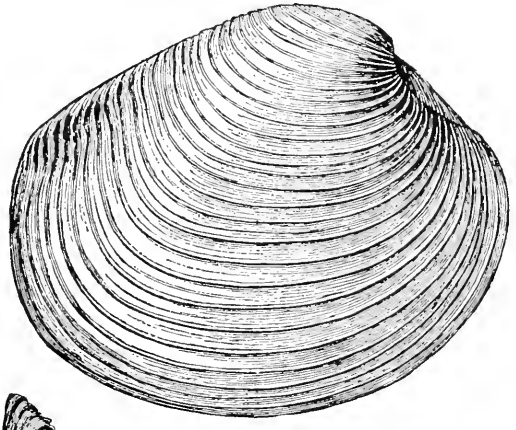
FOR EXPLANATION OF PLATE SEE PAGE 166.



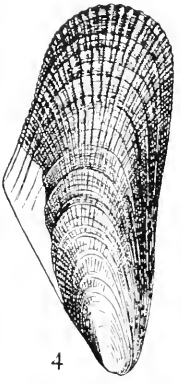
1



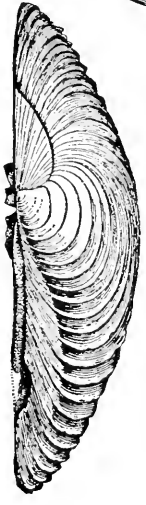
2



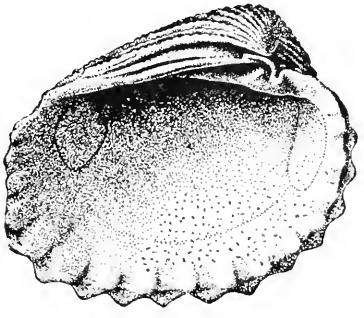
3



4



5



7

FOSSILS OF THE ORTHAULAX PUGNAX ZONE.

FOR EXPLANATION OF PLATE SEE PAGE 167.

INDEX.

The names in italics are newly proposed in this Bulletin.

SMITHSONIAN INSTITUTION LIBRARIES
3 9088 01421 1445